Go
The Board Game
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Go is played on a grid of black lines (usually 19\times19). Game pieces, called stones, are played on the line intersections.

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<th><strong>Years active</strong></th>
<th>Zhou Dynasty (1046–256 BC) to present</th>
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<tbody>
<tr>
<td><strong>Genre(s)</strong></td>
<td>Board game, abstract strategy game</td>
</tr>
<tr>
<td><strong>Players</strong></td>
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</tr>
<tr>
<td><strong>Age range</strong></td>
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</tr>
<tr>
<td><strong>Setup time</strong></td>
<td>Minimal</td>
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<tr>
<td><strong>Playing time</strong></td>
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</tr>
<tr>
<td><strong>Random chance</strong></td>
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<tr>
<td><strong>Skill(s) required</strong></td>
<td>Strategy, tactics, observation</td>
</tr>
<tr>
<td><strong>Synonym(s)</strong></td>
<td>Igo Baduk Paduk Weiqi</td>
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</tbody>
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[^6]: Some professional games exceed 16 hours and are played in sessions spread over two days.

Go (Chinese: 围棋 wéiqí, Japanese: いご, Korean: 바둑 baduk, Vietnamese: cờ vây, common meaning: "encircling game") is a board game for two players that originated in China more than 2,500 years ago. The game is noted for being rich in strategy despite its relatively simple rules. According to chess master Edward Lasker: "The rules of Go are so elegant, organic, and rigorously logical that if intelligent life forms exist elsewhere in the universe, they almost certainly play Go."

The two players alternately place black and white playing pieces, called "stones", on the vacant intersections (called "points") of a grid of 19\times19 lines (beginners often play on smaller 9\times9 and 13\times13 boards).[^5] The object of the game is to use one's stones to surround a larger total area of the board than the opponent.[^6] Once placed on the board, stones may not be moved, but stones are removed from the board if captured.[^7] When a game concludes, the controlled points (territory) are counted along with captured stones to determine who has more points.[^8] Games may also be won by resignation.
Go originated in ancient China. Archaeological evidence shows that the early game was played on a board with a 17×17 grid, but by the time the game had spread to Korea and Japan, in about the 5th and 7th centuries CE respectively, boards with a 19×19 grid had become standard.\(^9\)

As of mid-2008 there were well over 40 million Go players worldwide, the overwhelming majority living in East Asia.\(^10\) As of May 2012, the International Go Federation has a total of 74 member countries and four Association Members covering multiple countries.\(^11\)

**Overview**

Go is an adversarial game with the objective of surrounding more territory than one's opponent.\(^5\) As the game progresses, the board gets divided up into areas of territory, as outlined by groups of stones. These areas are then contested in local battles, which are often complicated, and may result in the expansion, reduction, or wholesale capture and loss of the contested area. It is often the case that a certain kind of "trade" goes on, where a player's loss in one part of the board can be compensated for or mitigated by a gain in another part of the board.

A basic principle of Go is that stones must have at least one "liberty" (Chinese: 氣) to remain on the board. "A liberty" is an open "point" (intersection) next to a stone.\(^7\) An enclosed liberty (or liberties) is called an "eye" (眼), and a group of stones with at least two separate eyes is said to be unconditionally "alive".\(^13\) Such groups cannot be captured, even if surrounded.\(^14\) "Dead" stones are stones that are surrounded and in groups with poor shape (one or no eyes), and thus cannot resist eventual capture.\(^15\)

The general strategy of Go is to expand one's territory where possible, attack the opponent's weak groups (groups that can possibly be killed), and always stay mindful of the "life status" of one's own groups.\(^16\) The liberties of groups are countable. Situations where two opposing groups must capture the other to live are called capturing races ('semeai' in Japanese).\(^18\) In a capturing race, the group with more liberties (and/or better "shape") will ultimately be able to capture the opponent's stones.\(^18\) Capturing races and questions of life and death are examples of what makes go challenging.

The game ends when both players pass, and players pass when there are no more profitable moves to be made.\(^20\) The game is then scored: The player with the greater number of controlled (surrounded) points, factoring in the
number of captured stones, wins the game. Games may also be won by resignation, for example if a player has lost a large group of stones.

**Finer points**

In the opening stages of the game, players typically establish positions (or "bases") in the corners and around the sides of the board. These bases help to quickly develop living shapes and surround territory. Players usually start in the corners, because it is more efficient there to make life and to establish territory. Established corner opening sequences are called "joseki (Japanese) or jungsuk (Korean)" and are often studied independently.

"Dame" ("dah-may", 'neutral points') are points that lie in-between the boundary walls of black and white, and as such are considered to be of no value to either side. "Sekis" (Chinese: 共活) are mutually alive pairs of white and black groups where neither has two eyes. A "ko" (Chinese and Japanese: 劫) is a repeated-position shape that may be contested by making forcing moves elsewhere. After the forcing move is played, the ko may be "taken back" and returned to its original position. Some "ko fights" may be important and decide the life of a large group, while others may be worth just one or two points.

Playing with others usually requires a knowledge of each player's strength, as indicated by their rank (30kyu→1kyu1dan→6dan1dan pro→9dan pro). Handicaps are given if there is a notable difference in rank—Black is allowed to place two or more stones on the board to compensate for White's greater strength. There are different rule-sets (Japanese, Chinese, AGA, etc.), which are almost entirely equivalent, except for certain special-case positions.

**Rules**

Aside from the order of play rules (alternating moves, black moves first or takes a handicap), there are essentially only two rules in Go:

- **Rule 1** (the rule of liberty) states that every stone remaining on the board must have at least one open "point" (an intersection, called a "liberty") directly next to it (up, down, left, or right), or must be part of a connected group that has at least one such open point ("liberty") next to it. Stones or groups of stones which lose their last liberty are removed from the board.

- **Rule 2** (the "ko rule") states that the stones on the board must never repeat a previous position of stones. Moves which would do so are forbidden, and thus that move must be placed elsewhere on the board.

Almost all other information about how the game is played is a heuristic, meaning it is learned information about how the game is played, rather than a rule. Other rules are specialized, as they come about through different rule-sets, but the above two rules cover almost all of any played game.

Although there are some minor differences between rule sets used in different countries, most notably in Chinese and Japanese scoring rules, these differences do not greatly affect the tactics and strategy of the game.

Except where noted otherwise, the basic rules presented here are valid independent of the scoring rules used. The scoring rules are explained separately. Go terms for which there are no ready English equivalent are commonly called by their Japanese names.
**Basic rules**

Two players, *Black* and *White*, take turns placing a *stone* (game piece) of their own color on a vacant *point* (intersection) of the grid on a Go board. Black moves first. If there is a large difference in skill between the players, Black is typically allowed to place two or more stones on the board to compensate for the difference (see Go handicaps). The official grid comprises 19×19 lines, though the rules can be applied to any grid size. 13×13 and 9×9 boards are popular choices to teach beginners.\(^{[30]}\) One placed, a stone may not be moved to a different point.\(^{[31]}\)

Vertically and horizontally adjacent stones of the same color form a *chain* (also called a *string* or *group*) that cannot subsequently be subdivided and, in effect, becomes a single larger stone.\(^{[32]}\) Only stones connected to one another by the lines on the board create a chain; stones that are diagonally adjacent are not connected. Chains may be expanded by placing additional stones on adjacent intersections, and can be connected together by placing a stone on an intersection that is adjacent to two or more chains of the same color.

A vacant point adjacent to a stone is called a *liberty* for that stone.\(^{[33]}\)[34] Stones in a chain share their liberties. A chain of stones must have at least one liberty to remain on the board. When a chain is surrounded by opposing stones so that it has no liberties, it is *captured* and removed from the board.

**The ko rule**

Players are not allowed to make a move that returns the game to the previous position. This rule, called the *ko rule* (Chinese: 劫; Japanese: 劫 kō "eon", Korean: 패; ‘pae’), prevents unending repetition.\(^{[35]}\) As shown in the example pictured to the right: Black has just played the stone marked 1, capturing a white stone at the intersection marked with a circle. If White were now allowed to play on the marked intersection, that move would capture the black stone
marked 1 and recreate the situation before Black made the move marked 1. Allowing this could result in an unending cycle of captures by both players. The ko rule therefore prohibits White from playing at the marked intersection immediately. Instead White must play elsewhere; Black can then end the ko by filling at the marked intersection, creating a five-stone black chain. If White wants to continue the ko (that specific repeating position), White tries to find a play elsewhere on the board that Black must answer; if Black answers, then White can retake the ko. A repetition of such exchanges is called a ko fight.\[36\]

While the various rule sets agree on the ko rule prohibiting returning the board to an immediately previous position, they deal in different ways with the relatively uncommon situation in which a player might recreate a past position that is further removed. See Rules of Go: Repetition for further information.

Passing

Instead of placing a stone, a player may pass. This usually occurs when they believe no useful moves remain. When both players pass consecutively, the game ends and is then scored.

Playing stones with no liberties

A player may not place a stone such that it or its group immediately has no liberties, unless doing so immediately deprives an enemy group of its final liberty. In the latter case, the enemy group is captured, leaving the new stone with at least one liberty.\[39\] This rule is responsible for the all-important difference between one and two eyes: if a group with only one eye is fully surrounded on the outside, it can be killed with a stone placed in its single eye.

The Ing and New Zealand rules don’t have this rule,\[38\] and there a player might destroy one of its own groups—“commit suicide”. This play would only be useful in a limited set of situations involving a small interior space.\[40\]

Komi

Because Black has a first move advantage, the idea of awarding White some compensation came into being during the 20th century. This predetermined compensation, called “komidashi”, (“komi”) means that White may receive somewhere on average of 6.5 points compensation for Black’s first move advantage. If there is one stone difference in strength between players, the stronger player takes white, and White may receive only 0.5 points komi, to break a possible tie (“jigo”). In handicap games with two or more handicap stones, White may also take 0.5 points komi to break a tie.
**Scoring rules**

Two general types of scoring system are used, and players determine which to use before play. Both systems almost always give the same result. *Territory scoring* counts the number of empty points a player's stones surround, together with the number of stones he captured. While it originated in China, today it is commonly associated with Japan and Korea. *Area scoring* counts the number of points your stones occupy and surround. It is associated with contemporary Chinese play and was probably established there during the Ming Dynasty in the 15th or 16th century.\[41\]

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**Detailed description**

A simplified game at its end. Black's territory (A) is counted and compared to White's territory (B). In this example, both Black and White attempted to invade and live (C and D groups) to reduce the other's total territory. Only Black's invading group (C) was successful in living, as White's group (D) was killed with a black stone at E. The points in the middle (F) are "dame", meaning they belong to neither player.
After both players have passed consecutively, the stones that are still on the board but unable to avoid capture, called *dead* stones, are removed.

**Area scoring (including Chinese):** A player's score is the number of stones he has on the board, plus the number of empty intersections surrounded by that player's stones.

**Territory scoring (including Japanese and Korean):** In the course of the game, each player retains the stones they capture, termed *prisoners*. Any dead stones removed at the end of the game become prisoners. The score is the number of empty points enclosed by a player's stones, plus the number of prisoners captured by that player.\[42\]

If there is disagreement about which stones are dead, then under area scoring rules, the players simply resume play to resolve the matter. The score is computed using the position after the next time the players pass consecutively. Under territory scoring, the rules are considerably more complex; however, in practice, players generally play on, and, once the status of each stone has been determined, return to the position at the time the first two consecutive passes occurred and remove the dead stones. For further information, see Rules of Go.

Given that the number of stones a player has on the board is related to the number of prisoners their opponent has taken, the resulting *net score*, *i.e.* the difference between Black and White's respective scores, is identical under both rulesets (unless the players have passed different numbers of times during the course of the game). Thus, the net result given by the two scoring systems rarely differs by more than a point.\[43\]
**Life and death**

While not actually mentioned in the rules of Go (at least in simpler rule sets, such as those of New Zealand and the US), the concept of a *living* group of stones is necessary for a practical understanding of the game.[44]

Examples of eyes (marked). The black groups at the top of the board are alive, as they have at least two eyes. The black groups at the bottom are dead as they only have one eye.

When a group of stones is mostly surrounded and has no options to connect with friendly stones elsewhere, the status of the group is either *alive*, *dead* or *unsettled*. A group of stones is said to be alive if it cannot be captured, even if the opponent is allowed to move first. Conversely, a group of stones is said to be dead if it cannot avoid capture, even if the owner of the group is allowed the first move. Otherwise, the group is said to be unsettled: in such a situation, the player that moves first may be able to either make it alive if he is the owner, or *kill* it if he is the group owner's opponent.[44]

To be alive, a group must be able to create at least two "eyes" if threatened. An eye is an empty point that is surrounded by friendly stones, where the opponent can never play due to the suicide rule. If two such eyes exist, the opponent can never capture a group of stones, because it always has at least two liberties. One eye is not enough for life, because a point that would normally be suicide may be played upon if doing so fills the last liberty of opposing stones, thereby capturing those stones. In the "Examples of eyes" diagram, all the circled points are eyes. The two black groups in the upper corners are alive, as both have at least two eyes. The groups in the lower corners are dead, as both have only one eye. The group in the lower left may seem to have two eyes, but the surrounded empty point without a circle is not actually an eye. White can play there and take a black stone. Such a point is often called a *false eye*.[44]
Seki (mutual life)

There is an exception to the requirement that a group must have two eyes to be alive, a situation called seki (or mutual life). Where different coloured groups are adjacent and share liberties, the situation may reach a position when neither player wants to move first, because doing so would allow the opponent to capture; in such situations therefore both player's stones remain on the board in mutual life or "seki". Neither player receives any points for those groups, but at least those groups themselves remain living, as opposed to being captured.[45]

Seki can occur in many ways. The simplest are: (1) each player has a group without eyes and they share two liberties, and (2) each player has a group with one eye and they share one more liberty. In the "Example of seki (mutual life)" diagram, the circled points are liberties shared by both a black and a white group. Neither player wants to play on a circled point, because doing so would allow the opponent to capture. All the other groups in this example, both black and white, are alive with at least two eyes. Seki is unusual, but can result from an attempt by one player to invade and kill a nearly settled group of the other player.[44]

Tactics

In Go, tactics deal with immediate fighting between stones, capturing and saving stones, life, death and other issues localized to a specific part of the board. Larger issues, not limited to only part of the board, are referred to as strategy, and are covered in their own section.

Capturing tactics

There are several tactical constructs aimed at capturing stones.[46] These are among the first things a player learns after understanding the rules. Recognizing the possibility that stones can be captured using these techniques is an important step forward.

A ladder. Black cannot escape unless the ladder connects to friendly stones further down the board.

The most basic technique is the ladder.[47] To capture stones in a ladder, a player uses a constant series of capture threats—called atari—to force the opponent into a zigzag pattern as shown in the diagram to the right. Unless the pattern runs into friendly stones along the way, the stones in the ladder cannot avoid capture. Experienced players recognize the futility of continuing the pattern and play elsewhere. The presence of a ladder on the board does give a player the option to play a stone in the path of the ladder, thereby threatening to rescue their stones, forcing a
response. Such a move is called a ladder breaker and may be a powerful strategic move. In the diagram, Black has the option of playing a ladder breaker.

A net. The chain of three marked black stones cannot escape in any direction.

Another technique to capture stones is the so-called net, also known by its Japanese name, geta. This refers to a move that loosely surrounds some stones, preventing their escape in all directions. An example is given in the diagram to the left. It is generally better to capture stones in a net than in a ladder, because a net does not depend on the condition that there are no opposing stones in the way, nor does it allow the opponent to play a strategic ladder breaker.

A snapback. Although Black can capture the white stone by playing at the circled point, the resulting shape for Black has only one liberty (at 1), thus White can then capture the three black stones by playing at 1 again (snap back).

A third technique to capture stones is the snapback. In a snapback, one player allows a single stone to be captured, then immediately plays on the point formerly occupied by that stone; by so doing, the player captures a larger group of their opponent’s stones, in effect snapping back at those stones. An example can be seen on the right.

As with the ladder, an experienced player does not play out such a sequence, recognizing the futility of capturing only to be captured back immediately.
Reading ahead

One of the most important skills required for strong tactical play is the ability to read ahead. Reading ahead includes considering available moves to play, the possible responses to each move, and the subsequent possibilities after each of those responses. Some of the strongest players of the game can read up to 40 moves ahead even in complicated positions.\[50]\]

As explained in the scoring rules, some stone formations can never be captured and are said to be alive, while other stones may be in the position where they cannot avoid being captured and are said to be dead. Much of the practice material available to students of the game comes in the form of life and death problems, also known as tsu\-mego.\[51]\]

In such problems, players are challenged to find the vital move sequence that kills a group of the opponent or saves a group of their own. Tsu\-mego are considered an excellent way to train a player's ability at reading ahead,\[51]\] and are available for all skill levels, some posing a challenge even to top players.

Ko fighting

In situations when the Ko rule applies, a ko fight may occur.\[36]\] If the player who is prohibited from capture is of the opinion that the capture is important, because it prevents a large group of stones from being captured for instance, the player may play a ko threat.\[36]\] This is a move elsewhere on the board that threatens to make a large profit if the opponent does not respond. If the opponent does respond to the ko threat, the situation on the board has changed, and the prohibition on capturing the ko no longer applies. Thus the player who made the ko threat may now recapture the ko. Their opponent is then in the same situation and can either play a ko threat as well, or concede the ko by simply playing elsewhere. If a player concedes the ko, either because they do not think it important or because there are no moves left that could function as a ko threat, they have lost the ko, and their opponent may connect the ko.

Instead of responding to a ko threat, a player may also choose to ignore the threat and connect the ko.\[36]\] They thereby win the ko, but at a cost. The choice of when to respond to a threat and when to ignore it is a subtle one, which requires a player to consider many factors, including how much is gained by connecting, how much is lost by not responding, how many possible ko threats both players have remaining, what the optimal order of playing them is, and what the size—points lost or gained—of each of the remaining threats is.

Frequently, the winner of the ko fight does not connect the ko but instead captures one of the chains that constituted their opponent's side of the ko.\[36]\] In some cases, this leads to another ko fight at a neighboring location.
Strategy

Game 1 of the 2002 Korean LG Cup final between Choe Myeong-hun (White) and Lee Sedol (Black)\textsuperscript{[52]} at the end of the opening stage; White has developed a great deal of potential territory, while Black has emphasized central influence. After white move 1, Black turns at $a$, and makes thickness all the way out to $b$, which he then uses to mount a successful attack on the marked white group.

Strategy deals with global influence, interaction between distant stones, keeping the whole board in mind during local fights, and other issues that involve the overall game. It is therefore possible to allow a tactical loss when it confers a strategic advantage.

Go is not easy to play well. With each new level (rank) comes a deeper appreciation for the subtlety and nuances involved and for the insight of stronger players. The acquisition of major concepts of the game comes slowly. Novices often start by randomly placing stones on the board, as if it were a game of chance; they inevitably lose to experienced players who know how to create effective formations. An understanding of how stones connect for greater power develops, and then a few basic common opening sequences may be understood. Learning the ways of life and death helps in a fundamental way to develop one's strategic understanding of weak groups.\textsuperscript{[53]} It is necessary to play thousands of games before one can get close to one's ultimate potential skill level in Go. A player who both plays aggressively and can handle adversity is said to display $kiai$, or fighting spirit, in the game.

Familiarity with the board shows first the tactical importance of the edges, and then the efficiency of developing in the corners first, then sides, then center. The more advanced beginner understands that territory and influence are somewhat interchangeable—but there needs to be a balance. This intricate struggle of power and control makes the game highly dynamic.
Basic concepts

Basic strategic aspects include the following:

- Connection: Keeping one's own stones connected means that fewer groups need to make living shape, and one has fewer groups to defend.
- Cut: Keeping opposing stones disconnected means that the opponent needs to defend and make living shape for more groups.
- Stay alive: The simplest way to stay alive is to establish a foothold in the corner or along one of the sides. At a minimum, a group must have two eyes (separate open points) to be "alive". An opponent cannot fill in either eye, as any such move is suicidal and prohibited in the rules.
- Mutual life (seki) is better than dying: A situation in which neither player can play on a particular point without then allowing the other player to play at another point to capture. The most common example is that of adjacent groups that share their last few liberties—if either player plays in the shared liberties, they can reduce their own group to a single liberty (putting themselves in atari), allowing their opponent to capture it on the next move.
- Death: A group that lacks living shape (meaning one with fewer than two eyes) is eventually removed from the board as captured.
- Invasion: Set up a new living group inside an area where the opponent has greater influence, means one reduces the opponents score in proportion to the area one occupies.
- Reduction: Placing a stone far enough into the opponent's area of influence to reduce the amount of territory they eventually get, but not so far in that it can be cut off from friendly stones outside.
- Sente: A play that forces one's opponent to respond (gote), such as placing an opponent's group in atari (immediate danger of capture). A player who can regularly play sente has the initiative, as in chess, and can control the flow of the game.
- Sacrifice: Allowing a group to die in order to carry out a play, or plan, in a more important area.

The strategy involved can become very abstract and complex. High-level players spend years improving their understanding of strategy, and a novice may play many hundreds of games against opponents before being able to win regularly.

Opening strategy

In the opening of the game, players usually play in the corners of the board first, as the presence of two edges make it easier for them to surround territory and establish their stones. After the corners, focus moves to the sides, where there is still one edge to support a player's stones. Opening moves are generally on the third and fourth line from the edge, with occasional moves on the second and fifth lines. In general, stones on the third line offer stability and are good defensive moves, whereas stones on the fourth line influence more of the board and are good attacking moves.

In the opening, players often play established sequences called joseki, which are locally balanced exchanges; however, the joseki chosen should also produce a satisfactory result on a global scale. It is generally advisable to keep a balance between territory and influence. Which of these gets precedence is often a matter of individual taste.

Phases of the game

While the opening moves in a game have a distinct set of aims, they usually make up only 10% to at most 20% of the game. In other words, in a game of 250 moves, there may be around 30 or so opening moves, with limited "fighting". At the end of such a game, around the last 100 moves are considered the endgame, in which territories are finished off definitively and all issues on capturing stones become clear. The middle phase of the game is the most combative, and usually lasts for more than 100 moves. During the middlegame, or just "the fighting", the players invade each other's frameworks, and attack weak groups, formations that lack the necessary two eyes for viability. Such groups must run away, i.e., expand to avoid enclosure, giving a dynamic feeling to the struggle. It is possible
that one player may succeed in capturing a large weak group of the opponent’s, which often proves decisive and ends
the game by a resignation. However, matters may be more complex yet, with major trade-offs, apparently dead
groups reviving, and skillful play to attack in such a way as to construct territories rather than kill.

The end of the middlegame and transition to the endgame is marked by a few features. The game breaks up into
areas that do not affect each other (with a caveat about \textit{ko} fights), where before the central area of the board related
to all parts of it. No large weak groups are still in serious danger. Moves can reasonably be attributed some definite
value, such as 20 points or fewer, rather than simply being necessary to compete. Both players set limited objectives
in their plans, in making or destroying territory, capturing or saving stones. These changing aspects of the game
usually occur at much the same time, for strong players. In brief, the middlegame switches into the endgame when
the concepts of strategy and influence need reassessment in terms of concrete final results on the board.

\section*{History}

\begin{center}
\begin{tabular}{ | l | l |}
\hline
\textbf{Go} & \\
\hline
\textbf{Chinese name} & \\
\hline
Traditional Chinese & 围棋 \\
Simplified Chinese & 围棋 \\
Literal meaning & surround game \\
\hline
\textbf{Transcriptions} & \\
Mandarin & \\
- Hanyu Pinyin & Wei-qí \\
- Wade–Giles & Wei-ch’i \\
\hline
\textbf{Tibetan name} & \\
Tibetan & མིག་མངས \\
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\textbf{Transcriptions} & \\
- Wylie & mig mangs \\
\hline
\textbf{Korean name} & \\
Hangul & 바둑 \\
\hline
\textbf{Transcriptions} & \\
- Revised Romanization & Baduk \\
- McCune-Reischauer & Paduk \\
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\textbf{Japanese name} & \\
Kanji & 碁, 布 (“surround game”) \\
\hline
\textbf{Transcriptions} & \\
- Romanization & Go, Igo \\
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Go

Origin in China

The earliest written reference to the game is generally recognized as the historical annal Zuo Zhuan\(^{[56]}\) (c. 4th century BC),\(^{[57]}\) referring to a historical event of 548 BC. It is also mentioned in Book XVII of the Analects of Confucius\(^{[57]}\) and in two books written by Mencius\(^{[58]}\) (c. 3rd century BC).\(^{[57]}\) In all of these works, the game is referred to as \(yì\) (弈), Today, in China, it is known as \textit{weiqi} (simplified Chinese: 围棋; traditional Chinese: 圍棋; pinyin: wéiqí; Wade–Giles: wei ch'i), literally the "encirclement board game".

Go was originally played on a 17×17 line grid, but a 19×19 grid became standard by the time of the Tang Dynasty (618–907).\(^{[59]}\) Legends trace the origin of the game to Chinese emperor Yao (2337–2258 BC), said to have had his councilor Shun design it for his unruly son, Danzhu, to favorably influence him.\(^{[60]}\) Other theories suggest that the game was derived from Chinese tribal warlords and generals, who used pieces of stone to map out attacking positions.\(^{[61]}\)

In China, Go was considered one of the four cultivated arts of the Chinese scholar gentleman, along with calligraphy, painting and playing the musical instrument guqin.\(^{[62]}\)

Spread to Korea and Japan

Weiqi was introduced to Korea sometime between the 5th and 7th centuries AD, and was popular among the higher classes. In Korea, the game is called \textit{baduk} (hangul: 바둑), and a variant of the game called Sunjang baduk was developed by the 16th century. Sunjang baduk became the main variant played in Korea until the end of the 19th century.\(^{[63]}\)\(^{[64]}\)

The game reached Japan in the 7th century AD—where it is called \textit{go} (碁) or \textit{igo} (囲碁)—the game became popular at the Japanese imperial court in the 8th century,\(^{[65]}\) and among the general public by the 13th century.\(^{[66]}\) In 1603, Tokugawa Ieyasu re-established Japan's unified national government. In the same year, he assigned the then-best player in Japan, a Buddhist monk named Nikkai (né Kanō Yosaburo, 1559), to the post of Godokoro (Minister of Go).\(^{[67]}\) Nikkai took the name Honinbo Sansa and founded the Honinbo Go school.\(^{[67]}\) Several competing schools were founded soon after.\(^{[67]}\) These officially recognized and subsidized Go schools greatly developed the level of play and introduced the dan/kyu style system of ranking players.\(^{[68]}\) Players from the four schools (Honinbo, Yasui, Inoue and Hayashi) competed in the annual castle games, played in the presence of the shogun.\(^{[69]}\)
Go in the West

Despite its widespread popularity in East Asia, Go has been slow to spread to the rest of the world. Although there are some mentions of the game in western literature from the 16th century forward, Go did not start to become popular in the West until the end of the 19th century, when German scientist Oskar Korschelt wrote a treatise on the game. By the early 20th century, Go had spread throughout the German and Austro-Hungarian empires. In 1905, Edward Lasker learned the game while in Berlin. When he moved to New York, Lasker founded the New York Go Club together with (amongst others) Arthur Smith, who had learned of the game while touring the East and had published the book The Game of Go in 1908. Lasker's book Go and Go-moku (1934) helped spread the game throughout the US, and in 1935, the American Go Association was formed. Two years later, in 1937, the German Go Association was founded.

World War II put a stop to most Go activity, but after the war, Go continued to spread. For most of the 20th century, the Japan Go Association (Nihon Ki-in) played a leading role in spreading Go outside East Asia by publishing the English-language magazine Go Review in the 1960s; establishing Go centers in the US, Europe and South America; and often sending professional teachers on tour to Western nations. Internationally, the game is now commonly known by its shortened Japanese name, and terms for common Go concepts are derived from their Japanese pronunciation.

In 1996, NASA astronaut Daniel Barry and Japanese astronaut Koichi Wakata became the first people to play Go in space. They used a special Go set, which was named Go Space, designed by Wai-Cheung Willson Chow. Both astronauts were awarded honorary dan ranks by the Nihon Ki-in.

As of May 2012, the International Go Federation has 57 member countries outside Asia.

Competitive play

Ranks and ratings

In Go, rank indicates a player's skill in the game. Traditionally, ranks are measured using kyu and dan grades, a system also adopted by many martial arts. More recently, mathematical rating systems similar to the Elo rating system have been introduced. Such rating systems often provide a mechanism for converting a rating to a kyu or dan grade. Kyu grades (abbreviated k) are considered student grades and decrease as playing level increases, meaning 1st kyu is the strongest available kyu grade. Dan grades (abbreviated d) are considered master grades, and increase from 1st dan to 7th dan. First dan equals a black belt in eastern martial arts using this system. The difference among each amateur rank is one handicap stone. For example, if a 5k plays a game with a 1k, the 5k would need a handicap of four stones to even the odds. Top-level amateur players sometimes defeat professionals in tournament play. Professional players have professional dan ranks (abbreviated p). These ranks are separate from amateur ranks.

The rank system comprises, from the lowest to highest ranks:
<table>
<thead>
<tr>
<th>Rank Type</th>
<th>Range</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double-digit <em>kyu</em></td>
<td>30–21k</td>
<td>Beginner</td>
</tr>
<tr>
<td>Double-digit <em>kyu</em></td>
<td>20–11k</td>
<td>Casual player</td>
</tr>
<tr>
<td>Single-digit <em>kyu</em></td>
<td>10–1k</td>
<td>Intermediate/club player</td>
</tr>
<tr>
<td>Amateur <em>dan</em></td>
<td>1–7d (where 8d is special title)</td>
<td>Advanced player</td>
</tr>
<tr>
<td>Professional <em>dan</em></td>
<td>1–9p (where 10p is special title)</td>
<td>Professionals</td>
</tr>
</tbody>
</table>

### Tournament and match rules
Tournament and match rules deal with factors that may influence the game but are not part of the actual rules of play. Such rules may differ between events. Rules that influence the game include: the setting of compensation points (*komi*), handicap strategies, and time control parameters. Rules that do not generally influence the game are: the tournament system, pairing strategies, and placement criteria.

Common tournament systems used in Go include the McMahon system,[78] Swiss system, league systems and the knockout system. Tournaments may combine multiple systems; many professional Go tournaments use a combination of the league and knockout systems.[79]

Tournament rules may also set the following:

- compensation points, called *komi*, which compensate the second player for the first move advantage of his opponent; tournaments commonly use a compensation in the range of 5–8 points,[80] generally including a half-point to prevent draws;
- compensation stones placed on the board before alternate play, allowing players of different strengths to play competitively (see Go handicap for more information); and
- *superko*: Although the basic ko rule described above covers more than 95% of all cycles occurring in games,[81] there are some complex situations—triple ko, eternal life,[82] etc.—that are not covered by it but would allow the game to cycle indefinitely. To prevent this, the ko rule is sometimes extended to disallow the repetition of any previous position. This extension is called superko.[81]

### Top players
Although the game was developed in China, the establishment of the Four Go houses by Tokugawa Ieyasu at the start of the 17th century shifted the focus of the Go world to Japan. State sponsorship, allowing players to dedicate themselves full-time to study of the game, and fierce competition between individual houses resulted in a significant increase in the level of play. During this period, the best player of his generation was given the prestigious title Meijin (master) and the post of Godokoro (minister of Go). Of special note are the players who were dubbed Kisei (Go Sage). The only three players to receive this honor were Dosaku, Jowa and Shusaku, all of the house Honinbo.[83]
Honinbo Shusai (left), last head of house Honinbo, plays against then-up-and-coming Go Seigen in the game of the century.

After the end of the Tokugawa shogunate and the Meiji Restoration period, the Go houses slowly disappeared, and in 1924, the Nihon Ki-in (Japanese Go Association) was formed. Top players from this period often played newspaper-sponsored matches of 2–10 games. Of special note are Go Seigen (Chinese: Wu Qingyuan), who scored an impressive 80% in these matches, and Minoru Kitani, who dominated matches in the early 1930s. These two players are also recognized for their groundbreaking work on new opening theory (Shinfuseki).

For much of the 20th century, Go continued to be dominated by players trained in Japan. Notable names included Eio Sakata, Rin Kaiho (born in China), Masao Kato, Koichi Kobayashi and Cho Chikun (born Cho Chi-hun, South Korea). Top Chinese and Korean talents often moved to Japan, because the level of play there was high and funding was more lavish. One of the first Korean players to do so was Cho Namchul, who studied in the Kitani Dojo 1937–1944. After his return to Korea, the Hanguk Kiwon (Korea Baduk Association) was formed and caused the level of play in South Korea to rise significantly in the second half of the 20th century. In China, the game declined during the Cultural Revolution (1966–1976) but quickly recovered in the last quarter of the 20th century, bringing Chinese players, such as Nie Weiping and Ma Xiaochun, on par with their Japanese and Korean counterparts.

With the advent of major international titles from 1989 onward, it became possible to compare the level of players from different countries more accurately. Korean players such as Lee Chang-ho, Cho Hunhyun, Lee Sedol and Yoo Changhyuk dominated international Go and won an impressive number of titles. Several Chinese players also rose to the top in international Go, most notably Ma Xiaochun, Chang Hao and Gu Li. As of 2008, Japan lags behind in the international Go scene.

Historically, as with most sports and games, more men than women have played Go. Special tournaments for women exist, but until recently, men and women did not compete together at the highest levels; however, the creation of new, open tournaments and the rise of strong female players, most notably Rui Naiwei, have in recent years highlighted the strength and competitiveness of emerging female players.

The level in other countries has traditionally been much lower, except for some players who had preparatory professional training in Asia. Knowledge of the game has been scant elsewhere up until the 20th century. A famous player of the 1920s was Edward Lasker. It was not until the 1950s that more than a few Western players took up the game as other than a passing interest. In 1978, Manfred Wimmer became the first Westerner to receive a professional player's certificate from an Asian professional Go association. In 2000, a Westerner, Michael Redmond, finally achieved the top rank awarded by an Asian Go association, 9 dan. In total, as of 2008, only nine non-Asian Go players have ever achieved professional status in Asian associations.
**Equipment**

It is possible to play Go with a simple paper board and coins or plastic tokens for the stones. More popular midrange equipment includes cardstock, a laminated particle board, or wood boards with stones of plastic or glass. More expensive traditional materials are still used by many players. The most expensive Go sets have black stones carved from slate and white stones carved from translucent white shells, played on boards carved in a single piece from the trunk of a tree.

**Traditional equipment**

**Boards**

The Go board (generally referred to by its Japanese name goban) typically measures between 45 and 48 cm (18 and 19 in) in length (from one player's side to the other) and 42 to 44 cm (17 to 17 in) in width. Chinese boards are slightly larger, as a traditional Chinese Go stone is slightly larger to match. The board is not square; there is a 15:14 ratio in length to width, because with a perfectly square board, from the player's viewing angle the perspective creates a foreshortening of the board. The added length compensates for this.\(^{[96]}\)

There are two main types of boards: a table board similar in most respects to other gameboards like that used for chess, and a floor board, which is its own free-standing table and at which the players sit.

The traditional Japanese goban is between 10 and 18 cm (3.9 and 7.1 in) thick and has legs; it sits on the floor (see picture to right).\(^{[96]}\) It is preferably made from the rare golden-tinged Kaya tree (Torreya nucifera), with the very best made from Kaya trees up to 700 years old. More recently, the related California Torreya (Torreya californica) has been prized for its light color and pale rings as well as its reduced expense and more readily available stock. The natural resources of Japan have been unable to keep up with the enormous demand for the slow-growing Kaya trees; both T. nucifera and T. californica take many hundreds of years to grow to the necessary size, and they are now extremely rare, raising the price of such equipment tremendously.\(^{[97]}\) As Kaya trees are a protected species in Japan, they cannot be harvested until they have died. Thus, an old-growth, floor-standing Kaya goban can easily cost in excess of US$10,000 with the highest-quality examples costing more than $60,000.\(^{[98]}\)

Other, less expensive woods often used to make quality table boards in both Chinese and Japanese dimensions include Hiba (Thujopsis dolabrata), Katsura (Cercidiphyllum japonicum), Kauri (Agathis), and Shin Kaya (various varieties of spruce, commonly from Alaska, Siberia and China's Yunnan Province).\(^{[97]}\) So-called Shin Kaya is a potentially confusing merchant's term: shin means "new", and thus shin kaya is best translated “faux kaya”, because the woods so described are biologically unrelated to Kaya.\(^{[97]}\)
Stones
A full set of Go stones (goishi) usually contains 181 black stones and 180 white ones; a 19×19 grid has 361 points, so there are enough stones to cover the board, and Black gets the extra odd stone because that player goes first.

Traditional Japanese stones are double-convex, and made of clamshell (white) and slate (black). The classic slate is nachiguro stone mined in Wakayama Prefecture and the clamshell from the Hamaguri clam; however, due to a scarcity in the Japanese supply of this clam, the stones are most often made of shells harvested from Mexico. Historically, the most prized stones were made of jade, often given to the reigning emperor as a gift.

In China, the game is traditionally played with single-convex stones made of a composite called Yunzi. The material comes from Yunnan Province and is made by sintering a proprietary and trade-secret mixture of mineral compounds derived from the local stone. This process dates to the Tang Dynasty and, after the knowledge was lost in the 1920s during the Chinese Civil War, was rediscovered in the 1960s by the now state-run Yunzi company. The material is praised for its colors, its pleasing sound as compared to glass or to synthetics such as melamine, and its lower cost as opposed to other materials such as slate/shell. The term "yunzi" can also refer to a single-convex stone made of any material; however, most English-language Go suppliers specify Yunzi as a material and single-convex as a shape to avoid confusion, as stones made of Yunzi are also available in double-convex while synthetic stones can be either shape.

Traditional stones are made so that black stones are slightly larger in diameter than white; this is to compensate for the optical illusion created by contrasting colors that would make equal-sized white stones appear larger on the board than black stones.

Bowls
The bowls for the stones are shaped like a flattened sphere with a level underside. The lid is loose fitting and upturned before play to receive stones captured during the game. Chinese bowls are slightly larger, and a little more rounded, a style known generally as Go Seigen; Japanese Kitani bowls tend to have a shape closer to that of the bowl of a snifter glass, such as for brandy. The bowls are usually made of turned wood. Rosewood is the traditional material for Japanese bowls, but is very expensive; wood from the Chinese jujube date tree, which has a lighter color (it is often stained) and slightly more visible grain pattern, is a common substitute for rosewood, and traditional for Go Seigen-style bowls. Other traditional materials used for making Chinese bowls include lacquered wood, ceramics, stone and woven straw or rattan. The names of the bowl shapes, Go Seigen and Kitani, pay homage to two 20th-century professional Go players by the same names, of Chinese and Japanese nationality, respectively, who are referred to as the "Fathers of modern Go".

Modern and low-cost alternatives
In clubs and at tournaments, where large numbers of sets must be purchased and maintained by one organization, expensive traditional sets are not usually used. For these situations, table boards are usually used instead of floor boards, and are either made of a lower-cost wood such as spruce or bamboo, or are flexible mats made of vinyl or leather that can be rolled up. In such cases, the stones are usually made of glass, plastic or resin (such as melamine or Bakelite) rather than slate and shell. Bowls are often made of plastic or inexpensive wood.

Common "novice" Go sets are all-inclusive kits made of particle board or plywood, with plastic or glass stones, that either fold up to enclose the stone containers or have pull-out drawers to keep stones. In relative terms, these sets are inexpensive, costing US$20–$40 depending on component quality, and thus are popular with casual Go players. Magnetic sets are also available, either as portable travel sets or in larger sizes for educational purposes.
Playing technique and etiquette

The traditional way to place a Go stone is to first take one from the bowl, gripping it between the index and middle fingers, with the middle finger on top, and then placing it directly on the desired intersection. It is considered respectful towards one's opponent to place one's first stone in the upper right-hand corner.

It is considered poor manners to run one's fingers through one's bowl of unplayed stones, as the sound, however soothing to the player doing this, can be disturbing to one's opponent. Similarly, "clacking" a stone against another stone, the board, or the table or floor is also discouraged. However, it is permissible to emphasize select moves by striking the board more firmly than normal, thus producing a sharp clack.

Time control

A game of Go may be timed using a game clock. Formal time controls were introduced into the professional game during the 1920s and were controversial. Adjournments and sealed moves began to be regulated in the 1930s. Go tournaments use a number of different time control systems. All common systems envisage a single main period of time for each player for the game, but they vary on the protocols for continuation (in overtime) after a player has finished that time allowance. The most widely used time control system is the so-called byoyomi system. The top professional Go matches have timekeepers so that the players do not have to press their own clocks.

Two widely used variants of the byoyomi system are:

- **Standard byoyomi**: After the main time is depleted, a player has a certain number of time periods (typically around thirty seconds). After each move, the number of full-time periods that the player took (often zero) is subtracted. For example, if a player has three thirty-second time periods and takes thirty or more (but less than sixty) seconds to make a move, they lose one time period. With 60–89 seconds, they lose two time periods, and so on. If, however, they take less than thirty seconds, the timer simply resets without subtracting any periods. Using up the last period means that the player has lost on time.

- **Canadian byoyomi**: After using all of their main time, a player must make a certain number of moves within a certain period of time, such as twenty moves within five minutes. If the time period expires without the required number of stones having been played, then the player has lost on time.

Notation and recording games

Go games are recorded with a simple coordinate system. This is comparable to algebraic chess notation, except that Go stones do not move and thus require only one coordinate per turn. Coordinate systems include purely numerical (4-4 point), hybrid (K3), and purely alphabetical. The Smart Game Format uses alphabetical coordinates internally, but most editors represent the board with hybrid coordinates as this reduces confusion. The Japanese word kifu is sometimes used to refer to a game record.

In Unicode, Go stones are encoded in the block Miscellaneous Symbols:
Computers and Go

Nature of the game

In combinatorial game theory terms, Go is a zero-sum, perfect-information, partisan, deterministic strategy game, putting it in the same class as chess, checkers (draughts) and Reversi (Othello); however it differs from these in its game play. Although the rules are simple, the practical strategy is extremely complex.

The game emphasizes the importance of balance on multiple levels and has internal tensions. To secure an area of the board, it is good to play moves close together; however, to cover the largest area, one needs to spread out, perhaps leaving weaknesses that can be exploited. Playing too low (close to the edge) secures insufficient territory and influence, yet playing too high (far from the edge) allows the opponent to invade.

It has been claimed that Go is the most complex game in the world due to its vast number of variations in individual games. Its large board and lack of restrictions allow great scope in strategy and expression of players' individuality. Decisions in one part of the board may be influenced by an apparently unrelated situation in a distant part of the board. Plays made early in the game can shape the nature of conflict a hundred moves later.

The game complexity of Go is such that describing even elementary strategy fills many introductory books. In fact, numerical estimates show that the number of possible games of Go far exceeds the number of atoms in the observable universe.

Software players

Go poses a daunting challenge to computer programmers. The strongest computer chess programs defeat the best human players (for example, the Deep Fritz program, running on a laptop, beat reigning world champion Vladimir Kramnik without losing a single game in 2006). The best Go programs manage to reach amateur dan level. On the small 9×9 board, the computer fares better, and some programs now win a fraction of their 9×9 games against professional players. Many in the field of artificial intelligence consider Go to require more elements that mimic human thought than chess.

The reasons why computer programs do not play Go at the professional dan level include:

- The number of spaces on the board is much larger (over five times the number of spaces on a chess board—361 vs. 64). On most turns there are many more possible moves in Go than in chess.

Throughout most of the game, the number of legal moves stays at around 150–250 per turn, and rarely falls below 50 (in chess, the average number of moves is 37). Because an exhaustive computer program for Go must calculate and compare every possible legal move in each ply (player turn), its ability to calculate the best plays is sharply reduced when there are a large number of possible moves. Most computer game algorithms, such as those for chess, compute several moves in advance. Given an average of 200 available moves through most of the game, for a computer to calculate its next move by exhaustively anticipating the next four moves of each possible play (two of its own and two of its opponent's), it would have to consider more than 320 billion (3.2×10^11) possible combinations. To exhaustively calculate the next eight moves, would require computing 512 quintillion (5.12×10^20) possible combinations. As of June 2008, the most powerful supercomputer in the world, IBM's "Roadrunner" distributed cluster, can sustain 1.02 petaflops. At this rate, even given an exceedingly low estimate of 10 operations required to assess the value of one play of a stone, Roadrunner would require 138 hours, more than five days, to assess all possible combinations of the next eight moves in order to make a single play.
• The placement of a single stone in the initial phase can affect the play of the game a hundred or more moves later. A computer would have to predict this influence, and it would be unworkable to attempt to exhaustively analyze the next hundred moves.
• In capture-based games (such as chess), a position can often be evaluated relatively easily, such as by calculating who has a material advantage or more active pieces. In Go, there is often no easy way to evaluate a position. However a 6-kyu human can evaluate a position at a glance, to see which player has more territory, and even beginners can estimate the score within 10 points, given time to count it. The number of stones on the board (material advantage) is only a weak indicator of the strength of a position, and a territorial advantage (more empty points surrounded) for one player might be compensated by the opponent's strong positions and influence all over the board. Normally a 3-dan can easily judge most of these positions.

As an illustration, the greatest handicap normally given to a weaker opponent is 9 stones. It was not until August 2008 that a computer won a game against a professional level player at this handicap. It was the Mogo program, which scored this first victory in an exhibition game played during the US Go Congress.

Software assistance

An abundance of software is available to support players of the game. This includes programs that can be used to view or edit game records and diagrams, programs that allow the user to search for patterns in the games of strong players, and programs that allow users to play against each other over the Internet.

Some web servers provide graphical aids like maps, to aid learning during play. These graphical aids may suggest possible next moves, indicate areas of influence, highlight vital stones under attack and mark stones in atari or about to be captured.

There are several file formats used to store game records, the most popular of which is SGF, short for Smart Game Format. Programs used for editing game records allow the user to record not only the moves, but also variations, commentary and further information on the game.

Electronic databases can be used to study life and death situations, joseki, fuseki and games by a particular player. Programs are available that give players pattern searching options, which allow players to research positions by searching for high-level games in which similar situations occur. Such software generally lists common follow-up moves that have been played by professionals and gives statistics on win/loss ratio in opening situations.

Internet-based Go servers allow access to competition with players all over the world, for real-time and turn-based games. Such servers also allow easy access to professional teaching, with both teaching games and interactive game review being possible.
Video games

Igo: Kyū Roban Taikyoku (囲碁九路盤対局, lit. "Go: 9x9 Grid Match")[^130] is a 1987 Go video game that was released exclusively in Japan for the Nintendo Entertainment System.

In culture and science

Literature, television, and film

Apart from technical literature and study material, Go and its strategies have been the subject of several works of fiction, such as The Master of Go by Nobel prize-winning author Yasunari Kawabata[^131] and The Girl Who Played Go by Shan Sa. Other books have used Go as a theme or minor plot device. For example, the novel Shibumi by Trevanian centers around the game and uses Go metaphors[^132] and The Way of Go: 8 Ancient Strategy Secrets for Success in Business and Life by Troy Anderson applies Go strategy to business.[^133]

Go, referred to as Weiqi, features prominently in the Eric Van Lustbader novel Jian.

Similarly, Go has been used as a subject or plot device in film, such as π, A Beautiful Mind, and The Go Master, a biopic of Go professional Go Seigen.[^134][^135] In King Hu's wuxia film The Valiant Ones, the characters are color-coded as Go pieces (black or other dark shades for the Chinese, white for the Japanese invaders), Go boards and stones are used by the characters to keep track of soldiers prior to battle, and the battles themselves are structured like a game of Go.[^136] Go is used as a device for criminal profiling in the pilot episode of Criminal Minds, "Extreme Aggressor". In the Diagnosis: Murder episode "Deadly Games", Dr. Sloan plays Go with a suspected killer to determine his strategy.[^137]

In the second season of Star Trek: Enterprise, Trip Tucker plays a game of Go with the Cogenitor. When the Cogenitor wins, Trip comments that nobody else had beaten him in two years.

The Go proverb, “Strange things happen at the One Two point,” is used as the episode title of a season two episode of Terminator: The Sarah Connor Chronicles. Cameron is told by Xander that he doesn’t play chess, but rather plays Go, and he offers to teach her how to play. Later, Cameron explains to Sarah that the proverb means that the "usual rules don’t always apply.”

Of particular note is the manga (Japanese comic book) and anime series Hikaru no Go, released in Japan in 1998, which had a large impact in popularizing Go among young players, both in Japan and—as translations were released—abroad.[^138][^139]

The corporation and brand Atari was named after the Go term.

Psychology

A 2004 review of literature by Fernand Gobet, de Voogt & Retschitzki[^140] shows that relatively little scientific research has been carried out on the psychology of Go, compared with other traditional board games such as chess and Mancala. Computer Go research has shown that given the large search tree, knowledge and pattern recognition are more important in Go than in other strategy games, such as chess.[^140] A study of the effects of age on Go-playing[^141] has shown that mental decline is milder with strong players than with weaker players. According to the review of Gobet and colleagues, the pattern of brain activity observed with techniques such as PET and fMRI does not show large differences between Go and chess. On the other hand, a study by Xiangchuan Chen et al.[^142] showed greater activation in the right hemisphere among Go players than among chess players. There is some evidence to suggest a correlation between playing board games and reduced risk of Alzheimer's disease and dementia.[^143]
Notes

Footnotes


[2] Children below a certain age may swallow or choke on stones.

[3] The full Japanese name igo is derived from its Chinese name weiqi, which roughly translates as "board game of surrounding", see Etymology Of Go (http://senseis.xmp.net/?EtymologyOfGo) at Sensei's Library for more information. To differentiate the game Go from the common English verb to go, it is generally capitalized (Gao 2007) or, in events sponsored by the Ing Foundation, spelled goe.


[7] Iwamoto, p.22

[8] Iwamoto, p.18

[9] Cho Chikun, p.18


[12] Cobb p.12

[13] Cho Chikun, p.21

[14] Iwamoto, p.77

[15] Cho Chikun, p.27

[16] Cho Chikun, p.28

[17] Cobb p.21

[18] Cho Chikun, p.69

[19] Cobb p.20

[20] Cho Chikun, p.35


[22] Iwamoto, p.93

[23] Cho Chikun, p.119


[26] Iwamoto, p.109

[27] Cho Chikun, p.91


[34] Compare "liberty", a small local government unit in medieval England — the "local area under control".


[40] Kim 1994 p. 28

[41] Fairbairn, John, "The Rules Debate" (http://www.gogod.co.uk/NewInGo/C&IP.htm), New in Go (http://www.gogod.co.uk/NewInGo/NewInGo.htm), Games of Go on Disc. Retrieved 2007-11-27

[42] Exceptionally, in Japanese and Korean rules, empty points, even those surrounded by stones of a single colour, may count as neutral territory if some of them are alive by seki. See the section on "Life and Death" for seki.


[45] In game theoretical terms, seki positions are an example of a Nash equilibrium.


[93] Kaku Takagawa toured Europe around 1970, and reported (*Go Review*) a general standard of amateur 4 dan. This is a good amateur level but no more than might be found in ordinary Asian clubs. Published current European ratings would suggest around 100 players stronger than that, with very few European 7 dan.

[94] European Go has been documented by Franco Pratesi, *Eurogo* (Florence 2003) in three volumes, up to 1920, 1920–1950, and 1950 and later.


[98] *Kiseido clearance sale* (http://www.kiseido.com/clearance.htm), lists the regular price for a Shihomasa Kaya Go Board with legs (20.4 cm or 8 in thick) as $60,000+


[100] See Overshoot in Western typography for similar subtle adjustment to create a uniform appearance.


[102] *A stylish way to play your stones* (http://www.nihonkiin.or.jp/lesson/knowledge-e/uchikata-e.htm), Nihon Ki-in., retrieved 2007-02-24

[103] Sensei’s Library: Playing the first move in the upper right corner (http://senseis.xmpl.net/?PlayingTheFirstMoveInTheUpperRightCorner)


[105] Roughly, one has the time to play the game and then a little time to finish it off. Time-wasting tactics are possible in Go, so that sudden death systems, in which time runs out at a predetermined point however many plays are in the game, are relatively unpopular (in the West).

[106] Literally in Japanese *byōyomi* means ‘reading of seconds’.


[108] Typically, players stop the clock, and the player in overtime sets his/her clock for the desired interval, counts out the required number of stones and sets the remaining stones out of reach, so as not to become confused. If twenty moves are made in time, the timer is reset to five minutes again.

[109] In other words, Canadian byoyomi is essentially a standard chess-style time control, based on N moves in a time period T, imposed after a main period is used up. It is possible to decrease T, or increase N, as each overtime period expires; but systems with constant T and N, for example 20 plays in 5 minutes, are widely used.

[110] Go FAQ (http://stason.org/TULARC/games/go/5-3-Recording-Go-games.html)


[113] The number of board positions is at most $3^{361}$ (about $10^{172}$) since each position can be white, black, or vacant. Ignoring (illegal) suicide moves, there are at least $361!$ games (about $10^{96}$) since every permutation of the board positions corresponds to a game. See Go and mathematics for more details, which includes much larger estimates.


[122] While chess position evaluation is simpler than Go position evaluation, it is still more complicated than simply calculating material advantage or piece activity; pawn structure and king safety matter, as do the possibilities in further play. The complexity of the algorithm differs per engine.
Citations

References


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Further reading

Introductory books:

Historical interest:
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• Smith, Arthur (1956), The Game of Go: The National Game of Japan, C.E. Tuttle Co, OCLC 912228

External links
• International Go Federation (IGF) (http://www.intergofed.org/), at intergofed.org
• European Go Federation (EGF) (http://www.eurogofed.org/), at eurogofed.org
• American Go Association (AGA) (http://www.usgo.org/), at usgo.org
• The Nihon Ki-in (Japan Go Association) (http://www.nihonkiin.or.jp/index-e.htm), at nihonkiin.or.jp
• Go in Print (http://www.usgo.org/resources/books.html), list and reviews of English Go books, at usgo.org
• Go Servers (http://senseis.xmp.net/?GoServers), list of servers for playing on-line at Sensei's Library, at senseis.xmp.net
• Goproblems.com (http://www.goproblems.com/), open database of interactive Go problems, at goproblems.com
- Go Game Guru (http://gogameguru.com/), frequently updated site where you can learn Go, study Go and read Go news
History of Go

Go players, a painting by the artist Zhou Wenju, 11th century, Song Dynasty
The game of Go (Chinese: 围棋, Pinyin: Wéiqí) originated in China in ancient times. It was a worthy pastime for a gentleman, as described in the Analects of Confucius. It reached Korea by the 5th century, [1] in the 7th century it had reached Japan. The game was described by Thomas Hyde in 1694, but it did not become popular in the West until the late 19th century.

According to legend, the game was created as a teaching tool after the ancient Chinese Emperor Yao (2337 - 2258 BC) designed it for his son, Danzhu, to learn discipline, concentration, and balance. Another suggested genesis for the game is that Chinese warlords and generals used pieces of stone to map attacking positions. Other plausible theories relate Go equipment to divination or flood control.

**Origin in China**

Go’s early history is debated, but there are myths about its existence, one of which assuming that Go was an ancient fortune telling device used by Chinese astrologers to simulate the universe's relationship to an individual.

The earliest written reference of the game is usually taken to be the historical annal Zuo Zhuan [2] (c. 4th century BC [3]), referring to a historical event of 548 BC. It is also mentioned in Book XVII of the Analects of Confucius [3] and in two of the books of Mencius [4] (c. 3rd century BC [5]). In all of these works, the game is referred to as yì (弈).
In ancient China, Go was often seen as the refined pastime of the scholars, while xiangqi was the game of the masses. Go was one of the four cultivated arts of the Chinese scholar gentlemen, along with calligraphy, painting and playing the musical instrument guqin, and examinations of skill in those arts was used to qualify candidates for service in the bureaucracy.[5]

Chinese archaeologists have discovered a broken piece of a pottery go board from the Western Han Dynasty (206 BC - 24 AD) in Shaanxi Province. This is the earliest discovery of an existing board unearthed in China. A picture can be found here[6] (third picture down).

The board was found in the ruins of a watchtower at the tombs of Emperor Jingdi of the Western Han Dynasty, and his empress. The broken fragment of the board measures 5.7 cm to 28.5 cm long, 17 cm to 19.7 cm wide and 3.6 cm thick.

Li Gang, a research fellow with the Shaanxi Provincial Archaeological Research Institute, said that this board might have been made from a floor tile, and that it did not belong to the royal family since the carvings are too rough. Li said the board could have been made by the tomb guards who played go to pass the time. "That proves that go was being played not only by nobles, but also by ordinary people like tomb guards, more than 2,000 years ago," Li noted.

In 1954 a complete Go board made out of stone was found in a tomb dating to the Eastern Han Dynasty (25-220) in Wangdu County, Hebei Province. This board has a 17 × 17 grid, which confirms the statement by the 3rd century author Handan Chun in the Classic of Arts that Go was at this time played on a 17 × 17 grid:

The go board has 17 lines along its length and breadth, making 289 points in all. The black and white stones each number 150.[7]

The earliest board with a 19 × 19 grid to have been found is a ceramic board dating to the Sui Dynasty (581-618) that was excavated from Anyang in Henan Province, so sometime between the 3rd and 6th centuries a change in grid size must have taken place. However, the 17 × 17 board has survived in the version of Go played in Tibet.[8]

**Growth in east Asia**

Go is believed to have been introduced to Japan by Kibi Makibi who had studied in Tang China at the beginning of the 8th century. But the Taihō Code, enacted in 701, has a description of Go and therefore the game may have been introduced a little earlier. After it was introduced from China, Go came to be actively played during the Nara period (710-794), and during the following Heian period (794-1185) Go was a favourite aristocratic pastime, as is described in typical literary works of this period such as The Pillow Book and The Tale of Genji.

During the Muromachi period (1336–1573), potentates employed semi-professional Go players, called Go-uchi (碁打ち) or Uwate (上手) who competed against other clans. At the end of the 16th century, Nikkai (Honinbo Sansa) served Oda Nobunaga, Toyotomi Hideyoshi and Tokugawa Ieyasu as a Go teacher, and in 1578 was recognized as the first Meijin of Go by Oda Nobunaga; he also became the first Honinbō.

In 1612, at the beginning of the Edo period (1603–1868), the Tokugawa Shogunate established Four hereditary "houses" to teach the game of Go: Honinbō (本因坊), Hayashi (林), Inoue (井上) and Yasui (安井). These four houses (Iemoto) competed with each other throughout the 300 years of the Edo period.

The wave of Westernization and modernization accompanying the Meiji Restoration in 1868 caused the dissolution of the official iemoto Go system and a wane in general popularity for the game. In the wake of this upheaval, the Honinbo title was transformed into a tournament title.
Development in the West

Despite its widespread popularity in East Asia, Go has been slow to spread to the rest of the world, unlike other games of ancient Asian origin, such as chess. Schadler\cite{9} speculates that chess has more widespread appeal because culturally congruent game pieces can be created in chess (e.g. Queen and Bishop in Western Chess, Advisor and Elephant in Chinese Chess), while Go is totally abstract. Also, there is no climactic ending in Go (such as checkmate in chess). New players often have trouble figuring out when a game of Go is over. Other theories center around the existence of fundamental differences in the level and type of thinking required by Go players as opposed to chess players. While pure analytical thought and the ability to plan many moves in advance are advantageous in chess, in Go a more intuitive approach based on pattern recognition and experience is stressed. A purely analytical approach, due to the sheer number of moves available for consideration, can be paralyzing.

The first detailed description of Go in a European language, *De Circumveniendi Ludo Chinensium* (*About the Chinese encircling game*), was written in Latin by Thomas Hyde, and included in his 1694 treatise on Oriental board games, *De Ludis Orientalibus* (*About Oriental games*); Oscar Korschelt, a German engineer, is credited with being the first person to try to popularize Go outside of Asia. He learned about the game from Honinbo Shuho (Murase Shuho) when he worked in Japan from 1878 to 1886. Korschelt published a detailed article on Go in 1880. A few years later he published a book based on this article. He brought the game to Europe, especially to Germany and Austria, and thus became the first person to systematically describe Go in a Western language. Since he learned Go in Japan, the terms of Go in Western languages come from Japanese, not Chinese.

By the early 20th century, Go had spread throughout the German and Austro-Hungarian empires.\cite{10} In 1905, Edward Lasker learned the game while in Berlin. When he moved to New York, Lasker founded the New York Go Club together with (amongst others) Arthur Smith, who had learned of the game while touring the East and had published the book *The Game of Go* in 1908.\cite{11} Lasker's book *Go and Go-moku* (1934) helped spread the game throughout the US,\cite{12} and in 1935, the American Go Association was formed. Two years later, in 1937, the German Go Association was founded.\cite{10} World War II put a stop to most Go activity, but after the war, Go continued to spread.\cite{12}

Western players' interest increased in the 1950s. In 1978, Manfred Wimmer\cite{13} became the first Westerner to receive a professional player's certificate from an Asian professional Go association. It was not until 2000 that a Westerner, Michael Redmond, achieved a professional 9 dan rating, the top rank awarded by Asian Go associations.

For most of the 20th century, the Japan Go Association played a leading role in spreading Go outside East Asia, publishing the English-language magazine *Go Review* in the 1960s, establishing Go centers in the US, Europe and South America, and often sending professional teachers on tour to Western nations.\cite{14} By 2005, the European Go Federation had a total of 35 member countries.\cite{15}

In 1996, NASA astronaut Daniel Barry and Japanese astronaut Koichi Wakata became the first people to play Go in space, using a special Go set designed by Wai-Cheung Willson Chow.\cite{16} Both astronauts were awarded honorary dan ranks by the Nihon Kiin.\cite{16}
Trivia

Maybe the first game of Go in Europe was played in 1872 between Kido Takayoshi and Ōkubo Toshimichi. Both were vice ambassadors of the Iwakura Mission, which traveled to the United States and Europe between 1871 and 1873. Kido was an enthusiastic go player, as can be seen from his diary (translated by Sidney DeVere Brown and Akiko Hirota as The Diary of Kido Takayoshi, Vol. I-III, Tokyo, The University of Tokyo Press, 1983–1986). During his journey, after arriving at Birmingham on 1 November 1872 and staying at the Queen's Hotel in Room No. 10, Kido notes two days later in his diary (Vol. II, p. 243):

3 November 1872 [Meiji 5/10/3] Fair, then rain. I stayed in my room all day to recuperate from my illness, and had a special diet. I played go with Ōkubo. (Note) Sunday.

References

[8] Shotwell 2003
[16] Peng & Hall 1996

Notes

External links

- The Go Link Explorer: History of Go (http://linkexplorer.net/go/history/history.html)
- History of Go in ancient China, Korea and Japan (http://gobase.org/history/)

Four go houses

In the history of go in Japan, the Four go houses were the four academies of Go instituted, supported, and controlled by the state, at the beginning of the Tokugawa shogunate. At roughly the same time shogi was organised into three houses. Here "house" implies institution run on the recognised lines of the iemoto system common in all Japanese traditional arts. In particular the house head had, in three of the four cases, a name handed down: Inoue Inseki, Yasui Senkaku, Hayashi Monnyu. References to these names therefore mean to the contemporary head of house.
The four academies were the Honinbo go house, Hayashi go house, Inoue go house and Yasui house. Theoretically these were on a par, and competed in the official castle games called *oshirogo*.

**History**

The first of the four houses was the house Honinbo, founded by Honinbo Sansa. Honinbo Sansa was a buddhist monk, and had been appointed Godokoro (minister of go) by Tokugawa Ieyasu after the unification of Japan in 1603.

**Buddhist connections**

They were also nominally Buddhist institutions, with the Honinbo and Hayashi aligned with the Nichiren sect, and the Inoue and Yasui with the Jodo Shu. All players were therefore male. Some outward forms only persisted of that connection, with the *oshirogo* games being played in Buddhist dress and with shaven heads; the stylish Ota Yuzo was given a waiver of the obligation since he was proud of his hair. After Honinbo Doetsu made a representation that long sleeves were troublesome for the players, a dispensation for shorter sleeves was allowed to them. At least in theory, matters on succession in the houses was subject to the authority of the *jisha bugyo*, an official regulating religious establishments. Nominations as heir, typically within the *iemoto* system of the best disciple, who might not be a natural son but in effect adopted, were supposed to be made official. Deaths at an early age particularly affected the Honinbo house, and irregular succession could occur with potential for scandal.

**Official status**

The official posts of Meijin and godokoro were awarded, somewhat sporadically, and brought great prestige to the house. In practice backstairs intrigue was often brought to bear on the appointments. More creditably, since the Meijin title could only be awarded to the undisputed master player of the time, there were occasions when it was withheld from two candidates whose merit was very close (an example was Genjo and Chitoku, around 1810-1820).

**Teaching**

The mode of teaching, by apprenticeship, brought a consistent and high level of play (though some say the standard sagged in the eighteenth century). Esoteric teaching was normal, with collections of very difficult *tsuinego* being compiled, one of which, the *Igo Hatsuryon*, is still used for professional training. Prepared variations were used in top games (notably in the blood-vomiting game of Jowa and Akaboshi). Go secrets were state secrets, in effect; since the country was closed to foreigners, in the main, the only international competition was against players from the Ryukyu Islands, but those games are still cited as examples of the difference between strong amateurs and really strong players.
Later history
After a while the Honinbo house (of Dosaku) emerged as most prestigious, and the Hayashi house ran into difficulties, eventually being taken over by the Honinbo. The Meiji Restoration threw the system into disarray, but three houses survived some hard times to 1900. Honinbo Shusai arranged that the Honinbo title should become a tournament of the Nihon Kiin after his death (1939). The Yasui house died out; it is not certain as of 2004 whether the Inoue house theoretically continues or not, though it dropped out of the mainstream from the 1920s.

Notes
This is an in-depth discussion of the rules of go.

There has been a certain amount of variation in the rules of go over time, and from place to place. This article discusses those sets of rules broadly similar to the ones currently in use in East Asia. Even among these, there is a degree of variation.

Notably, Chinese and Japanese rules differ in a number of respects. The most significant of these is the scoring method, together with attendant differences in the manner of ending the game.[1]
While differences between sets of rules may have moderate strategic consequences on occasion, they do not change the character of the game. The different sets of rules usually lead to the same game result,\(^2\) so long as the players make minor adjustments near the end of the game. Differences in the rules are said to cause problems in perhaps one in every 10,000 games in competition.\(^3\)

This article first presents a simple set of rules which are, except for wording, identical to those usually referred to as the Tromp-Taylor Rules,\(^4\) themselves close in most essential respects to the Chinese rules. These rules are then discussed at length, in a way that does not assume prior knowledge of go on the part of the reader. The discussion is for the most part applicable to all sets of rules, with exceptions noted. Later sections of the article address major areas of variation in the rules of go, and individual sets of rules.

**Basic rules**

A set of rules suitable for beginners is presented here. In some respects, these differ from the rules most commonly used. However, the basic rules are simply stated, and provide a convenient basis on which to discuss differences in rulesets. The rules are studied more fully in Explanation of the basic rules below.

Two statements of the same basic rules, differing only in wording, are given here. The first is a concise one due to James Davies. The second is a formulation of the basic rules used for expository purposes in this article.

Except for terminology, the basic rules are identical to the Logical Rules\(^5\) first proposed in their current form in September 1996 by John Tromp and Bill Taylor.\(^6\)\(^7\) They are also quite close to the Simplified Ing Rules\(^8\) of the European Go Federation, the only exception being the method of ending the game.

**Concise statement**

These rules appear in "The Rules and Elements of Go" by James Davies.\(^9\) They assume familiarity with the equipment used to play go, for which one may refer to Elements of the game below.

**Notes:** The words *move* and *territory* are used differently here than elsewhere in this article; *play* and *area*, respectively, are used instead. A clarification to rule 5 is added in parentheses.

1. The board is empty at the onset of the game (unless players agree to place a handicap).
2. Black makes the first move, after which White and Black alternate.
3. A move consists of placing one stone of one's own color on an empty intersection on the board.
4. A player may pass his turn at any time.
5. A stone or solidly connected group of stones of one color is captured and removed from the board when all the intersections directly adjacent to it are occupied by the enemy. (Capture of the enemy takes precedence over self-capture.)
6. No stone may be played so as to recreate a former board position.
7. Two consecutive passes end the game.
8. A player's territory consists of all the points the player has either occupied or surrounded.
9. The player with more territory wins.

These rules rely on common sense to make notions such as "connected group" and "surround" precise. What is here called a "solidly connected group of stones" is also called a *chain*. 
Reference statement
The basic rules are formulated here in a more detailed way to ease their presentation in the section #Explanation of the basic rules below. (Each rule and definition links to a detailed explanation in that section.)

An optional rule prohibiting suicide is included as Rule 7A.

Players and equipment
• Rule 1. Players: Go is a game between two players, called Black and White.
• Rule 2. Board: Go is played on a plain grid of 19 horizontal and 19 vertical lines, called a board.
  • Definition ("Intersection", "Adjacent") A point on the board where a horizontal line meets a vertical line is called an intersection. Two intersections are said to be adjacent if they are connected by a horizontal or vertical line with no other intersections between them.
• Rule 3. Stones: Go is played with playing tokens known as stones. Each player has at their disposal an adequate supply of stones of the same color.

Positions
• Rule 4. Positions: At any time in the game, each intersection on the board is in one and only one of the following three states: 1) empty; 2) occupied by a black stone; or 3) occupied by a white stone. A position consists of an indication of the state of each intersection.
  • Definition ("Connected") In a given position, two stones of the same color (or two empty intersections) are said to be connected if it is possible to pass from one to the other by a succession of stones of that color (or empty intersections, respectively) in which any two consecutive ones are adjacent.
• Rule 5. Initial position: At the beginning of the game, the board is empty.
• Rule 6. Turns: Black moves first. The players alternate thereafter.
• Rule 7. Moving: When it is their turn, a player may either pass (by announcing "pass" and performing no action) or play. A play consists of the following steps (performed in the prescribed order):
  • Step 1. (Playing a stone) Placing a stone of their color on an empty intersection (chosen subject to Rule 8 and, if it is in effect, to Optional Rule 7A).
  • Step 2. (Capture) Removing from the board any stones of their opponent's color that have no liberties.
  • Step 3. (Self-capture) Removing from the board any stones of their own color that have no liberties.
  • Optional Rule 7A. Prohibition of suicide: A play is illegal if one or more stones would be removed in Step 3 of that play.
• Rule 8. Prohibition of repetition: A play is illegal if it would have the effect (after all steps of the play have been completed) of creating a position that has occurred previously in the game.

End
• Rule 9. End: The game ends when both players have passed consecutively. The final position is the position on the board at the time the players pass consecutively.
  • Definition ("Territory") In the final position, an empty intersection is said to belong to a player's territory if 1) all stones adjacent to it or to an empty intersection connected to it are of the player's color; and 2) there is at least one such stone.
• Definition ("Area") In the final position, an intersection is said to belong to a player's area if either: 1) it belongs to that player's territory; or 2) it is occupied by a stone of that player's color.
• Definition.\textsuperscript{[27]} ("Score") A player's score is the number of intersections in their area in the final position.

• Rule 10.\textsuperscript{[28]} Winner: If one player has a higher score than the other, then that player wins. Otherwise, the game is drawn.

Comparative features of the basic rules

The essential features of these basic rules relative to other rulesets are summarized here. Each of the differences is discussed in greater detail in a later section of the article.

What variation exists among rulesets concerns primarily Rules 7A, 8, 9 and 10.

• The basic rules use area scoring, as in China and Taiwan, and as in the official rules of many Western countries. The main alternative is territory scoring. Though territory scoring is the system used in Japan and Korea, and is customarily used in the West, it is not possible to use territory scoring unless Rule 9 is replaced by a much more complex end-of-game rule. The goal of these basic rules is to present a simple system first. See the section "Scoring systems" below.

• The basic rules require the players to "play the game out" entirely. Virtually all rulesets used in practice provide some mechanism that allows players to begin scoring the game before the final position (the one used to score the game) has been reached. In some cases, this is merely a convenience intended to save time. In others, it may be an essential feature of the game. In any case, explaining these rules might obscure the nature of the game somewhat for a person unfamiliar with it. See the section "Counting phase" below.

• The basic rules allow suicide (or self-capture). This is unusual outside of Taiwan and New Zealand. Inclusion of Optional Rule 7A is in line with practice elsewhere. See the section "Suicide" below.

• The basic rules apply the rule of positional superko. This, or a similar rule, is common in official Western rulesets, but not in East Asia. See the section "Repetition" below.

• The basic rules do not contain any special exceptions for territory in a seki. This agrees with most practice outside Japan and Korea. See the section "Seki" below.

• The basic rules do not have a komi. This is now unusual in even-strength games, but was common practice until the mid-twentieth century. A komi is a number of points, usually five to eight, awarded to White in compensation for moving second. See the section "Komi" below.

• The basic rules make no provision for the use of handicap stones. See the section "Handicap" below.

• The basic rules do not specify a counting system. A counting system is a conventional method for calculating the difference in score between the players (hence determining the winner). It may incorporate various devices, such as filling in one's territory after the game, or shifting stones on the board into patterns, which allow quicker calculation of the difference in scores.

Explanation of the basic rules

The object of the game of go is, in rough terms, to control more territory at the end of the game than one's opponent does.

Elements of the game

Players

Rule 1. Go is a game between two players, called Black and White.

The choice of black or white is traditionally done by chance between players of even strength. The method of selection is called nigiri. One player, let's call him/her Player A, takes a handful of white stones; Player B then places either one or two black stones on the board, indicating "even" or "odd." Player A counts the number stones in his/her hand to determine whether there is an odd or even number. If the number of stones matches the other player's
selection of "even" or "odd." Player B will play the black stones; if not, he/she will take the white stones.

When players are of different strengths, the weaker player takes black. Black may also pre-place several handicap stones before play begins, to compensate for the difference in strength (see below).

**Board**

**Rule 2.** Go is played on a plane grid of 19 horizontal and 19 vertical lines, called a *board.*

**Definition:** A point on the board where a horizontal line meets a vertical line is called an *intersection.* Two intersections are said to be *adjacent* if they are distinct and connected by a horizontal or vertical line with no other intersections between them.

The condition that the intersections be "distinct" is included to ensure that an intersection is not considered to be adjacent to itself.

Intersections are also called *points.*

There are 361 points on a regular 19 × 19 board.

For simplicity, we will illustrate the rules mostly using 5 × 5 boards.

Each of the following diagrams shows two points on a 5 × 5 board:

![Adjacent points](image1)

![Adjacent points](image2)

![Non-adjacent points](image3)

In the first two diagrams, the points are adjacent; in the third they are not.

Though 19 × 19 boards are standard, go can be played on another size board. Particularly common sizes for quick games are 9 × 9 and 13 × 13. (See also "Board size" below.)

Beginners might prefer to play on a 9 × 9 board to start. The nature of the game remains similar enough to make this worthwhile, yet the games are shorter. For beginners, playing longer games is less important than playing a greater number of games.
Stones

Rule 3. Go is played with playing tokens known as stones. Each player has at his disposal an adequate supply of stones of his color.

Traditionally, Black is given 181 stones, and White, 180, to start the game. This is almost always sufficient, but if it turns out to be insufficient, extra stones will be used.

Positions

Rule 4. At any time in the game, each intersection on the board is in one and only one of the following three states: 1) empty; 2) occupied by a black stone; or 3) occupied by a white stone. A position consists of an indication of the state of each intersection.

Specifying a position involves only the current state of the board. It requires no indication of whose turn it is, nor any information relating to previous moves or states of the board. This definition of "position" is used in Rule 8 ("positional superko").

The diagram shows a possible position:

![Diagram of a possible Go position with stones and empty points]

Naturally, two stones are said to be adjacent if they occupy adjacent intersections. Similarly, a stone and an intersection are adjacent if the stone occupies an intersection adjacent to that intersection.

Connected stones and points

Definition. In a given position, two stones of the same color (or two empty intersections) are said to be connected if it is possible to pass from one to the other by a succession of stones of that color (or empty intersections, respectively) in which any two consecutive ones are adjacent.

The concept of connected stones is used to describe (via the concept of liberties, defined below) the conditions in which stones are captured by a move. The concept of connected empty points is used only at the end of the game, to define a player's score.

In the following position, the stones 1 and 7 are connected by the sequence of black stones 1, 2, ..., 7, in which each stone (other than 1) is adjacent to the stone before it. The empty points a and k are connected by the sequence of empty points a, b, ..., k, in which each point (other than a) is adjacent to the one before it. In fact, it is easy to see in this position that all the black stones are connected to each other and that all the empty points are connected to each other.
Let us examine the previous position and determine which stones and empty points are connected.

In the diagram, stones and empty points are marked with the same number or letter, respectively, whenever they are connected to each other.

A **chain** is a set of one or more stones (necessarily of the same color) that are all connected to each other and that are not connected to any other stones. Although it is not necessary to define the word *chain* in order to state the rules, the concept is important for an understanding of the game.

For example, Black and White each have four chains in the diagram above. Black has one three-stone chain, one two-stone chain, and two one-stone chains. White has one four-stone chain and three one-stone chains.

It follows from the definitions that any stone on the board belongs to exactly one chain. Furthermore, saying that two distinct stones of the same color are connected is the same as saying that they belong to the same chain.

**Liberties**

**Definition.** In a given position, a **liberty** of a stone is an empty intersection adjacent to that stone or adjacent to a stone which is connected to that stone.

We study some examples.

In the above position, the points $a$, $b$, $c$, $d$, $e$, are the liberties of the black stone at 1.

- $a$ is a liberty of Black 1 because it is adjacent to Black 1 itself.
- $b$ is a liberty of Black 1 because it is adjacent to Black 2, which is connected to Black 1. Alternatively, $b$ is adjacent to Black 3.
- $c$ is a liberty of Black 1 because it is adjacent to Black 3, which is connected to Black 1.
- $d$ is a liberty of Black 1 because it is adjacent to Black 4, which is connected to Black 1.
• \(e\) is a liberty of Black 1 because it is adjacent to Black 4, which is connected to Black 1. Alternatively, \(e\) is adjacent to Black 5.

The result would have been the same if we had determined the liberties of Black 2, or of any other stone belonging to the black chain.

In this position:

- The black stones marked 1 have the liberties \(c, d\) and \(h\).
- The black stones marked 2 have the liberties \(d, e, f, g\) and \(h\).
- The black stone marked 3 has the liberties \(g\) and \(h\).
- The white stones marked 4 have the liberties \(a, b\) and \(c\).
- The white stone marked 5 has the single liberty \(c\).
- The white stone marked 6 has the liberties \(d\) and \(h\).
- The white stone marked 7 has the liberties \(e\) and \(f\).

Since any two stones belonging to the same chain have the same liberties, we often speak of the liberties of that chain. For example, in the first diagram, the points \(a, b, c, d\) and \(e\) are the liberties of the lone black chain. In the second diagram, the liberties of the black chain in the lower right are \(c, d\) and \(h\).

**Play**

**Initial position**

**Rule 5.** At the beginning of the game, the board is empty.

**Alternation of turns**

**Rule 6.** Black moves first. The players alternate thereafter.

What players may do when they move is the object of Rules 7 and 8.

**Moving**

**Rule 7.** On his turn, a player may either pass (by announcing "pass" and performing no action) or play. A play consists of the following steps (performed in the prescribed order):

- **Step 1.** Placing a stone of his color on an empty intersection (chosen subject to Rule 8 and, if it is in effect, to Optional Rule 7A).
- **Step 2.** Removing from the board any stones of his opponent's color that have no liberties.
- **Step 3.** Removing from the board any stones of his own color that have no liberties.

A move is defined as a play or a pass. Thus, on each turn a player moves once.

A player may pass on any move. Usually, passing is beneficial only at the end of the game, when all territory has been claimed and further moves would be useless, or even harmful to a player's position.

The following three sections discuss the successive steps of a play in greater detail. Let us observe immediately however that, in view of Steps 2 and 3, all stones remaining on the board after any move must have at least one liberty.
Placing a stone on the board

Step 1 of a play. The player places a stone of his color on an empty intersection (chosen subject to Rule 8 and, if it is in effect, to Optional Rule 7A).

As indicated by the reference to Rules 8 and 7A (respectively the superko rule and prohibition of suicide, to be discussed later), there are some restrictions on the choice of point at which to play.

The following diagrams show a possible sequence of moves at the beginning of the game:

![Start](image1)  \( \text{Start} \)  \( \text{Black plays} \)  \( \text{White plays} \)

The following diagrams show how Black might play later in the same game:

![Before](image2)  \( \text{Before} \)  \( \text{After} \)

Numbers are often used, as here, to indicate new moves in printed diagrams.

Once a stone has been played, it remains on the board, in the same location, until the end of the game or until it is captured (removed from the board as part of Step 2 or Step 3 of a play).

Capture

Step 2 of a play. (After playing his stone) a player removes from the board any stones of his opponent's color that have no liberties.

We say that the stones removed from the board have been *captured* by the player moving.

We now give some examples in which the capture rule is applied.

The diagrams below show the capture of a white stone by Black. To begin with, the white stone has a single liberty at \( a \). By playing a stone at \( a \), Black removes the last remaining liberty of the white stone. It is subsequently removed from the board.
At the edge of the board and especially in the corners, stones have fewer liberties to start with and are more easily captured.

Next, White captures a chain of four black stones by playing at \( a \).

Black captures the white chain by playing at \( a \).
Black captures the marked white chain at the edge of the board by playing at $a$. Then White captures the black stone in the corner by playing at $b$.

![Diagram of Go board showing captures](image)

Here, White captures the three marked black chains by playing at $a$.

![Diagram of Go board showing captures](image)

### Self-capture

**Step 3 of a play.** (After playing his stone and capturing any opposing stones) a player removes from the board any stones of his own color that have no liberties.

**Optional Rule 7A. A play is illegal if one or more stones would be removed in Step 3 of that play.**

The removal of one or more stones in Step 3 is called *self-capture*, or *suicide*. Before discussing self-capture further, let us note that most rulesets give effect to Optional Rule 7A, which prohibits it. This means that, in those rulesets, any play which under the basic rules would require a self-capture to be performed is illegal. For further information, see "Suicide" below.

We begin with an example which, it is emphasized, does *not* involve self-capture. When Black plays at $a$, the capture of the marked white stones results in the black chain at the bottom right acquiring liberties. This move is legal (with the same result) whatever the rules.

![Diagram of Go board showing captures](image)
The previous example shows that it is important that Step 2 of a play (capture) precedes Step 3 (self-capture). If the order were reversed, then self-capture would occur here.

It is not difficult to convince oneself that if a play results in the capture of opposing stones, self-capture does not occur.

We now present some examples of plays in which self-capture occurs. These moves would be illegal under the optional rule prohibiting suicide.

In this example, if Black plays at a, then the stone played by him is removed immediately. This move has the same effect on the position as a pass, though it would not allow White to end the game by passing next (Rule 9). The move is in any event illegal by Rule 8. (This is the positional superko rule. This move might be legal under other versions of the superko rule. See "Repetition" below.)

In the next example, Black plays at a, resulting in the self-capture of the marked black stones.

**Ko and Superko**

**Rule 8.** A play is illegal if it would have the effect (after all steps of the play have been completed) of creating a position that has occurred previously in the game.

Though a pass is a kind of "move," it is not a "play." Therefore, Rule 8 never bars a player from passing. Before going further, we state a consequence of Rule 8 called the *ko* rule:

**Consequence (ko rule).** One may not play in such a way as to recreate the board position following one's previous move.

Whereas Rule 8 prohibits repetition of any previous position, the ko rule prohibits only *immediate* repetition.

The word *ko*, pronounced with a long "o", is taken from Japanese (劫, *kō*; usually written with katakana: ホウ) and can mean both "threat" and "aeon" (from the Buddhist *kalpa*).[^29]

Rule 8 is known as the *positional superko* rule. The word "positional" is used to distinguish it from slightly different superko rules that are sometimes used. While the ko rule is observed in all forms of go, not all rulesets have a superko rule. The practical effects of the ko rule and the superko rule are similar; situations governed by the superko
The superko rule is designed to ensure the game eventually comes to an end, by preventing indefinite repetition of the same positions. While its purpose is similar to that of the threefold repetition rule of chess, it differs from it significantly in nature; the superko rule bans moves that would cause repetition, whereas chess allows such moves as one method of forcing a draw. The ko rule has important strategic consequences in go.

Some examples follow in which Rule 8 applies. These examples cover only the most important case, namely the ko rule.

The first diagram shows the board immediately after White has played at 1, and it is Black's turn. Black captures the marked white stone by playing at a. If White responds by capturing at b with 3, the board position is identical to that immediately following White 1. White 3 is therefore prohibited by the ko rule.

Another example of ko follows. Here, Black 3 is illegal by the ko rule.

As noted in the section "Self-capture," Rule 8 prohibits the suicide of a single stone. This is something of a triviality since such a move would not be strategically useful. Taking it for granted that no suicide of a single stone has occurred, a moment's thought will convince the reader that the ko rule can be engaged in only one situation:

Restatement of the ko rule. One may not capture just one stone, if that stone was played on the previous move, and that move also captured just one stone.

Furthermore, this can occur only when one plays in the location at which one's stone was captured in the previous move. The two points where consecutive captures might occur, but for the ko rule, are said to be in ko. For example, in the first two diagrams above, the points a and b are in ko.

The next two examples involve capture and immediate recapture, but the ko rule is not engaged, because either the first or second capture takes more than one stone.

In the first diagram below, White must prevent Black from playing at a, and does this with 1 in the second diagram. Black can capture the three stones in White 1's group by playing at b. He does this with Black 2 in the third diagram. White may recapture Black 2 by playing at a again, because the resulting position, shown in the fourth diagram, has not occurred previously. It differs from the position after White 1 by the absence of the two marked white stones.
**Rules of Go**

Capture is called a *snapback*.

At this point, White could choose to connect at $b$ because of the ko rule. So the second diagram shows the resulting position. Black cannot immediately recapture at $b$ elsewhere on the board.

The first diagram below shows the position after Black 1. White can capture the marked black stones by playing at $a$. In the third diagram, Black plays at $b$ to prevent this, capturing White 1. However, by playing at $a$ again, White can capture Black 2’s group. This is not barred by the ko rule because the resulting position, shown in the fourth diagram, differs from the one after White 1 by the absence of the marked white stones. This kind of capture is called a *snapback*.

**Ko threats**

The next example is typical of real games. It shows how the ko rule can sometimes be circumvented by first playing elsewhere on the board.

The first diagram below shows the position after Black 1. White can capture the marked black stone by playing at $a$. The second diagram shows the resulting position. Black cannot immediately recapture at $b$ because of the ko rule. So he instead plays 3 in the third diagram. For reasons that will become clear, Black 3 is called a "ko threat."

At this point, White could choose to connect at $b$, as shown in the first diagram below. However, this would be strategically unsound, because Black 5 would guarantee that Black could eventually kill the white group altogether.
no matter how White played.

Instead, White responds correctly to Black 3 with 4 in the first diagram below. Now, contrary to the situation after White 2, Black can legally play at b, because the resulting position, shown in the second diagram, has not occurred previously. It differs from the position after Black 1 because of the presence of Black 3 and White 4 on the board. Now White is himself prohibited from recapturing at a by the ko rule. White has no moves elsewhere on the board requiring an immediate reply from Black (ko threats), so White plays the less urgent move 6, capturing the black stone at 3, which could not have evaded capture even if White had waited. In the next diagram, Black connects at a before White has a chance to recapture. Both players pass and the game ends in this position.

**End**

**Rule 9.** The game ends when both players have passed consecutively. The *final position* (the position later used to score the game) is the position on the board at the time the players pass consecutively.

Since the position on the board at the time of the first two consecutive passes is the one used to score the game, Rule 9 can be said to require the players to “play the game out.”

Under Rule 9, players must for example capture enemy stones even when it may be obvious to both players that they cannot evade capture. Otherwise the stones are not considered to have been captured. Because Rule 9 differs significantly from the various systems for ending the game used in practice, a word must be said about them.

These systems, which are discussed more fully in the section “Counting phase” below, generally allow the game to end as soon as it is clear to the players which stones would remain on the board if the game continued. The precise means of achieving this varies widely by ruleset, and in some cases has strategic implications. These systems often use passing in a way that is incompatible with Rule 9. For players, knowing the conventions surrounding the manner of ending the game in a particular ruleset can therefore have practical importance.

Under Chinese rules, and more generally under any using the area scoring system, a player who played the game out as if Rule 9 were in effect would not be committing any strategic errors by doing so. He would, however, likely be viewed as unsportsmanlike for prolonging the game unnecessarily. On the other hand, under a territory scoring
system like that of the Japanese rules, playing the game out in this way would in most cases be a strategic mistake.

**Territory**

**Definition.** In the final position, an empty intersection is said to belong to a player's territory if 1) all stones adjacent to it or to an empty intersection connected to it are of his color; and 2) there is at least one stone of his color.

*Note:* Unless the entire board is empty, the second condition - that there be at least one stone of the kind required - is always satisfied and can be ignored.

A point can never belong to both players' territories.

On the other hand, it may well happen that an empty intersection belongs to neither player's territory. In that case the point is said to be *neutral territory*. \(^{[30]}\) There are rarely any more than a handful of neutral points at the end of a game; in the majority of cases, there are none at all.

Japanese and Korean rules count some points as neutral where the basic rules, like Chinese rules, would not. For more on this, see the section "Seki".

In order to understand the definition of territory, it is instructive to apply it first to a position of a kind that might arise before the end of a game. Let us assume that a game has ended in the position below \(^{[31]}\) (even though it would not normally occur as a final position between skilled players).

![Diagram of territory](image)

The point *a* is adjacent to a black stone. Therefore *a* does not belong to White's territory. However, *a* is connected to *b* (by the path shown in the diagram, among others), which is adjacent to a white stone. Therefore *a* does not belong to Black's territory either. In conclusion, *a* is neutral territory.

The point *c* is connected to *d*, which is adjacent to a white stone. But *c* is also connected to *e*, which is adjacent to a black stone. Therefore *c* is neutral territory.

Similarly, the points *f* and *g* are neutral territory.

On the other hand, *h* is adjacent only to black stones and is not connected to any other points. Therefore, *h* is black territory. For the same reason, *i* and *j* are black territory, and *k* is white territory.

It is because there is so much territory left to be claimed that skilled players would not end the game in the previous position. The game might continue with White playing 1 in the next diagram. If the game ended in this new position, the marked intersections would become White's territory, since they would no longer be connected to an empty intersection adjacent to a black stone.
The game might end with the moves shown below. In the final position, the points marked \( a \) are black territory and the points marked \( b \) are white territory. The point marked \( c \) is the only neutral territory left.

In Japanese and Korean rules, the point in the lower right corner and the point marked \( a \) on the right side of the board would fall under the seki exception, in which they would be considered neutral territory. (See the section "Seki" below.)

**Area**

**Definition.** In the final position, an intersection is said to belong to a player's *area* if either: 1) it belongs to that player’s territory; or 2) it is occupied by a stone of that player’s color.

Consider once again the final position shown in the last diagram of the section "Territory." The following diagram illustrates the area of each player in that position. Points in a player's area are occupied by a stone of the corresponding color. The lone neutral point does not belong to either player's area.
Score

Definition. A player's score is the number of intersections in his area in the final position.

For example, if a game ended as in the last diagram in the section "Territory," the score would be: Black 44, White 36. The players' scores add to 80. The difference between this and the 81 intersections on a 9 × 9 board is accounted for by the one point of neutral territory.

The scoring system described here is known as area scoring, and is the one used in the Chinese rules. Different scoring systems exist. These determine the same winner in most instances. See the Scoring systems section below.

Winner

Rule 10. If one player has a higher score than the other, then that player wins. Otherwise, the game is drawn.

In the previous example, Black wins by eight points.

Margin of victory does not matter; winning by one point is as good as winning by 100 points.

Scoring systems

The most prominent difference between rulesets is the scoring method. There are two main scoring systems: territory scoring (the traditional Japanese method) and area scoring (the Chinese method). A third system (stone scoring) is rarely used today but was used in the past and has historical and theoretical interest.

Care should be taken to distinguish between scoring systems and counting methods. Only two scoring systems are in wide use, but there are two ways of counting using "area" scoring.

Territory scoring

In territory scoring (including Japanese and Korean rules) a player's score is determined by the number of empty locations that player has surrounded minus the number of stones their opponent has captured.

Furthermore, Japanese and Korean rules have special provisions in cases of seki, though this is not a necessary part of a territory scoring system. (See "Seki" below.)

Typically, counting is done by having each player place the prisoners they have taken into the opponent's territory and rearranging the remaining territory into easy-to-count shapes.
Area scoring

In area scoring (including Chinese rules), a player's score is determined by the number of stones that player has on the board plus the empty area surrounded by that player's stones.

There are several common ways in which to count the score (all these ways will always result in the same winner):

- The oldest counting method is as follows: At the end of the game, all white stones are removed from the board, and the players use black stones to fill the entirety of the black territory. Score is determined by counting the black stones. Since the board contains 361 intersections, black must have 181 or more stones to win. This method is still widely used in Mainland China.
- Around 1975, Taiwanese player and industrialist Ing Chang-ki invented a method of counting now known as Ing counting. Each player begins the game with exactly 180 stones (Mr. Ing also invented special stone containers that count each player's stones). At the end, all stones are placed on the board. One vacant intersection will remain, appearing in the winner's area; the number of stones of one color in the other color's area will indicate the margin of victory.

Stone scoring

In stone scoring, a player's score is the number of stones that player has on the board. Play typically continues until both players have nearly filled their territories, leaving only the two eyes necessary to prevent capture.[32]

Attempts at reconciling the scoring systems

If the game ends with both players having passed the same number of times, then the score will be identical in territory and area scoring. AGA rules[33] call for a player to give the opponent a stone when passing. This "passing stone", which is treated like a prisoner, ensures a correct result under any counting method.

The results for stone and area scoring are identical if both sides have the same number of groups. Otherwise the results will differ by two points for each extra group. Some older rules used area scoring with a "group tax" of two points per group; this will give results identical to those with stone scoring.

Counting phase

Customarily, when players agree that there are no useful moves left (most often by passing in succession), they attempt to agree which groups are alive and which are dead. If disagreement arises, then under Chinese rules the players simply play on.

However, under Japanese rules, the game is already considered to have ended. The players attempt to ascertain which groups of stones would remain if both players played perfectly from that point on. (These groups are said to be alive.) In addition, this play is done under rules in which kos are treated differently from ordinary play. If the players reach an incorrect conclusion, then they both lose.

Unlike most other rulesets, the Japanese rules contain lengthy definitions of when groups are considered alive and when they are dead. In fact, these definitions do not cover every situation that may arise. Some difficult cases not entirely determined by the rules and existing precedent must be adjudicated by a go tribunal.

The need for the Japanese rules to address the definition of life and death follows from the fact that in the Japanese rules, scores are calculated by territory rather than by area. The rules cannot simply require a player to play on in order to prove that an opponent's group is dead, since playing in his own territory to do this would reduce his score. Therefore, the game is divided into a phase of ordinary play, and a phase of determination of life and death (which according to the Japanese rules is not technically part of the game).
Optional rules

Compensation
To allow players of different skills to compete fairly, handicaps and komi are used. These are considered a part of the game and, unlike in many other games, they do not distort the nature of the game. Players at all levels employ handicaps to make the game more balanced.

Komi
In an “even”, or non-handicap game, Black’s initial advantage of moving first can be offset by komi (compensation points): a fixed number of points, agreed before the game, added to White's score at the end of the game. The correct value of komi (to properly compensate for Black’s advantage) is controversial, but common values are 5.5, 6.5, or 7.5; the fractional value avoids a tied game. In a handicap game, komi is usually set to 0.5 (i.e., White wins if the game is tied). A handicap game with a handicap of 1 starts like an even game, but White receives only 0.5 komi (i.e., a White player who is stronger by one rank is handicapped only by Black’s first-move advantage).

Before the 20th century, there was no komi system. When the great Shusaku was once asked how an important game came out, he said simply, “I had Black”, implying that victory was inevitable. As more people become aware of the significance of Black having the first move, komi was introduced. The amount of komi has been increased periodically based on analysis of game results indicating >50% wins for Black; each time, after a period of adjustment Black has again begun winning >50% of games. When it was introduced in Japanese Professional games, it was 4.5 points. However, Black still had a better chance to win, so komi was increased to 5.5 points in 1974. In 2002, the Japanese Go Association again increased the komi value to 6.5.

Handicap
Handicaps are given by allowing the weaker player to take Black and declaring White's first few moves as mandatory "pass" moves. In practice, this means that Black's first move is to place a certain number of stones (usually the number is equal to the difference in the players' ranks) on the board before allowing White to play. Traditionally, the hoshi ("star points") -- strategically important intersections marked with small dots— are used to place these handicap stones. On the 19 × 19 board, there are nine star points: at the four 4-4 points in the corners, at the four 4-10 points along the sides, and one at the 10-10 point (the centre of the board, or tengen in Japanese). Smaller boards such as the 13 × 13 and 9 × 9 also have star points. The 13 × 13 has 9 at the 4-4 points, 4-7 points, and the center. The 9 × 9 board has only 5 points: the 3-3 points and the center.

When Black is only one rank weaker (also known as one stone weaker, due to the close relationship between ranks and the handicap system), Black is given the advantage of playing Black, perhaps without komi, but without any mandatory White passes. For rank differences from two through nine stones, the appropriate number of handicap stones are used. Beyond nine stones, the difference in strength between the players is usually considered great enough that the game is more a lesson than a competition where White teaches Black. Thus, nine stones is the nominal upper limit on handicap stones regardless of the difference in rank (although higher numbers of stones, up to 41 stones in some cases, may be given if the teacher wants a greater challenge).
Thinking times

See the Time control section of the main Go article.

Variations

Go was already an ancient game before its rules were codified, and therefore, although the basic rules and strategy are universal, there are regional variations in some aspects of the rules.

Seki

To define this notion, we must begin with two definitions:

Terminology:

- An **eye** is a connected group of one (or more) empty intersections entirely surrounded by a chain or chains of stones of one color.
- A chain of one color is *independently alive* if it is (or can be made to be) adjacent to two eyes.

These definitions are given only loosely, since a number of complications arise when attempts are made to formalize the notion of life and death.

A group of stones of one color is said to be **alive by seki** (or **in seki**) if it is not independently alive, yet cannot be captured by the opponent.

For example, in the diagram above, the black and white groups each have only one eye. Hence they are not independently alive. However, if either Black or White were to play at the circled point, the other side would then capture their group by playing in its eye. In this case both the black and white groups are alive by seki.

In the diagram above, the circled point is not surrounded by stones of a single color, and accordingly is not counted as territory for either side (irrespective of ruleset). In more complex cases, as here,[34]

a vacant point may be surrounded by a group of a single color which is in seki. According to Japanese and Korean rules, such a point is nonetheless treated as neutral territory for scoring purposes. Generally, the Japanese and Korean rules only count a vacant point as territory for one color if it is surrounded by a group or groups of that color that are independently alive.
Repetition

The major division in rules to prevent repetition is between the simple ko rule and the super ko rule: the simple ko rule (typically part of the Japanese ruleset) prevents repetition of the last previous board position; while the superko rule (typically part of Chinese derived rulesets, including those of the AGA and the New Zealand Go Society) prevents repetition of any previous position. In both cases, the rule does not however prohibit passing.

The super ko rule is differentiated into situational super ko (SSK, in which the "position" that cannot be recreated includes knowledge of whose turn it is) and positional super ko (PSK, which ignores whose turn it is). Natural situational super ko (NSSK) is a variant in which what matters is not whose turn it is, but who created the position (i.e., who made the last move other than a pass.)

The Ing rules feature a complicated distinction between "fighting" and "disturbing" ko.

Situations other than ko which could lead to an endlessly repeating position are rare enough that many frequent players never encounter them; their treatment depends on what ruleset is being used. The simple ko rule generally requires the inclusion of additional rules to handle other undesirable repetitions (e.g. long cycles which can lead to no result where the game must be replayed).

The first position below is an example of a triple ko, taken, with minor changes, from Ikeda Toshio's On the Rules of Go.\[35\]

Without a superko rule, this position would lead to an endless cycle, and hence "no result", a draw, or some other outcome determined by the rules.

We now discuss the position using the superko rule. For simplicity, we assume that the last move placed a stone in a position unoccupied since the beginning of the game, and away from the ko. Under positional and situational super ko, Black captures the white group. This is also the case with natural situational super ko if it is Black's turn. If it is White's turn however, then NSSK exhibits odd behavior. White can get a seki by passing, but only at the cost of allowing Black unlimited moves away from the ko. If White insists on saving his group, the final position might look like the second diagram. On the other hand, with the first move (which should be a pass), White wins by two points in the third position using NSSK (assuming area scoring). Black's best response, in terms of maximizing his score, is a pass.
Suicide

Currently, most major rulesets forbid playing such that a play results in that player's own stones being removed from the board. Some rulesets (notably, New Zealand derived rules and Ing rules) allow suicide of more than one stone. Suicide of more than one stone rarely occurs in real games, but in certain circumstances, a suicidal move may threaten the opponent's eye shape, yielding a ko threat.

Compensation

The major rulesets differ in how handicap stones are placed on the board: free placement (Chinese), where stones can be placed anywhere (as if the player's turn repeated); and fixed placement (Japanese), where tradition dictates the stone placement (according to the handicap). Area scoring rules and territory scoring rules also differ in the compensation given for each handicap stone (since each handicap stone would count under area scoring). Komi (compensation for going first) also varies, ranging from several fixed values (commonly 5.5, 6.5, or 7.5) to various meta-games to determine a value (notably Auction Komi).

Board sizes

Most Go is played on a 19 × 19 board, but 13 × 13 and 9 × 9 are also popular sizes. Historically other board sizes were commonly used (notably 17 × 17, a predecessor of the 19 × 19 board in ancient China). Go is also sometimes played on various novelty sized boards as small as 5 × 5 and larger than 19 × 19. All board sizes have an odd number of lines to ensure that there is a center point, possibly to make mirror go a less attractive strategy. Generally all rules apply to all board sizes, with the exception of handicaps and compensation (whose placement and values vary according to board size).

Scoring

Historically in China a scoring system was used that penalized the player who had the greatest number of unconnected live groups of stones. On the basis that every group needs two eyes to be alive, and that the two eyes could not be filled in, two points were deducted from the score for each live group at the end of the game. This was known as the "cutting penalty" in Chinese, and is sometimes referred to as the "group tax" in English. This rule is not applied in modern Chinese scoring.

Issues

In general, there are three closely related issues which have to be addressed by each variation of the rules.

First, how to ensure that the game comes to an end. Players must be able to settle unsettled situations rather than going around in circles. And neither player should be able to drag the game out indefinitely either to avoid losing or to irritate the other player. Possible methods include: the super-ko rule, time control, or placing an upper bound on the number of moves. This is also affected by the scoring method used since territory scoring penalizes extended play after the boundaries of the territories have been settled.

Second, how to decide which player won the game; and should draws (jigo) be allowed. Possible terms to include in the score are: komi, prisoners captured during the game, stones in dead groups on the board at the end of the game, points of territory controlled by a player but not occupied by his stones, his living stones, the number of passes, and the number of disjoint living groups on the board.

Third, how to determine whether a group of stones is alive or dead at the end of the game, and whether protective plays are necessary; e.g., connecting a group which would be in atari if all dame were filled. If the players are unable to agree, some rules provide for arbitration using virtual attempts to capture the group. Others allow play to resume until the group is captured or clearly immortal.
Rulesets

There are many official rulesets for playing Go. These vary in significant ways, such as the method used to count the final score, and in very small ways, such as whether the two kinds of "bent four in the corner" positions result in removal of the dead stones automatically at the end of the game or whether the position must be played out, and whether the players must start the game with a fixed number of stones or with an unbounded number.

Rule sets include Japanese [37], Chinese [38], Korean [39], AGA [33] (American Go Association), Ing [40], and New Zealand [41].

Further detailed information may be found at the following external links.

Japanese rules

These are rules used in Japan and, with some minor differences, in Korea. They are in wide use throughout the West, sometimes known as "territory" rules. The scoring is based on territory and captured stones. At the end of the game, prisoners are placed in the opponent's territory and players rearrange the board so that territories are easy to count, leaving a visual image resembling the game, which some players find aesthetically pleasing. There is no superko (the triple ko leads to an undecided game.) Suicide is always forbidden. Komi is 6.5.

Disagreements about whether certain groups are alive or dead, and about the counting of territory, are resolved in a notoriously complex manner (see "Counting phase" above).

Japanese rules count vacant points in a seki as neutral, even if they are entirely surrounded by stones of a single color.

World Amateur Go Championship Rules

The rules of the World Amateur Go Championship are based on the Japanese rules, with some differences.[42] These rules are sanctioned by the International Go Federation.

Chinese rules

This is the other major set of rules in widespread use, also known as "area" rules. At the end, one player (usually Black) fills in all of his/her captured territory, and the other (White) stones are removed from the board. Prisoners do not count. Black stones are then arranged in groups of ten—eighteen such groups, plus half the komi, plus at least one additional stone = victory for Black. So for example with a komidashi of 7.5 points, under Chinese rules Black needs at least 185 stones on the board at the end to win. Komidashi is usually 7.5 points.

In the Chinese rules, there is no penalty for playing within one's territory at the end of the game, for example to kill and remove dead enemy groups. Thus passing to signal that one believes that there are no more useful moves may be conceived as simply being a convenient device to accelerate the end of the game - assuming one is not mistaken. The result will always be the same as if the game had been played out entirely.

The fact that disagreements can be resolved by playing on means that Chinese-style rules can be implemented easily without the need for the rules to define what is meant by "living" and "dead" groups.
**World Mind Sports Games Rules**

The rules of the First World Mind Sports Games, held in Beijing in October 2008, are based on the Chinese rules, but are simpler, and represent a compromise with the Japanese and Korean rules. These rules are sanctioned by the International Go Federation.

These rules use area scoring, and have a komi of 6.5. Black has one further point deducted in the event that White was the first player to pass in the game. This last feature is a compromise with Japanese and Korean rules in that it is similar, in terms of its strategic consequences, to territory scoring. Unlike the Chinese rules, this rule will generally impose a penalty for an additional move at the end of the game within one's territory. In particular, the result of the game may differ by up to a point from what it would have been had both players played it out.

The game normally ends after two consecutive passes, but in the event of disagreement about the score, play resumes in the original order. Once this resumption has occurred, then when two consecutive passes do eventually occur again, play stops and all stones left on the board are deemed alive. Thus after a single disagreement, the players are required to play the game out entirely. (By this point in the game, there is no longer any penalty for making "useless" plays within one's territory to kill dead enemy groups, since the one-point advantage for passing first has already been attributed to one player or the other by the first set of consecutive passes.)

Suicide is forbidden in these rules. Unlike the Chinese rules, the WMSG rules apply superko (specifically, positional superko).

**AGA rules**

These are used by the American Go Association. Some special rules (like giving the opponent a prisoner when passing) are added, which make the area scoring and territory scoring equal.

The Federation Française de Go use AGA rules with one exception, the type of superko used. The British Go Association also adopted the AGA rules, with some minor departures, in April 2008.

**Ing rules**

The scoring is basically the same as area scoring, but is done with a special technique involving "Ing bowls". Both players must start with exactly 180 stones; the Ing Foundation makes special bowls that allow players to count their stones easily. Prisoners come back to the owner. After the game finishes, both players fill their empty territory with their stones. The one that gets rid of all of them is the winner. Black pays White eight points (komi) by allowing four white stones in Black's territory to be placed at the beginning of the counting phase. As Black wins ties it is 7.5 in effect. The ko rule makes a distinction between "fighting" and "disturbing" ko. Multi-stone suicide is allowed. This ruleset was invented and promoted by Ing Chang-ki.

**Differences**

In most cases the differences between the rulesets are negligible. The choice of ruleset rarely results in a difference in score of more than one point, and the strategy and tactics of the game are mostly unaffected by the ruleset used.

**References**

[2] How to play Go (http://www.britgo.org/intro/intro2), British Go Association
[3] Interview with Zhu Baoxun (http://ranka.intergofed.org/?p=940), Ranka Online. “The differences are more significant theoretically than practically. During the last 100 years no professional or amateur tournament has ever been stopped because of the differences of rules. In practice, the differences will cause problems only in very rare situations, maybe once in 10,000 games.” — Zhu Baoxun, deputy chief arbiter of the First World Mind Sports Games, October 12, 2008.
New in Go

Elementary Rules (http://home.snafu.de/jasiek/element.html) of James Davies

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 1: "The two sides are known as Black and White[...]

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 1: "Go is a game of strategy between two sides usually played on a 19x19 grid (the board).

New Zealand Go Society Rules of Go (http://homepages.ihug.co.nz/~barryp/rules.htm): "Adjacent intersections are those intersections connected by lines of the grid, with no intervening intersections."

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 1: "The two sides, known as Black and White, are each provided with an adequate supply of playing tokens, known as stones, of the appropriate color."

Tromp-Taylor rules of go (http://homepages.cwi.nl/~tromp/go.html): "Each point on the grid may be colored black, white or empty."

Simplified Ing Rules (http://home.snafu.de/jasiek/siming.html) of the EGF: "The position is the distribution of black, white, and no stones on all the unique intersections of the grid. For a play, this is given after all its removals."

Simplified Ing Rules (http://home.snafu.de/jasiek/siming.html) of the EGF: "Stones of the same colour are connected if they are adjacent or if there is a chain of adjacent stones of their colour between them. Likewise, empty intersections are connected if they are adjacent or if there is a chain of adjacent empty intersections between them."

New Zealand Go Society Rules of Go (http://homepages.ihug.co.nz/~barryp/rules.htm): "A liberty of a stone is an unoccupied intersection adjacent to that stone or to any stone connected to that stone."

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 1: "The board is initially vacant [...]


New Zealand Go Society Rules of Go (http://homepages.ihug.co.nz/~barryp/rules.htm): "A play consists of placing a stone (of that player's own colour) on an unoccupied intersection, then removing any of the opponent's stones that then have no liberties (if any), and then removing any of that player's own stones that then have no liberties (if any). A move consists of 1. making a play [... or 2. saying 'pass'."

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 5: "It is illegal for a player to move so as to create a string of their own stones which is completely surrounded (without liberties) after any surrounded opposing stones are captured."

Simplified Ing Rules (http://home.snafu.de/jasiek/siming.html) of the EGF: "A play may not recreate a previous position from the game."

Elementary Rules (http://home.snafu.de/jasiek/element.html) of James Davies: "Two consecutive passes end the game."

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 12: " Territory: Those empty points on the board which are entirely surrounded by live stones of a single color are considered the territory of the player of that color."

Though the Simplified Ing Rules use the word "territory" differently, they describe what is here defined to be a player's territory as consisting of "the empty regions that are adjacent only to intersections with stones of a player's colour." The Commentary to the rules further specifies: "During scoring, an empty region does not provide any points if a) it is adjacent to at least one black intersection and adjacent to at least one white intersection or b) the whole board is empty."

Official AGA Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html), Rule 12: "Area: All live stones of a player's color left on the board together with any points of territory surrounded by a player constitute that player's area."

Simplified Ing Rules (http://home.snafu.de/jasiek/siming.html) of the EGF: "The score of each player is the number of all intersections a) with stones of the player's color, and b) of the empty regions that are adjacent only to intersections with stones of the player's color.

Simplified Ing Rules (http://home.snafu.de/jasiek/siming.html) of the EGF: "For the final position, either the scores are unequal and the winner is the player with the greater score or the scores are equal and the game is a tie."

Ko Etymology Discussion (http://senseis.xmp.net/?KoEtymologyDiscussion) at Sensei's Library

AGA Official Rules of Go (http://www.cs.cmu.edu/~wjh/go/rules/AGA.html): "Neutral Points: Any empty points left on the board at the end of the game which are not completely surrounded by either player's stones are known as neutral points, and are not counted toward either player's territory or area."


Diagram taken from Robert Jasiek [ n s a f u ] (http://home.snafu.de/jasiek/diffsasts.html) (German)

European Go Culture Centre Homepage (http://gobase.org/studying/rules/ikeda/?sec=2030601)

Fairbairn, John, "The Rules Debate" (http://www.gogod.co.uk/NewInGo/C&IP.htm), New in Go (http://www.gogod.co.uk/NewInGo/NewInGo.htm), Games of Go on Disc., retrieved 2009-06-09


External links

Rules comparisons

- A listing of rules pages (http://senseis.xmp.net/?RulesOfGo)
- Another listing of rules pages (http://www.usgo.org/resources/internet.asp#Rules)
- Comparison of some go rules (http://www.britgo.org/rules/compare.html) summarized in a table
- Go (Weiqi, Baduk) rules (http://home.snafu.de/jasiek/rules.html)
- Go rule dialects (http://wwwhomes.uni-bielefeld.de/achim/go_rule_philo.html)

Specific rulesets

- Ing's SST laws of Goe (http://www.cs.cmu.edu/~wjh/go/rules/SST.html)
- "Logical" rules (http://www.cwi.nl/~tromp/go.html) (Tromp-Taylor ruleset)
- "Mathematical Rules" (http://www.brooklyngoclub.org/jc/rulesgo.html) of Go by Jean-Claude Chetrit
- "Simple" rules (http://home.snafu.de/jasiek/simple.html)
- A collection of essays (http://www.usgo.org/resources/internet.html#Rules) assessing and comparing the various rulesets
- Ikeda's rule sets for Go (http://gobase.org/studying/rules/ikeda/?sec=e_rules)
Go handicaps

Within most systems and at most levels, handicap is given to offset the strength difference between players of different ranks in the game of Go.
Forms of handicaps

In the game of Go, a handicap is given by means of stones and compensation points. In contrast to an even game, in which black plays first, white plays the first move in a game with handicap (after black's handicap stones have been placed).

Handicap stones

The rank difference within a given amateur ranking system is one guide to how many handicap stones should be given to make the game a more equal contest. As a general rule, each rank represents the value of one stone. (In terms of points, one stone is considered to be 13-16 points, but this figure is not constant over levels: the more skillful a player, the greater the usefulness of each stone.)

For example, a 3 kyu player gives a 7 kyu player four handicap stones to allow for an interesting game with roughly equal challenge for both players. If traditional fixed placement of the handicap stones is used, nine stones is normally the maximum handicap. Larger handicaps are certainly possible; but with such a great difference in strength, Black may be simply bewildered, and not understand how many of White's moves relate to his own.

The above rank relationship reliably applies for single-digit kyu (1-9k) and amateur dan (1-7d) ranks. The advantage of moving first is equivalent to only half a stone of handicap, as the opponent then has the initiative. Because White gets the next move after Black places the handicap stones, a nominal handicap of \( n \) stones is therefore in reality half a stone less than \( n \).

Nowadays professional ranks are awarded by professional go players' organizations; they are, unlike amateur ranks, not reliable as a measure of current playing strength, but rather an indication of achievements. Before the late 20th century, they were used as strength measurement, with a difference in skill of less than a third of a stone per rank.

Small board handicaps

Small boards are often used for novice players (double-digit kyu players) just learning to play Go, or for quick games. As the fewer moves made when playing on smaller boards gives White fewer chances to overcome the advantage conferred by the handicap, smaller handicaps are used on smaller go boards (most commonly 13×13 and 9×9).\(^1\)

The per-rank handicap is therefore reduced, by a scaling factor. Various estimates have been given for the factor that applies to 13×13, in the range 2.5 up to 4; and on grounds both theoretical and experimental (small-board tournament play). The evidence is that 2.5 is more realistic than 4, for clock games. The corresponding factor for a 9×9 board is not easy to understand, and the change for each stone added is very large.

One theoretical approach is according to the distribution of the number of moves made in a game on a board of a given size relative to the number made on a 19×19 board. Using estimates that a 19×19 game will last about 250-300 moves, a 13×13 game about 95-120 moves, and a 9×9 game about 40-50 moves, a quadratic formula for the ratio of the mean number of plays may apply. Arguing that White catches up by means of Black's 'small errors', so that White's deficit drifts at a constant rate, it makes sense to take the ratio of game lengths as scaling factor.\(^2\)

Each full stone of handicap on a 13×13 board is in any case probably equivalent to about 2.5 to 3 ranks, and each full stone on a 9×9 board is equivalent to about 6 ranks. For example if the appropriate handicap is 9 (i.e., 8.5) stones on a 19×19 board, the handicap between those two players is reduced to 4 (because \( 3.5 \times 2.5 = 8.75 \)) stones on a 13×13 board and 2 (\( 1.5 \times 6 = 9 \)) stones on a 9×9 board. A 5 (i.e., 4.5) stone handicap on a 9×9 board is accordingly equivalent to a handicap of 27 or 28 stones on a 19×19 board.

These figures are not a consensus, but have wide support. They can be used to give rankings, by converting 13×13 handicaps back to rank difference.
Handicap placement

Fixed placement

There are 9 star points marked on a 19 x 19 board – in each corner on the (4,4) point, in the middle of each side on the fourth line, (4,10); and the very center of the board, (10,10). Traditionally handicaps are always placed on the star points, as follows:

<table>
<thead>
<tr>
<th>Stones</th>
<th>Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Black plays his first stone as he wishes, and gives no komi</td>
</tr>
<tr>
<td>2</td>
<td>Black plays the star points to his upper right and lower left</td>
</tr>
<tr>
<td>3</td>
<td>Black adds the star point to his lower right (In Classical Chinese rules the third handicap stone is place on tengen)</td>
</tr>
<tr>
<td>4</td>
<td>Black takes all four corner star points</td>
</tr>
<tr>
<td>5</td>
<td>Black adds the center star point</td>
</tr>
<tr>
<td>6</td>
<td>Black takes all three star points at left and right</td>
</tr>
<tr>
<td>7</td>
<td>Black adds the center star point</td>
</tr>
<tr>
<td>8</td>
<td>Black takes all star points except the center</td>
</tr>
<tr>
<td>9</td>
<td>Black takes all nine star points</td>
</tr>
</tbody>
</table>

As the stones are always at the same (4,4) points in the corners, Black always plays more (4,4) openings, and doesn’t gain experience playing the (3,4) openings, or others such as (3,3), (5,4), (5,3), etc., except on two and three stones.[3]

Free placement

Recently, some have advocated free placement of handicap stones. Free placement means one can place handicap stones anywhere on the board without restriction. Here is the list of countries[4] and servers[5] that use free placement of handicap stones:[6]

<table>
<thead>
<tr>
<th>Fixed Placement</th>
<th>Japan, Korea, United States (by default), IGS online server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Placement</td>
<td>Chinese, Ing, New Zealand</td>
</tr>
</tbody>
</table>

Although free placement is less common because many players are attached to tradition, especially in East Asian countries, it offers advantages which are not available with fixed placement.
Advantages

For weaker players:
• They can choose their opening strategies according to their own understanding of the game, and thus follow a consistent strategy.
• They can think for themselves and learn about different opening strategies through actual game experience.
• The mandatory handicap points stress influence rather than taking territory directly; some weaker players have a more territorial style.
• They can learn a much larger range of corner plays in actual competition against stronger opponents.

For stronger players:
• Many more variations with fewer repetitions mean the game is more refreshing, challenging, and interesting to the strong player. They may be more willing to play and teach the weaker player.

Disadvantages

With free placement, weaker players may not place their stones in respect to their comparable handicap to their opponent, thus eliminating the point of the handicap. The standard fixed handicap points allow for a good standard that allows novices to have the handicap they need since they are not experienced and may not be able to take advantage of the free placement of handicap stones. Therefore, free placement handicap may be best suited for more experienced players or those who want more flexibility and variety in play.

Compensation Points

When the difference in strength is one rank, no handicap stone is given. Instead the stronger player takes white but without compensation points. The compensation points are called Komi in Japanese. It is a custom that Black plays first; White moves second. Playing first is regarded as a significant advantage in modern go, and to make the game fair to both players, this advantage must be compensated. It is regarded that playing first is equal to half a move or more ahead throughout the game.

Another common type of compensation used is the reverse compensation points, where the weaker player takes black, and is given both the first move and compensation points too. This is more advantageous than the above situation.

Compensation points are sometimes preferred to stones because the players would like to play or practice as if it is an even game. They would like to have the feel of an "even game". White (the stronger player) must play better to overcome these disadvantages (points gained by playing first + compensation points).

Fixed compensation point (Komi) system

When ranks are equal, Black gets advantages by playing first. The advantage of that first move is compensated by compensation points. However there are still no absolute standards on the number of compensation points due to the difficulty of determining a fair value. 6.5 points are used in Japan and Korea. 7.5 points are used in China and America (see AGA rules). The 0.5 point is used to prevent a draw.

Auction compensation point system

As no one can be absolutely sure what the fair number of compensation points is, some advocate another system which is often used in some amateur matches and tournaments. There are no fixed compensation points. The decision is left to both players. They arrive at a value through negotiation and bidding. This is called auction compensation point system.

Examples of auction komi systems include:
• one player chooses how big komi will be given to white and the other player then chooses to play black or white.
• the game is without komi; one player makes the first move of black (not too weak and not too strong) and the other one then chooses to play black or white. This is an application of the pie rule.
• the players do an "auction" by saying: "I am willing to play black against XXX komi" and the player who wins the auction plays black.

**Handicap strategy**

Handicap go is the traditional form of teaching given to go players. Fixed handicap placements are in effect a form of graded tutorials: if you cannot beat your teacher with a nine-stone handicap, some fundamental points are still to be learned.

The pedagogic value of fixed handicaps is an old debate for Western players. The 'theory' of handicap go shares with much of the rest of the Japanese pedagogic go literature a less explicit approach, based on perception as much as analysis. Whether fixed handicap placement makes it easier or more difficult for the weaker player to learn these fundamental points is moot. The nature of these 'tutorial' steps may certainly be misunderstood and contested by Western players new to the game. Handicaps are also unpopular with Chinese players, who have more of a tradition of equality at the board rather than deference to a teacher.

There are some book treatments of low-handicap go by strong professionals (Kobayashi Koichi and Kajiwara Takeo, in particular); and examples of pro-pro games to follow. With the traditional handicap placements, the only consistent strategy Black can follow depends on the use of influence. This is particularly true in the early stages of the middle-game fighting. [7]

While Black often assumes that consolidating territory from the opening stages should be enough to win, that is not the case when the handicap stones are placed on the star points, where they are more effective in obtaining influence than territory. If Black does not understand and utilize the value of star-point handicap stones for attack, White will gradually build a more advantageous position, and steadily close the gap.

**Notes and references**

[2] Psychologically speaking, Black (the pupil) probably sees blunders as more important in a loss; but White (the teacher) is more aware of getting into the game by means of Black's inefficiencies.
[3] Historically, in China, Black and White were constrained to play on diagonally-opposite star points for their first two moves in even games. In Japan, from some point in the sixteenth century perhaps, the board was empty in even games. The consequence was a deeper study of the joseki that in the Chinese system were used only in three-stone handicaps. Those joseki dominated opening theory in Japan, until the shinfuseki period of the 1930s. In contemporary go, the 4-4 point openings are fundamental.
[4] Handicap placement convention and effect actually depends on different rule sets, such as Japanese or Chinese rules, and not on different countries. Not all countries have their own rule sets
[5] Some servers offer a choice between different rule sets
[7] See for example the book Kage's Secret Chronicles. In it more explicit reference is made, than is typical, to the need to fight hard rather than play slackly, in order to use the handicap stones properly. This lesson on influence is at the heart of the traditional system.
Komidashi

Komi (コミ) in the game of Go are points added to the score of the player with the white stones as compensation for playing second. Black's first move advantage is generally considered to equal somewhere between 5 and 7 points by the end of the game. Standard komi is 6.5 points under the Japanese and Korean rules; under Chinese, Ing and AGA rules standard komi is 7.5 points. Komi typically applies only to games where both players are evenly ranked. In the case of a one-rank difference, the stronger player will typically play with the white stones and players often agree on a simple .5 point komi to break a tie ("jigo") in favor of white.

Komidashi (コミ出し) is the more complete Japanese language term. Komi is known as Deom (뎀) in Korean.

Whole number and halves

Conventional komi in most competitions is a half-integer such as 6.5 points. This is convenient and the prevailing usage for tournaments, since it rules out a tied game (jigo in Japanese) and rematches. In a club or friendly game this is not a problem, so a value such as 6 points is just as practical. Within a Swiss system draw, tied games are not inconvenient and tiebreakers are used.

Some argue there is nothing wrong in having a tie. Forbidding a draw may misrepresent one player as superior when there is no clear difference in skill. There is however a hidden parity question which means that a draw may be unlikely. Lately, the Ing Cup has been using an 8 point komi rule in their tournament, but with the rule that if the scores are equal after komi then Black wins, so this is equivalent to 7.5 points.

History

White is at a disadvantage because Black gets to move first, giving that player sente. Records show that the winning percentage of Black is higher. The importance of playing first was however not dealt with by rule, until the 1930s, and then only tentatively.

The compensation (komi) system was introduced into professional Go in Japan as a gradual process of innovation, beginning in the 1930s. The correct value of komi has been re-evaluated over the years, as professional opening strategy has evolved.

At first, komi started as low as 2.5 points or 3 points. It was later increased to 4.5, and then 5.5 points. A komi of 5.5 points was used for a long time, but research found that 5.5 points was insufficient to compensate for White's disadvantage. Statistical analyses of the year's games would sometimes appear in the Igo Nenkan (Kido Yearbook), backing up the intuition of many top players. The use of databases confirmed figures such as 53% victories for Black, not just at the highest level.

Komi was then raised to 6.5. Some events use as high as 7.5 points. Under the Chinese method of counting, the difference between 5.5 and 6.5 point is of minimal effect. Chinese sources usually in fact quote figures that are halved, such as 2.75 for 5.5, at least for Chinese domestic competitions, as one stone (the scoring increment typically used in China) is equivalent to two points.

Handicap games are almost universally played with a komi of 0.5 points. The advantage of playing one or more black stones (the number usually calculated as the difference in player's rank) before the white player's first move constitutes the remainder of the handicap, with the 0.5 komi determining white as winner in games that would otherwise be a draw.

John Fairbairn, a Go historian, has written on the History of Komi.
Effects on strategy

Since very minor mistakes can cost one point, discussion of the 'true' value for komi makes little sense, except at the level of the top-ranked players in the world. These are (in most cases) also the opening-theory experts, and evaluate opening strategies in practical play against their peers.

The introduction and then increase of komi has led to ever more ambitious or aggressive strategies for Black, the first player. In the days before komi, White as second player had to disrupt the smooth working of Black's classical strategies, described sometimes as aiming for a sure win by 3 points. From the introduction of komi in most pro events, around 1950, Black's older methods had to be reconsidered, since White suddenly needed appreciably less (in pro terms) in secure area. The 3-3 point became an interesting play for White, where previously it appeared experimental, and was developed in particular by Go Seigen and Sakata Eio.

In the following decades a mixture of classical and shinfuseki techniques became normal. The most obvious effect was the replacement of the 4-3 point by the 4-4 point as the most common way to first occupy a corner.

Fairness of compensation points

It is a hard theoretical problem to determine the best and fairest value of compensation points, because it can be taken to ask for the result of a game of Go with best play by both sides. It can be estimated that playing first is equal to about half a move (or a bit more) ahead throughout the game.

Local variations

Although 6.5 points is a common komi as of 2007; each country, association, and tournament may set its own specific komi:

• In Japan, the usual komi was once about 2.5 points. Some time later, it was raised to 4.5 points. In 1955 the Oza became the first tournament to adopt 5.5. The value of 5.5 became standard over some decades. The Nihon Ki-in decided to change to 6.5 in September 2002.
• In Korea, it used to be 5.5, but is now 6.5.
• In China, 5.5 points was common, but 7.5 is now standard. A value of 6.5 would seldom give a different result from 5.5 due to Chinese scoring rules.
• In America, American Go association (AGA) official rules used to specify 5.5 points, however they later suggested also experimenting with values up to 8.5 points in both informal games and tournaments in order to gather data to determine the effects of increasing U.S. komi officially. The American Go Association changed komi from 5.5 to 7.5 in August 2004, effective 2005.
• The New Zealand rules specify a komi of 7.
• For the Ing Foundation (Ing rules) komi is specified as 8 points. Due to the different counting method used by the Ing system, this komi is equivalent to 7.5 points under the Japanese rules.
Types

Fixed compensation point system
By far the most common type of komi is a fixed compensation point system. A fixed number of points, determined by the Go organization or the tournament director, is given to the second player (White) in an even game (without handicaps) to make up for first-player (Black) advantage.

Auction komi
As no one can be absolutely sure of the ideal value for komi, systems without fixed komi are used in some amateur matches and tournaments. This is called auction komi.

Examples of auction komi systems:
- the players do an "auction" by saying: "I am willing to play black against XXX komi" and the player who wins the auction plays black.
- one player chooses the size of the komi, and the other player then chooses to play black or white.

External links
- USGO page on komi [1]
- Sensei's Library [2]

References
Go terms

Players of the game of Go often use jargon to describe situations on the board and surrounding the game. Such technical terms are likely to be encountered in books and articles about Go in English as well as other languages. Many of these terms have been borrowed from Japanese, mostly when no short equivalent English term could be found. This page gives an overview of the most important terms.
**Use of Japanese terms**

Although Go originated in China, the current English and Western technical vocabulary borrows a high proportion of terms from the Japanese language because it was through Japan that Go was introduced to Western culture.

Many of these terms are from a jargon used for technical go writing and to some extent specially developed for go journalism. Some authors of English-language go materials avoid use of Japanese technical terms, and the way they are applied can differ in subtle ways from the original meanings.

A very small number of Korean-language terms have come into use (e.g. *haengma* as a way of describing the development of stones).[^1] [^2]

**Terms**

**Aji**

The closest English one could use is 'latent potential.' From the Japanese, *aji* (味), meaning taste. It refers to the lingering ability of dead stones to open possible avenues of subtle play. Though *aji* might never be used, it bears on the course of the game. Good *aji* is when your groups are strong, and have little or no possibility of being compromised. Bad *aji* is when dead stones or weaknesses in one's own formation carry a latent threat of compromising an existing area should the situation become ripe. *Aji* is different from a simple defect or weakness in that it can be exploited and/or repaired in multiple ways at multiple stages of the game and the best way or time is not immediately clear; hence the "aftertaste" metaphor.

**Atari**

*Atari* (当たり) (Chinese: *dāchī*; Korean: *dansu*) is a term used for a situation where a stone or chain of stones has only one liberty, and may be captured on the next move if not given one or more additional liberties. It can be a verb for the act of placing a chain under *atari*, as well as an adjective to describe the status of a unit, as being "in (the state of) atari". Calling out *atari* during a game is sometimes done by beginners much like calling out *check* in chess, but it is considered rude by many more advanced players. [^3]

![Atari Diagram](image)

Above is a simple *atari* formation with only one stone (the white triangled stone) in danger of being captured. If black plays *a*, the white piece is immediately captured and removed from the board. White can escape toward the center by playing at *a* himself, creating a string with three liberties. Below, another white group is in *atari*, but playing at *b* along the side will do no good, since Black can then play *c* and capture the whole group on the next turn.
As the distance of a stone from the edge of the board has important tactical and strategic implications, it is normal to term the corner points of the board (1, 1) points, and count lines in from the edge.

- **Star point** (星 hoshi): an intersection traditionally marked with a small dot on the board. These are either
  - a (4, 4) point in an empty corner, or
  - a (4, 10) or (10, 4) point on one of the sides
- **Origin of heaven** (天元 tengen): the center of the board, located at (10, 10).
- **Five by five** (五の五 go no go): a (5, 5) point in a corner.
- **Three by three** (三々 san san): a (3, 3) point in a corner.
- **Small eye** (小目 komoku): a (4, 3) or (3, 4) point in a corner.
- **High eye** (高目 takamoku): a (4, 5) or (5, 4) point in a corner.
- **Large high eye** (大高目 ōtakamoku): a (6, 4) or (4, 6) point in a corner.
- **Outside the eye** (目外し mokuhażushi): a (3, 5) or (5, 3) point in a corner.
- **Outside the large eye** (大目外し ōmokuhażushi): a (6, 3) or (3, 6) point in a corner.
Dame

Dame (駄目 "DAH-meh") are unfilled neutral points that will not benefit either side. Typically the term refers to vacant points that lie between two opposing forces, and will eventually be filled without altering the score. Basically, dame points are of no interest, though they must be filled before counting the score under area (Chinese style) scoring. The Japanese rules define a dame as a vacant point that is not surrounded by live stones of only one color, so the term can also refer to an empty point that is tactically useful as a liberty for a unit.

Divine move

A divine move is a truly inspired and original move; one that is non-obvious and which balances strategy and tactics to turn a losing game into a winning game. A divine move is singular — they are of such rarity that a full-time go player might be lucky to play a single such move in their lifetime. The term comes from the Japanese Kami no Itte, meaning "hand of god".

The Divine Move is used in Go teaching as a motivation to look again at positions in games and consider not just the obvious moves but the less obvious and more innovative as well, in particular tenuki.

An example of one such divine move might be seen in the ear-reddening move played by Honinbo Shusaku in 1846.

Eyes

Eyes are internal liberties of a group of stones that, like external liberties, prevent the group's capture, but unlike external liberties are much harder for an opponent to fill. The presence or absence of eyes in a group determine life or death of that group. A group with no eyes, or only one eye, will die unless its owner can develop them. Conversely, a group with two eyes or more will live. There is nothing an opponent can do to capture such a group, because it is impossible to remove all liberties of the group by playing one stone, thus any such play is suicide.

Eyes are counted as occupied territory of the group that fully contains the eye. There are cases where a group may share one or more eyes with one of the opposing player's groups. These eyes do not count as territory for either player; sometimes these eyes are reduced to dame as the board changes in other areas to give one or both groups additional eyes, allowing one or both players to fill these shared eyes, but sometimes they cannot resolve (see seki below).

Gote and Sente

A move that leaves the player an overwhelming follow-up move, and thus forces the opponent to respond, is said to have "sente" (先手), or "initiative"; the opponent has "gote" (後手). In most games, the player who keeps sente most of the time will win.

Gote means "succeeding move" (lit: "after hand"), the opposite of sente, meaning "preceding move" (lit: "before hand"). Sente denotes which player has the initiative in the game, and which moves result in taking and holding the initiative. More precisely, as one player attacks, and the other defends in gote, it can be said that they respectively do and do not have the initiative. The situation of having sente is favorable, permitting control of the flow of the game.

Applying these concepts to a whole sequence is basic to higher strategy. If Black starts a sequence that properly ends in an even number of plays, Black retains sente in doing this. If Black starts a sequence that properly ends after an odd number of plays, Black loses sente and takes gote. Accepting gote should only be in return for some profitable exchange. Correct play in the yose (endgame) can consist of playing available sente sequences, and then taking the largest gote sequence on the board. That description is a simplification, though. A reverse sente play is a special type of gote play, preventing the opponent from making some sente move. The relative value of reverse sente plays depends on the overall position, but one can count it as twice the value of what it would be if purely gote.

A player has sente if he does not currently need to respond to moves made by his opponent. This can be achieved by tenuki (ignoring the opponent), as a kind of gambit. A player can break out of gote, and can gain sente, by choosing
to accept some future loss, on the local level, in order to take the initiative to play elsewhere.

In the case that neither of the players directly respond to each other's moves, the game can become difficult. Both players will have sente on their turn, and the moves they are making are gote. This will probably end in large exchanges, or one player will be shown to have a weaker position, and will have to start answering to avoid heavy damage.

**Hane**

A hane is a move that goes around one or more of the opponent's stones.

![A simple hane](image)

**Joseki**

Joseki (定石) are established sequences of play which (locally speaking) are considered to give an optimal result to both players. There are thousands of such lines that have been researched and documented.

Often joseki are played out early in the game and involve dividing the corners. There are also "mid-game joseki", dealing with for example an invasion into a common enclosure or framework.

Though joseki have some parallel with chess openings, they differ significantly. Chess openings structure the whole board while joseki deal only with a local position. Therefore the choice of which joseki (of many possible) to play in any given situation should be based on an assessment of the global position. This includes considerations of the direction of play, current balance of territory and influence, and one's own game strategy.

It is also quite possible to deviate from joseki and obtain a good result if the surrounding position allows. In other words, joseki are sensitive to the context in which they are played.

**Kakari**

An approach move to a corner position, such as at the 5-3 point when an opponent has previously played the 3-4 point. That would be a "low kakari". A "high kakari" would be at the 5-4 point.\(^4\)

**Kiai**

In the context of Go, kiai (気合) often translates as "fighting spirit", i.e. aggressiveness or initiative, but not unthinking greed. Kiai means keeping sente, that is not letting the opponent have his or her way. A sensei might say, "You play too passively — put some kiai in your moves!" A passive player may follow an opponent around the board responding to each move in turn. Kiai moves are the opposite of passive or submissive and a player showing kiai will dictate the flow of play. Kiai moves can catch an opponent off-balance and turn the game around. Examples of kiai moves include snatching sente away from the opponent; defending with a move that also counter-attacks; or answering a kikashi (forcing move) in an unexpected way. Kiai is also a term used in Japanese martial arts, usually as a name for a loud yell accompanying an attack. Obviously this is outwardly more restrained in the context of a board game, but it is intended to be in the same spirit.
Kikashi

Literally meaning ‘an enlivenment’, Kikashi (利 かし) is a forcing move, usually one made outside the primary flow of play. Unlike sente, though, a move is kikashi when it yields a high efficiency in play by forcing the opponent to abandon certain courses of action. A kikashi stone can generally be sacrificed but meanwhile it still might confer an advantage, e.g. act as a ladder breaker or destroy the opponent’s potential eyeshape, while the answering move has no value at all.

Moves can be kikashi, or not, depending on whether they are answered with appropriate sophistication or not. If the answering move strengthens the position, then the play is not kikashi but aji keshi (ruining one's own potential).

Ko

Ko (コウ) can refer to the Ko rule or strategic use of the rule in a fight.

Komi

Komi (コミ) is a bonus in score given to white as compensation for going second. There is no agreement on what Komi ought to be, but is commonly in the range of 4.5 to 7.5 points. Komi almost always includes a half point for breaking ties.

Korigatchi

The term korigatchi (凝 り 形) is often translated as 'over-concentrated', but more literally is 'frozen shape'. If a player uses his stones in an inefficient way, the result will be korigatchi. Knowing something about this problem should tell you how to avoid it. Placing stones too close together is a fundamental mistake, rather than safe play.

Kosumi

The Kosumi (コスミ) is a move placed at a point diagonally adjacent to another of one's own stones where the adjoining intersections are unoccupied.
Liberty

A Liberty (気) is a vacant point that is immediately adjacent to a stone in a cardinal direction, or connected through a continuous string of same-colored stones to such a point. A stone, chain, or group must always have at least one liberty to survive. A group that has two or more separate internal liberties (eyes) is impossible to capture.

Miai

Miai (見合い) in Go are, in the simplest terms, a pair of vacant points on the board that are equivalent in terms of value. For example, if Black plays at A, White can play at B and suffer no disadvantage from the exchange.

This occurs often. With respect to a group's development or survival, pairs of points are frequently seen, such that if one player occupies one of them, his opponent will occupy the other. Miai can be seen in the fuseki stage on a large scale, or in a simple life and death problem, such as a straight four-space eye. This shape is alive because of its two central points a and b: if Black plays a, White can answer with b and vice versa.

The term originates from the Japanese custom of arranging marriage through a series of meetings (miai) to view prospective spouses (見る miru, "view", 合う au, "meet").
Go terms

**Monkey jump**

A monkey jump is a move, usually used in the end-game, which can reduce one's opponent's territory significantly. It can be played when the attacker has a strong stone on the second line and the defender has no nearby stones on the first or second line guarding his hoped-for territory. The attacker places a stone on the first line three spaces into the defender's territory from the strong stone. Due to the special properties of the edge of the board, the defender cannot usually cut off the stone.

**Moyo**

*Moyo* moyō模様 is a framework for potential territory which usually consists of unconnected stones with some distance between them. The early game usually consists of competing for *moyo* by attempting to expand one's own and/or invade or reduce one's opponent's. This term is often translated as "framework", "potential" or "wall".

**Myoushu**

*Myoushu* myōshu (妙 手) is an "inspired move", a move which turns a game around or otherwise exceeds expectations. An example of one such move might be seen in the ear-reddening move played by Honinbo Shusaku in 1846.

**Ni-dan bane**

The *Double Turn* (二段 バネ Ni-dan bane), or two-step *hane* is a sequence of two moves in succession that turn around an adjacent opponent group. It can be an aggressive and appropriate way to play, although it exposes the stones to cutting.
Sekibana

In this joseki, white plays ni-dan bane with 10 and 12.

Sabaki

Sabaki (捌き) is the development of a flexible, efficient position that is difficult for the opponent to attack, often by means of contact plays and sacrifice tactics.

Seki

Seki (関) is a Japanese term for an impasse that cannot be resolved into simple life and death. It is sometimes translated as "mutual life." For example, a capturing race may end in a position in which neither player can capture the other. There are numerous types of seki position that can arise, characterized as cases in which neither player adds a play to groups that do not have two eyes. The area remains untouched; at the end all groups involved are deemed alive, but no points are scored for territory. Under area scoring stones in seki are counted as live and do give points.

In the figure, neither White nor Black can play on the points marked a. White would put himself in atari and be captured immediately. Black would be captured as well, leaving a shape (four in line) where White can always make two eyes.
Shape

Shape is the configuration of stones in terms of their flexibility and efficiency at staying connected, forming eyes, and maintaining liberties. Stones are said to have good shape if they are efficient and flexible, or bad shape if they are inefficient. Classic examples of good shape are the ponnuki (four stones in a diamond created by capturing an enemy stone) and the bamboo joint (a 2x3 pattern of two stones, two spaces and two more stones). Examples of bad shape are the empty triangle (three adjacent stones forming an 'L') and the dango (large clump of stones not containing any eyes). Joseki is in large part the study of forming good shape with your stones.

Tesuji

A Japanese term used in the games of go or shogi. A tesuji (手筋) is a clever play, the best play in a local position, a skillful move. Tesuji is derived from suji (筋), which means "line of play".

The opposite of tesuji is zokusuji, which can be translated as "crude line of play", and also referred to as anti-suji, or a vulgar move depending on the situation.

Tesuji is one of the important aspects of the game in which a player exerts his or her ability to "read ahead". In the game of Go, they are used in life and death situations (tsumego), in order to obtain initiative (sente), to capture stones, to gain extra points in the yose, or to otherwise save a seemingly unfavorable situation.

Thickness

Thickness is a literal translation of the Japanese word atsumi (厚み) and connotes the position of power and impregnability conferred by the thickness of medieval castles' stone walls. A group is thick when it has developed beyond the level of stability in its local area without accruing significant weaknesses, and consequently projects power at a distance, especially over vacant or unsettled areas of the board. Such positions have a profound influence on the flow of the game. In the diagram, though white has about 10 points of territory in the corner, black can expect the power projected outward by his thick position to more than make up for this.\[^{[5]}\] Note that his result would not be as good if white had a settled position in the direction black's influence is facing.
Yose

Yose (ヨセ) is a term used in connection with go endgame plays. From the Japanese, a yose would mean a tightening play, relating strictly to a play on the board that consolidates territory or destroys the opponent's territory. It is not, properly speaking, synonymous with the endgame phase as a whole but it is often used that way in both Japan and the West.[6]

A fundamental skill in the endgame is the ability to evaluate plays in different areas of the board and identify which plays have priority. This usually depends on counting: determining the number of points at stake. Knowledge of counting begins with some simple examples and heuristics. Combinatorial game theory has been implicated in gaining actual proofs rather than practical ways to win positions.

Oyose, or large yose, is a term often used in English language literature. It can be used for a yose that is large enough to be hard to count with precision (say, 20 points or more). It may also be used to refer to the early endgame phase of the game, immediately after middlegame combat, in which the typical yose plays are substantial but were neglected due to pressure elsewhere.

Yosu-miru

A probe. A yosu-miru move is, in some sense, a sacrifice of a stone, but is designed to yield a very sophisticated kind of information about a developing group and how best to attack it, based on its response. Yosu-miru draws on other concepts such as kikashi, aji, and korigatachi.

様子 (yōsu) means situation or the state of things, and 見る (miru) is "to see", thus "yōsu o miru", to "see how things stand". In Japanese this expression is usually used to say that it's better to wait and see before taking an action (e.g. "shibaraku yōsu o miru beki da", it's better to wait and see for a little while). It is not a single word or a set phrase except in Western Go literature, and "probe" is the preferred word, being self-explanatory and actually used by the speakers of its originating language.

References

External links
• Sensei's Library — Strategy (http://senseis.xmp.net/?Strategy)
• Sensei's Library — Essential Go Terms (http://senseis.xmp.net/?EssentialGoTerms)
• Go terminology (http://learnbaduk.com/go-terminology.html) - A list of go terminology
Strategy and Tactics

Byoyomi

Byo-yomi (秒読み byōyomi) is an extended time control in two-player games, specifically shogi and go. The word is borrowed from Japanese; the term literally means “counting the seconds,” or more generally, “countdown.”

A typical time control is "60 minutes + 30 seconds byo-yomi”, which means that each player may make as many or as few moves as he chooses during his first 60 minutes of thinking time, but after the hour is exhausted, he must make each move in thirty seconds or less. To enforce byo-yomi, a third person or a game clock with a byo-yomi option is necessary.

In professional Go games and many amateur tournaments, a player has several byo-yomi periods, for example five periods of one minute each. If a player makes his move within a one-minute period, he retains all five periods for his future moves. If a player oversteps one minute, he starts the following move in the second rather than the first byo-yomi period. In effect, the player has one minute per move plus four extra one-minute packets which may be used as needed, e.g. four moves of two minutes each, or one move of five minutes, or any other combination.

In higher-level tournaments, such as the Kisei tournament, the player's time is often composed entirely of byo-yomi periods (for example, in an eight-hour game, the player may have 480 periods of one minute each), rather than having a main block of thinking time. In this case, the actual counting of time (verbally) begins once the player falls below a certain threshold of time, such as 10 minutes; when the time is being counted, the player is informed at intervals how much time they have used in their current period, and how many extra periods they have left. (For example, the time may be called at 10-second intervals, and when 55 and 58 seconds have been used; during a player's final minute, the last 10 seconds are counted one by one.)[1]

When analog game clocks are used to enforce byo-yomi, it is more convenient to assign additional time for a block of moves, rather than for each move. In Canadian byo-yomi, a player typically gets 5 minutes for 10 to 20 moves. The IGS Go server uses a similar system, but the byo-yomi time is variable and always covers 25 moves. Thus the time control “20 minutes + 15 minutes byoyomi” on IGS means that after the initial 20 minutes of thinking time are over, a player is granted 15 additional minutes, which may be spent however he chooses. If these minutes expire before he has made 25 more moves, he loses. If he makes 25 more moves in less than 15 minutes, he is granted another 15 minutes of byo-yomi, and so on indefinitely.

Canadian byo-yomi imposes a certain average speed of play, but allows to spend more time to ponder on difficult moves. Several byo-yomi periods in one move per period variant (also known as Japanese byo-yomi, though that is a bit of tautology) serve essentially the same purpose, albeit to a lesser extent.

Unused time during one byo-yomi period does not carry forward to future moves. This is in contrast to the Fischer clock often used in chess, with designations such as "5 minutes + 12 seconds per move". Under this time control each player has twelve seconds added to his clock after every move, starting from the first move, regardless of how much time he spends on each move. Thus if a player thinks for eight seconds before making his first move, he will have five minutes and four seconds on his clock after making it.
### References


### External links

- Sensei’s Library (http://senseis.xmp.net/?ByoYomi) definition of *byo-yomi*.
- British Go Association (http://www.britgo.org/bgj/10643.html) description of how time is called.

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### Empty triangle

The **empty triangle** is the most fundamental example of the concept of bad shape.

Three stones of one color form an empty triangle when they are placed in a triangle arrangement that fits in a 2×2 square, and when one intersection is left empty.\(^1\) If the triangle is *filled* by a stone of the opponent’s at the fourth point of the 2×2, the shape is neutral — not necessarily good or bad.

The deficiencies of the empty triangle are twofold. Three stones in a straight line have eight liberties, while in an empty triangle they have only seven. This can mean the difference between success and failure in a life-and-death struggle. Also the formation lacks efficiency. In the case cited, the diagonally adjacent stones are tactically connected without the third stone, since the opponent can’t prevent them from connecting unless he is ignored for a turn.

However even though the empty triangle is a prime example of bad shape, creating one could make sense, or even qualify as brilliant, in certain situations.\(^2\)

*The Empty Triangle* is also the name of a popular series of comic panels about the game of Go that features personalities from the KGS Go Server.\(^3\)
Go opening theory

In the game of Go, the term opening theory refers to concepts which underlie where, why, in what order, and in what shapes the first several moves are played.[1] The middle game typically begins once the basic foundational areas called frameworks[2] are established and "fighting" begins.[3]

The opening is conceptually and traditionally divided for study into the sequences that are whole board openings[4] and those that are corner openings.[5] Each type constitutes a series of plays which have been studied for their balance (with the other) as well as for countermoves.

For a standard board,[6] the most basic single concept for the opening is that plays in the corners are more efficient for making territory than plays on the sides or in the center.

Concepts

Opening theory is less dominant in terms of study, for those wanting to reach a good amateur level, than in chess or shogi. It is, however, an important component of Go knowledge, though there is no single, codified source for it.[7]

The standard sequences for the joseki in many cases come to a definite end, after which both players should move elsewhere. In some cases a sharp local struggle breaks out, which neither player should neglect. For those cases, the result of the opening may develop out of a 10×10 corner area into the rest of the board. Analysis without taking into account what other stones are in place then becomes somewhat meaningless. The longest 'book' corner openings are about 50-ply.[8]

Most corner openings do not have special or picturesque names. A few that do are known by Japanese names: the taisha, the nadare (avalanche), the Magic sword of Muramasa[9]. These are among the most complex, and are contraindicated for novices.

Whole-board openings

Because each early move is typically isolated, and neither forced nor forcing,[10] patterns for play on the whole board have seen much less systematic study than for joseki, which in contrast often involve contact plays which require specific and immediate responses. Hence a game of Go may easily explore an unfamiliar path.

Only a relatively small proportion of openings have a recognised name. These include the Three stars opening (sanrensei), Two stars opening (nirensei), "Pinwheel" or Shusaku opening and Chinese opening (Chinese fuseki). To be more precise, these are names for the moyo (framework) formations which Black makes on one side of the board. Since White has a choice of perhaps two dozen legitimate variations on the other side, these are in fact large complexes of openings.
The Chinese opening, which has an intricate history but was indeed developed by Chinese players, was very popular from about 1970 onwards, and has by go standards a thoroughly-researched theory.

Joseki

**Joseki** are "sequences" of moves which have been

- played and documented in high-level play, and
- studied and deemed as consisting of optimal (balanced) moves for both sides.

Joseki is a Japanese word (定石) (Korean jungsuk), where jo (定) means "fixed" or "set", and seki (石) means stone(s). It thus literally means "set stones", as in "set pattern". Variations are shown to lead to different positional advantages and disadvantages for the two players in certain overall game situations. If Black and White both play the joseki correctly, they should achieve a balanced result within that particular corner; neither should have a large advantage, unless the opponent makes a mistake.[11]

"Balance" typically refers to an equitable trade-off between securing territory in the corner versus making good thickness toward the sides and center. The assessment also takes into account who started and ended the corner sequence: if Black has played one more stone than White in the corner, for example, Black's result should be objectively better than White's, to reflect the extra investment of a play.

In application these concepts are in fact very dynamic, and often joseki are deviated from depending on the needs of the situation, and the opportunities available. While learning joseki is a tool to defend against a local loss, players can seek to take advantage by deviating from the joseki, or "pausing" it.

Usually joseki as a term (in literature in English) is applied to a set sequence happening in one corner in the opening stage. These sequences are not the only set sequences in the game, however. There are also joseki seen in the middle game: these include standard follow-ups to earlier joseki. Other examples are common techniques for invading or reducing frameworks. Learning to apply these so-called "middle game joseki" is one of the steps to becoming strong.[12]

The current body made up of joseki is not fixed, but consists of patterns that have gained acceptance in professional games. That is, they form a consensus judgement that might change in the future, or with certain caveats.

Hence the basic definition may be misleading for new players in that joseki can be misconstrued as foolproof and unalterable, and are otherwise optimal for all situations. Some joseki are in fact useful only for study within an artificially confined corner, and in real play are only considered good form when used in proper combination with other plays on the board (i.e. other joseki and fuseki moves).

Knowing a particular joseki simply means that one knows a sequence of moves, resulting in a balance or fair trade-off between their positions. This is in practice much easier than appraising how joseki relate to the rest of the board —hence knowledge of joseki is regarded as shallow, when compared with the ability to integrate a strategy into a complex game landscape.

There is a go proverb that states that "learning joseki loses two stones in strength," meaning that rote learning of sequences is not advantageous. Rather learning from joseki should be a player's goal. Hence the study of joseki is regarded as a double-edged sword and useful only if learned not by rote but rather by understanding the principles behind each move.

Every joseki should be used as a specific tool that leaves the board in a particular shape. Just as using an improper tool in machinery can be devastating, choosing the wrong joseki can easily be worse than improvising one's own moves.

In his book *A Way of Play for the 21st Century*, Go Seigen compared choosing the proper joseki to choosing the proper medicine —*pick the right one, and you feel better. Pick the wrong one and you die.*(par.) Rui Naiwei similarly remarked that *playing joseki is easy [but] choosing the right one [in a game] is hard.*(par.)
A *joseki* may fall out of use for various reasons, some of which may often seem minor to the amateur player, and professionals may consider one variation suboptimal for a very specific reason. There is no definitive guide to what is *joseki*; the situation with *joseki* dictionaries is similar to that of natural language dictionaries, in that some entries are obsolete and the listing is not likely to be complete. Studying *joseki* is only important part of developing one's strength as a player at some levels; the study of life and death and middle-game fighting are considered to be more important.

**History**

Go openings have been studied in depth for many centuries, and center upon concepts of finding balance with the opponent. Because black moves first, opening moves for black are based on the concept of exploiting that first-move advantage (along with sente) to gain influence (or strength) and thus establish areas of territory. There is no complete theory of go, simply because the number of possible variations makes any literal study impossible. Hence even the opening is subject to changes of fashion, and also some notable periods of innovation.

Certain professional players are known for their use of specific or innovative types of openings, and their ability to combine their use of those openings with other strengths in competitive play.

**The 10-10 point**

Go Seigen played his third move (Black 5) on tengen, in a 1933 game against Honinbo Shusai, the top player of the time. Go lost the controversial 4-month game, which was played over 14 sessions in a *ryokan* in Tokyo from 16 October 1933 to 19 January 1934.\[13\][14]

**Notes**

[1] The opening is normally around 20 ply long.
[3] This occurs when moves directly attack an opponent's weak groups, with the serious possibility of killing it.
[4] The Japanese term *fuseki* is also current in English.
[6] I.e. a 19x19 line goban; essentially no theory for smaller boards gets into print.
[7] There are 'joseki dictionaries' and 'fuseki dictionaries'. The largest joseki dictionaries contain around 50000 variations; the usual estimate is that a professional player would know about 10% of that number of corner opening lines. Fuseki dictionaries have never been produced in any comparable degree of comprehensiveness; the Large Fuseki Dictionary (布石大事典) of the Nihon Ki-in has around 1000 representative openings.
[8] There are some localised variations of this length in the *kado* variation of the *nikkentakabasami*, and in the *taisha*, where in fact a ko fight may arise.
[9] [http://senseis.xmp.net/?MagicSword](http://senseis.xmp.net/?MagicSword)
[10] I.e. not a *sente* play; this is not always true, but covers most styles until a *joseki* starts.
[11] On the other hand, the evaluation of the result as fair has to take into account both *who started in the corner*, and *who ended the sequence*. The first player in a corner expects some advantage; the last player loses the initiative.
[12] See Sakata Eio, *The Middle Game of Go: Chubansen* for examples. "Middle game joseki" may not correspond to any definite concept translated from the Japanese technical vocabulary, however, since they may simply be classified as known "techniques".
[13] [http://senseis.xmp.net/?GameOfTheCentury](http://senseis.xmp.net/?GameOfTheCentury)
External links

- Kogo's Joseki Dictionary (http://waterfire.us/joseki.htm)
  - Extensive repository of the most common joseki, stored in the smart go format.
- Opening article at Sensei's library (http://senseis.xmp.net/?AboutTheOpening)
  - This is the introductory opening article at the Go wiki "Sensei's Library".
  - It branches out into several sub-articles and covers most of the basic opening patterns.
- Sensei's Library, information about go dictionaries (http://senseis.xmp.net/?DictionariesPage)
  - Series of articles on openings written by Charles Matthews 3-dan.

Fuseki

**Fuseki** (布石 or 布局 in Chinese) is the whole board opening in the game of Go.

**Characteristics**

**Less systematic**

Since each move is typically isolated and unforced (i.e. not a sente move), patterns for play on the whole board have seen much less systematic study than for Joseki, which are often contact moves which require specific and immediate responses. Hence a game of Go may easily explore an unfamiliar path.

**Recognised names**

Only a proportion of fusekis have recognised or specific names. These include the two-star fuseki (**nirensei fuseki**), three-star fuseki (**sanrensei fuseki**), Chinese fuseki, Kobayashi fuseki, and Shusaku fuseki. These are names for the influential formations which Black makes on one side of the board.

**Type of fuseki**

**Territorial approach**

As played on a large board (i.e. the standard 19x19 line goban), traditional wisdom says the priority is to play corner enclosures, then to extend to the middle of the sides, and finally to the center because it is easier to secure territory in the corners than on the sides or in the center. The classical view, particularly for the 3-3, 3-4 or 4-3 point, emphasizes good points to play in the opening because these points ensure larger and/or faster corner enclosure. Higher points are discouraged. This approach has clearer goals (control territory in the corners) and is easier for
beginners to grasp and play.

**Influence-oriented approach**

Unlike the territory-oriented playing style, this approach emphasizes control of the center. The reason for this is that one's play should not be narrowly focused on attempting to secure points quickly by occupying the corners first. Although it requires more effort to secure the center, it constitutes the majority of territory on the board. The key is to build a good framework in order to control the center of the board. Higher points like 4-4, 4-5 or 5-4 are encouraged. Some players occupy the side very quickly in order to build up a good framework, while some place their stones around the center. However, the influence-oriented approach is more abstract and harder for beginners to grasp and play.

**History**

**Pre-20th century**

The development of fuseki was very limited in the distant past, because nearly all players' efforts were put into making corner plays and enclosures (Joseki). Up till about 1900, professional players made use only of a relatively small proportion of the currently established patterns in the opening. The range of possibilities is great, and the number of game records from high-level play that are actually published is not so large (even now a few thousand a year, only).

**First half of 20th century**

Fuseki did not see significant improvement until the influence-oriented style of play evolved in the 20th century. Perhaps the most highly regarded pioneer player of the 20th century, Go Seigen, created an uproar when he played his third move (black 5) on the tengen, or center point in a game against the reigning Honinbo Shusai. An unwise move in classical thinking, it was considered an insult to someone of the Honinbo's stature. Go Seigen lost the controversial 4-month game (which is believed to be due to help from one of the Honinbo's students), but proved his ability against high-ranking opponents, even when employing such an unusual strategy.

**Second half of 20th century**

The concept of influence-oriented play gave birth to many revolutionary fuseki such as the two-star fuseki (*nirensei fuseki*), three-star fuseki (*sanrensei fuseki*) and so on. Many similar patterns have been tried and played in modern games.

The Chinese fuseki, which has an intricate history but was indeed developed by Chinese players, was very popular from about 1970 onwards, and has by go standards a thoroughly-researched theory.

Since around 1990, there has been a succession of fashionable openings, largely a product of Korean professionals, which have been studied and played in a more chess-like manner (that is, with successive refinements hammered out in high-profile games). This style of innovation is actually something new to the go tradition, however; it is not the traditional way, and there is a large part of go strategy that remains unexplored to that degree of intensity.
**External links**

- "Weon Seongjin 7-dan and his thoughts about the role of fuseki in modern Go" [1]

**References**


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**Kobayashi opening**

**Kobayashi fuseki** is a fuseki for Black stones in the game of Go. Its name comes from Kobayashi Koichi, who has very often used this fuseki.

Kobayashi fuseki is as below. It is similar to the mini Chinese fuseki. It emphasizes influence in order to shape out a big Moyo.

![Kobayashi fuseki diagram](kobayashi-fuseki.png)
External links

• Kobayashi fuseki [1]

References


Chinese opening

The Chinese opening (often Chinese fuseki) (Japanese: 中国流布石, chūgokuryū fuseki; Chinese: 中国流布局, zhōngguóliú bùjú) is an opening pattern in the game of Go. It refers to the placement of Black 1, Black 3 and Black 5 at the start of the game; and so, depending on White's plays, is a complex of whole-board go openings.

It is distinguished by rapid development on the side, rather than making a corner enclosure. It has a fairly long history, but the Chinese player Chen Zude pioneered it in top-level play.

The Chinese style became very popular in Japan from about 1970 onwards, and has by Go standards a thoroughly-researched theory. It has two variants: high (with 5 in the diagram on the fourth line) and low (as depicted). There is also a so-called "mini"-Chinese fuseki, an attack against the opponent's corner and placement of a stone midway between the attacking stone and a friendly corner. These are now amongst the most important patterns in go opening theory.

Low Chinese fuseki
Low Chinese Fuseki.

**High Chinese fuseki**

![High Chinese fuseki diagram]

High Chinese Fuseki.

**Mini Chinese fuseki**

![Mini Chinese fuseki diagram]
Mini Chinese Fuseki.

References


External links

- Chinese Fuseki [1]
- Mini Chinese Fuseki [2]
- MindZine page with history [3]

References

Skill in the traditional board game Go is measured by a number of different national, regional and online ranking and rating systems. Traditionally, go rankings have been measured using a system of dan and kyu ranks. Especially in amateur play, these ranks facilitate the handicapping system, with a difference of one rank roughly corresponding to one free move at the beginning of the game. With the ready availability of calculators and computers, rating systems have been introduced. In such systems, a rating is rigorously calculated on the basis of game results.


**Kyu and dan ranks**

Traditionally, the level of players has been defined using **kyu** and **dan** ranks.\(^1\) Kyu ranks are considered *student* ranks.\(^2\) Dan ranks are considered *master* ranks.\(^2\) Beginners who have just learned the rules of the game are usually around 30th kyu.\(^3\) As they progress, they advance numerically downwards through the kyu grades. The best kyu grade attainable is therefore 1st kyu. If players progress beyond 1st kyu, they will receive the rank of 1st dan, and from thereon will move numerically upwards through the dan ranks.\(^3\) In martial arts which adopted kyu and dan rank system from Go, 1st dan is the equivalent of a black belt. The very best players may achieve a *professional dan rank*.\(^3\)

The rank system is tabulated from the lowest to highest ranks:

<table>
<thead>
<tr>
<th>Rank type</th>
<th>Range</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double-digit kyu (級,級,급) (geup in Korean)</td>
<td>30–20k</td>
<td>Beginner</td>
</tr>
<tr>
<td>Double-digit kyu (abbreviated: DDK)</td>
<td>19–10k</td>
<td>Casual player</td>
</tr>
<tr>
<td>Single-digit kyu (abbreviated: SDK)</td>
<td>9–1k</td>
<td>Intermediate amateur</td>
</tr>
<tr>
<td>Amateur dan (段,단)</td>
<td>1–7d (where 8d is special title)</td>
<td>Advanced amateur</td>
</tr>
<tr>
<td>Professional dan (段,단)</td>
<td>1–9p (where 10p is special title)</td>
<td>Professional player</td>
</tr>
</tbody>
</table>

Although almost all organizations use this system, there is no universal calibration. The means of awarding each of those ranks and the corresponding levels of strength vary from country to country and among online go servers. This means that a player who is considered to be a 2nd kyu in one country may only be considered a 5th kyu in another.\(^4\)

**Origin**

The first Go ranks were given in 2nd century China, when Handan Chun (Chinese: 邯郸淳) described the 9 Pin Zhi (九品制) ranking system in his book *Classic of Arts* (艺经). From the early 17th century, the Japanese formalised the teaching and ranking of Go.\(^5\) The system was later used in martial arts schools, and is thought to derive ultimately from court ranks in China. It is thought that there are 9 professional dan grades because of the original 9 Chinese Pin Zhi grades.

The difference between two amateur grades is based on the number of handicap stones that a player requires to even the odds against a stronger player. A 5th kyu player will generally need a 3 stone handicap when playing against a 2nd kyu player to give both players a fair chance of winning. Similarly, a 3rd dan player will need a 2 stone handicap against a 5th dan opponent.

**Achieving a dan rank**

Dan (abbreviated online as "d") ranks are for advanced amateur players. Although many organisations let players choose their own kyu rank to a certain extent, dan ranks are often regulated. This means that players will have to show good results in tournaments or pass exams to be awarded a dan rank. Serious students of the game will often strive to attain a dan rank, much as martial arts practitioners will strive to achieve a black belt. For amateurs, dan ranks up to 7th dan are available. Above this level, a player must become a professional player to achieve further promotions. In Japan and China, some players are awarded an amateur 8th dan rank as an honorary title for exceptional achievement. In the United States, amateur dan ranks are capped at 7 dan, although some professionals and strong amateurs have achieved the equivalent of 8 or 9 dan on the AGA's rating system. Similarly, some players have achieved 9th dan amateur ranks in the rating system of online go servers.

Although players who have achieved professional dan ranks are nominally stronger than amateur dan players, in practice some of the strongest 7th dan amateur players have a playing level on par with that of some professional players. Such players have either never tried for a professional rank, or have chosen to remain amateur players...
because they do not want to make a career out of playing Go.

**Professional ranks**

A very small percentage of the strongest players are eligible and achieve professional status, a distinction awarded under strict conditions by the professional go associations of Japan, China, Korea and Taiwan. Professional players use a dan ranking system similar to that of amateurs, with dan ranks that increase numerically with skill. The difference between these grades is much smaller than with amateurs however, and is not based on the number of handicap stones required. Professional dan ranks range from 1st dan to 9th dan, but the strength difference between individual professionals is generally never more than 2-3 handicap stones. The rank represents a lifetime achievement, and is never lost, so players of 9th dan rank need not necessarily be among the strongest professional players anymore.

To distinguish between professional *dan* and amateur *dan* ranks, the former is often abbreviated to "p" and the latter to "d". There was no such abbreviation in the past, and this is not generally used as an abbreviation beyond the Internet, where it is common, but not universal.

**Rating systems**

With the invention of calculators and computers, it has become easy to calculate a *rating* for players based on the results of their games. Commonly used rating systems include the Elo and Glicko rating systems. Rating systems generally predict the probability that one player will defeat another player and use this prediction to rank a players strength.

**Elo-like rating systems as used in Go**

<table>
<thead>
<tr>
<th>EGF Rating</th>
<th>Go rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2940</td>
<td>9 dan professional</td>
</tr>
<tr>
<td>2820</td>
<td>5 dan professional</td>
</tr>
<tr>
<td>2700</td>
<td>7 dan amateur or 1 dan professional.</td>
</tr>
<tr>
<td>2600</td>
<td>6 dan (amateur)</td>
</tr>
<tr>
<td>2500</td>
<td>5 dan</td>
</tr>
<tr>
<td>2400</td>
<td>4 dan</td>
</tr>
<tr>
<td>2300</td>
<td>3 dan</td>
</tr>
<tr>
<td>2200</td>
<td>2 dan</td>
</tr>
<tr>
<td>2100</td>
<td>1 dan</td>
</tr>
<tr>
<td>2000</td>
<td>1 kyu</td>
</tr>
<tr>
<td>1900</td>
<td>2 kyu</td>
</tr>
<tr>
<td>1800</td>
<td>3 kyu</td>
</tr>
<tr>
<td>1500</td>
<td>6 kyu</td>
</tr>
<tr>
<td>1000</td>
<td>11 kyu</td>
</tr>
<tr>
<td>500</td>
<td>16 kyu</td>
</tr>
<tr>
<td>100</td>
<td>20 kyu</td>
</tr>
</tbody>
</table>

The EGF rating system attempts to establish rough correspondence between ratings and kyu/dan ranks. This is done by taking the Elo rating system and varying some of the components of its formula to achieve a close match to the
Go ranks and ratings

The probability ($S_E$) that the player with the lower rating, player A, wins against a higher rated player B is given by the formula

$$S_E(A) = \frac{1}{e^{D/a} + 1}$$

- $D$ is the rating difference: $R_B - R_A$
- $a$ is varied depending on the prior rating of player A.

The probability that player B wins is calculated as

$$S_E(B) = 1 - S_E(A)$$

The new rating of a player is calculated as

$$R_n = R_o + K(S - S_E)$$

- $R_n$ = new rating
- $R_o$ = old rating
- $S$ = score (1, 0.5 or 0)
- $S_E$ = expected score
- $K$ is varied depending on the rating of the players

K is varied depending on the rating of the players, because of the low confidence in (lower) amateur ratings (high fluctuation in the outcome) but high confidence in pro ratings (stable, consistent play). $K$ is 116 at rating 100 and 10 at rating 2700.[6]

In the EGF system, points won by the winner almost equal the ones lost by the loser and the maximum points movement is the constant $K$ (from above). However, there is a slight inflationary mechanism built in to the ratings adjustment after each game to compensate for the fact that newcomers usually bring fewer points into the pool than they take out with them when they cease active play. Other Elo-flavor ratings such as the AGA, IGS, and DGS systems use maximum likelihood estimation to adjust ratings, so those systems are anchored by prior distributions rather than by attempting to ensure that the gain/loss of ratings is zero sum.

**Rating base**

The ratings of players are generally measured using the game results of Go competitions and tournaments. Most clubs and countries maintain their own ratings, as do Go playing servers. Go tournaments in Europe use the EGF Official ratings.[7]

In a small club, ranks may be decided informally and adjusted manually when players consistently win or lose. In larger clubs or country-wide rating systems, a mathematical ranking system is generally easier to maintain. Players can then be promoted or demoted based on their strength as calculated from their wins and losses.

Most Go playing servers use a mathematical rating system to keep track of the playing strength of their members. Such ratings may or may not be translated to kyu and dan ranks for the convenience of the players.

Player pools that do not regularly mix (such as different countries, or sub-groups on online servers) often result in divergent playing strengths compared to the same nominal rank level of other groups. Players asked to give their rank will therefore often qualify it with "in my country" or "on this Internet server."[4]
Winning probabilities

The rating indirectly represents the probability of winning an even game against other rated players. This probability depends only on the difference between the two players' ratings, but its magnitude varies greatly from one implementation to another. The American Go Association adopted a uniform standard deviation of 104,\textsuperscript{[8]} i.e. slightly more than one rank, while the European Go Federation ratings have a sliding standard of deviation from 200 for beginners down to 70 for top players.\textsuperscript{[6]} The IGS has a fixed standard deviation for all levels of play, but a non-standard distribution.\textsuperscript{[9]}

The following table displays some of the differences:

<table>
<thead>
<tr>
<th>Rating organisation</th>
<th>Rating organisation</th>
<th>2 kyu</th>
<th>1 kyu</th>
<th>1 dan</th>
<th>2 dan</th>
<th>1k vs. 2k</th>
<th>1d vs. 2k</th>
<th>2d vs. 2k</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGA</td>
<td>-250</td>
<td>-150</td>
<td>150</td>
<td>250</td>
<td>83.2%</td>
<td>97.3%</td>
<td>99.8%</td>
<td></td>
</tr>
<tr>
<td>EGF</td>
<td>1900</td>
<td>2000</td>
<td>2100</td>
<td>2200</td>
<td>71.3%</td>
<td>86.0%</td>
<td>93.9%</td>
<td></td>
</tr>
<tr>
<td>IGS</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>33</td>
<td>71.9%</td>
<td>84.2%</td>
<td>91.1%</td>
<td></td>
</tr>
</tbody>
</table>

Note how different the expectations of each system are regarding even games between players of unequal strength. If a player can win 90% of even games against a 2 kyu player, the AGA believes he or she is 1.33 ranks higher, the EGF believes (s)he is 2.42 ranks higher, and the IGS believes (s)he is 2.80 ranks higher. The lack of agreement stems from a tradition of playing handicap games between players of different ranks, so there is a lack of data regarding non-handicap games between mismatched opponents.

Winning chances and handicaps

For even games between players less than one rank apart, it doesn't matter very much which distribution curve is used: roughly accurate ratings will emerge on the basis of many even games. However, because games between unequal players are sometimes played at handicap, some rating systems have a mechanism to incorporate games played with handicap. Generally, they do this by equating the handicap stones to a certain number of rating points. These points are then added to the rating of the weaker player for purpose of calculating the rating change of the stronger player, and are conversely deducted from the rating of the stronger player for purposes of calculating the rating change of the weaker player. This mechanism has the effect of calibrating the rating-based ranks to be a stone of handicap apart, which is in conflict with ranks being a certain winning percentage apart.

In chess you must take some risks to avoid a draw, but the komi system in modern go has rendered draws extremely rare. Draws stem from an institution's ruling on unusual game occurrences, such as Article 12 of the Japanese rules.
Go ranks and ratings

regarding repeating positions; or a tournament's use of integer komi. Also, an average game of Go lasts for 240 moves, compared to 80 in chess, so there are more opportunities for a weaker player to make sub-optimal moves. The ability to transform a small advantage into a win increases with playing strength. Due to this ability, stronger players are more consistent in their results against weaker players and will generally score a higher percentage of wins against opponents at the same rank distance\[10\]

Notes and references

[8] Inside the AGA Ratings System (http://www.usgo.org/resources/downloads/aga-rating.pdf) refers to the standard deviation used to calculate winning expectancies as px_sigma.
[9] The IGS Rating System (http://www.pandanet.co.jp/English/commands/term/TOC.html) implies a distribution function which is not a bell curve, but a "pointy hat".

External links

• Official European Ratings (http://www.europeangodatabase.eu/EGD/EGF_rating_system.php) by the European Go Federation.
• AGA Rating Information (http://www.usgo.org/ratings/default.html) by the American GO Association.
• Approximate comparison between different ranking systems (http://senseis.xmp.net/?RankWorldwideComparison) at Sensei’s Library
## Go strategy

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<th>Game specifics</th>
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<tbody>
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<tr>
<td>• Go handicaps</td>
<td></td>
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<tr>
<td>• Go proverbs</td>
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<tr>
<td>• List of Go terms</td>
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<td>• Fuseki (whole-board openings)</td>
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<td>• Joseki (corner-based openings)</td>
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<tr>
<td>• Life and death</td>
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<td>• Tsumego (Go puzzles)</td>
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<table>
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<tr>
<th>Players and organizations</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>• Go players</td>
<td></td>
</tr>
<tr>
<td>• Go ranks and ratings</td>
<td></td>
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<tr>
<td>• Go professional</td>
<td></td>
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<tr>
<td>• Go organizations</td>
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<td>• Go competitions</td>
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<table>
<thead>
<tr>
<th>Computers and mathematics</th>
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<tbody>
<tr>
<td>• Go and mathematics</td>
<td></td>
</tr>
<tr>
<td>• Computer Go</td>
<td></td>
</tr>
<tr>
<td>• Go software</td>
<td></td>
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<tr>
<td>• Internet Go servers</td>
<td></td>
</tr>
</tbody>
</table>
In the game of Go, strategy deals with global influence, interaction between distant stones, with keeping the whole board in mind during local fights and other issues that involve the overall game. It is therefore possible to allow a tactical loss when it confers a strategic advantage.

Go is not easy to play well. With each new level (rank) comes a deeper appreciation for the subtlety and nuances involved and for the insight of stronger players. The acquisition of major concepts of the game comes slowly. Novices often start by randomly placing stones on the board, as if it were a game of chance; they inevitably lose to experienced players who know how to create effective formations. An understanding of how stones connect for greater power develops, and then a few basic common opening sequences may be understood. Learning the ways of life and death helps in a fundamental way to develop one's strategic understanding of weak groups. It is necessary to play some thousands of games before one can get close to one's ultimate potential Go skill. A player who both plays aggressively and can handle adversity is said to display kiai or fighting spirit in the game.

Familiarity with the board shows first the tactical importance of the edges, and then the efficiency of developing in the corners first, then sides, then center. The more advanced beginner understands that territory and influence are somewhat interchangeable—but there needs to be a balance. This intricate struggle of power and control makes the game highly dynamic.

**Basic concepts**

Basic strategic aspects include the following:

- **Connection**: Keeping one's own stones connected means that fewer groups need defense.
- **Cut**: Keeping opposing stones disconnected means that the opponent needs to defend more groups.
- **Life**: This is the ability of stones to permanently avoid capture. The simplest way is for the group to surround two eyes (separate empty areas), so that filling one eye will not kill the group and therefore be suicidal.
- **Death**: The absence of life coupled with the inability to create it, resulting in the eventual removal of a group.
- **Invasion**: Setting up a new living position inside an area where the opponent has greater influence, as a means of balancing territory.
- **Reduction**: Placing a stone far enough into the opponent's area of influence to reduce the amount of territory he/she will eventually get, but not so far in that it can be cut off from friendly stones outside.

The strategy involved can become very abstract and complex. High-level players spend years improving their understanding of strategy.

**Opening strategy**

In the opening of the game, players will usually play in the corners of the board first, as the presence of two edges make it easier for a player to surround territory and establish his stones. After the corners, focus moves to the sides, where there is still one edge to support a player's stones. Opening moves are generally on the third and fourth line from the edge, with occasional moves on the second and fifth lines. In general, stones on the third line offer stability and are good defensive moves, whereas stones on the fourth line influence more of the board and are good attacking moves.
In the opening, players often play established sequences called joseki,[6] which are locally balanced exchanges. Choosing the right joseki that also gives a good result globally is one of the challenges faced by good players. It is generally advisable to keep a balance between stability and influence. Which of these gets precedence is often a matter of individual taste.

References

Go strategy and tactics

The game of Go has simple rules that can be learned very quickly but, as with chess and similar board games, complex strategies may be deployed by experienced players.

Go opening theory

The whole board opening is called Fuseki. An important principle to follow in early play is "corner, side, center." In other words, the corners are the easiest places to take territory, because two sides of the board can be used as boundaries. Once the corners are occupied, the next most valuable points are along the side, aiming to use the edge as a territorial boundary. Capturing territory in the middle, where it must be surrounded on all four sides, is extremely difficult. The same is true for founding a living group: Easiest in the corner, most difficult in the center.

The first moves are usually played on or near the 4-4 star points in the corners, because in those places it is easiest to gain territory or influence. (In order to be totally secure alone, a corner stone must be placed on the 3-3 point.
However, if a stone is placed at a 4-4 point and the opponent invades, the first player can build a surrounding wall as the second (invader) is forming a live group, thus exerting strong influence on a large area.) After that, standard sequences (Joseki) can be used to develop corner positions, and extensions along the side can be made. Usually, the center area is kept empty the longest. Plays are usually on the third or fourth line—the second makes too little territory, while the fifth is too easily undermined by a play on the third. A play on the fourth line is directed more towards influence to the center, a play on the third line more towards making territory along the side.

Connection and separation

A fundamental Go strategy involves keeping stones connected. Connecting a group with one eye to another one-eyed group makes them live together. Connecting individual stones into a single group results in an increase of liberties; for instance, a single stone played in the center of the board has four liberties, while two adjacent stones in the center of the board form a unit with six; to capture the unit, an opponent would have to play stones on all of its liberties. Thus connected stones are stronger because they share their liberties. (While two separate stones have a total of up to eight liberties, they can be captured separately from one another.)

Since connecting stones keeps them secure, an important offensive tactic is to prevent the opponent from connecting his stones, while at the same time keeping one's own stones connected. This act of dividing the opponent's stones into separate groups is called cutting.

While one should generally try to keep one's own stones connected, situations exist where doing so would be a wasted move. Stones are considered tactically connected if no move by the opposing player could prevent them from being connected.

In a handicap game, Black starts with two or more handicap stones played before White's first move. If played in the traditional places on the "star points", these stones will be useful for the purpose of connection and separation of
Go strategy and tactics 107

stones played closer to the edge ("lower"), as well as in many other ways. The White player's stones are threatened immediately with separation, while Black has many potential connections to begin with.

An example of inefficiency or poor coordination of stones in the context of connection is the empty triangle, where the stones are arranged so that they share fewer liberties than if they were deployed in a straight line.

Life and death

A key concept in the tactics of Go, though not part of the rules, is the classification of groups of stones into alive, dead or unsettled.

At the end of the game, groups that cannot avoid being captured during normal play are removed as captures. These stones are dead. Groups can reach this state much earlier during play; a group of stones can quickly run out of options so that further play to save them is fruitless, or even detrimental. Similarly, further play to kill such a group is often of no benefit (except when securing liberties for an adjacent group), since if it remains on the board at the end of the game it is captured anyway. Thus groups can be considered "dead as they stand", or just dead, by both sides during the course of the game.

Groups enclosing an area completely can be harder to kill. Normally, when a play causes an area completely enclosed by the opponent to become filled, the group filling the area is captured since it has no remaining liberties (such a play is called "suicide"). Only if the last play inside the area would kill the enclosing group, thus freeing one or more liberties for the group that filled the space, can the play be considered. This can only be achieved if the liberties on the outside of the enclosing group have been covered first. Thus, enclosing an area of one or more liberties (called an eye) can make the group harder to kill, since the opponent must cover all of its external liberties before covering the final, internal liberty.

From this, it is possible to create groups that cannot be killed at all. If a group encloses two or more separate areas (two or more eyes), the opponent cannot simultaneously fill both of them with a single play, and thus can never play on the last liberty of the group. Such a group, or a group that cannot be prevented from forming such an enclosure, is called alive.

Groups which are not definitely alive nor definitely dead are sometimes called unsettled groups. Much of the tactical fighting in Go focuses on making one's own groups live, by ensuring they can make two eyes, and on making the opponent's groups die, by denying them two eyes.

Reading

Determining ahead of time whether a group is currently alive, dead, or unsettled, requires the ability to extrapolate from the current position and imagine possible plays by both sides, the best responses to those plays, the best responses to those responses, and so on. This is called reading ahead, or just reading, and it is a skill that grows with experience. Many players study books of life and death problems to increase their skill at reading more and more complicated positions.

In general, go players refer to analysis of positions as reading. One major purpose of reading is to be sure that a local position can be neglected for a while. For instance, a player may be able to make gains by playing for a certain patch of territory. Yet, this play may be worth only a few points, and thus deemed unnecessary, depending on the state of the game. With confidence in one's reading, it becomes much easier to set priorities and switch around the board (see sente). Not changing gears at the correct time can be a loss of opportunity.
High and low
In order to build a harmonious position, usually in the opening, one does not place all stones on the third line (for territory), nor all stones on the fourth line (for center influence). "Harmonious" as used here is not just an aesthetic quality; rather, it stands for a balance in the overall (strategic) connection of the stones.

Thickness and lightness
An outward-facing position that cannot be attacked, that is, one which can easily get two eyes or connect to a friendly live group and so does not need to answer enemy moves close by, is called thick. Thick positions are important as they radiate influence across the board. An error that is often made by weaker players is to make territory in front of their thick position; this is inefficient because the player is likely to get that territory anyway. Doing so is also inflexible strategically, so invites enemy forcing moves at the border of the incomplete territory. Thickness is better used from a distance, as support for other actions. For example, if Black has a thick group and a weak group nearby, and White attacks the weak group, Black can have its weak group run towards its thick group. If successful, the strength of the thick group will protect the weak group. Or, if White tries to invade near a thick group, Black can try to push White towards its thick group. If Black is successful, the strength of the thick group may help destroy the invasion. Even if the invaders are not killed, the pressure exerted by the thick position can allow Black to profit from the attack, for example gaining territory or thickness in a neighbouring area whilst chasing the weak stones. A thick group can also support invasion of enemy spheres of influence.

A light group is also one that is hard to attack, but for a different reason. If a group has a large number of options, often including the sacrifice of part of it, it is called light. Because it is usually impossible to take away all or almost all options, attacking such a group is very hard for the opponent and brings little advantage. A weak group which is too important to sacrifice is called heavy.

Attack and defense
A large part of the middle game of a game of Go may be spent by one player attacking the other player's weak group(s). What is important to remember is that in most cases the goal of an attack is not to kill the attacked group, but to gain territory or influence. The attack is more or less used to restrict the opponent's options and make it impossible for him to make territory or influence himself.

Territory and influence
See Go concepts

Ko fighting
Suppose that Black begins a ko by taking a stone of White's. White cannot immediately recapture; the rules state that he must, for the moment, play elsewhere. White may believe that good strategy requires he/she eventually recapture, but Black, on his/her next turn, will have the option of ending the ko, for example by filling in the spot White would use to recapture. To prevent Black from doing this, White can play a ko threat.

A ko threat is a move that forces one's opponent to respond, or risk a punishing blow. A ko threat by White will force Black to choose between responding to the threat, and allowing White to recapture (thereby continuing the ko), or ending the ko, but having a damaged, poor position elsewhere on the board.

A good ko threat should threaten more damage to one's opponent's position than the value of losing the ko. If the ko is then lost, the trade was still beneficial. [1]
Sente and gote

Sente and 'gote' are complementary terms. Sente loosely corresponds to taking the initiative, and gote loosely corresponds to the responsibility of defense. If a move forces the other player to respond, that player "has gote"; if not, he/she can play elsewhere, "taking sente." The player who holds sente more often in effect controls the flow of the game.

'Taking gote unnecessarily' would mean that one had defended for oneself a smaller area of the board than one could have threatened to take from the opponent, elsewhere. Very few plays in a game are really forcing — the opponent may well ignore you. If your play was 'really' sente, you expect to gain by following it up, as soon as possible.

The act of playing elsewhere (in other words, breaking off from a local exchange of plays in one area of the board) is called tenuki. It may indicate either a natural pause in the sequence, or a disagreement as to the importance of an area of the board. Between strong players tenuki may be used as a kind of gambit. Because the Go board is so spacious, the balance between attack and defense, and amongst different areas, holds great importance for strategy.

Direction of Play

The direction of play is a higher level concept in the opening, relating to the efficiency of stones played on the board. This involves the important trade-off between overconcentration (korigatachi) and vagueness - between playing a move that accomplishes too little and a move that tries to accomplish too much. Additionally, the stones already played are taken into consideration. The players aim not only at making efficient new moves, but also at playing moves that heighten the value of their previous moves, and at achieving maximum harmony in a global sense. One must strive to make each stone played important and valuable, that is, utilize its aji to the fullest extent possible. Thus, choosing the correct direction of play requires not only a deep understanding of the value of thickness, but also demands a good sense of positional judgment from the players.

Endgame (yose)

The endgame begins when large-scale contention over life and death, invasion, reduction etc. ends. Players then set about maximizing the boundaries of their territories while minimizing the opponent's territory. One must choose which of these moves is more urgent to play based not only on the points it may gain, but on whether that move is sente. Generally, in the endgame, all the major areas are staked out— however, there are still points to be made, as well as possible ways to reduce the opponent's territory. A simple example would be a move that is dame (neutral point for you), but when filled in, it is sente, requiring white to fill a stone in his territory to answer. It would be thus said this is 'a one point reduction in sente.'

References


External links

• Sensei's Library (http://senseis.xmp.net/), a collaborative wiki about Go strategy, concepts, history etc.
Go tactics

Go tactics deal with immediate fighting between stones, capturing and saving stones, life, death and other issues localized to a specific part of the board. Larger issues, not limited to only part of the board, are referred to as strategy, and are covered in their own article.
Capturing tactics

There are several tactical constructs aimed at capturing stones.[2] These are among the first things a player learns after understanding the rules. Recognizing the possibility that stones can be captured using these techniques is an important step forward.

A ladder. Black cannot escape unless the ladder connects to friendly stones further down the board.

The most basic technique is the ladder.[3] To capture stones in a ladder, a player uses a constant series of capture threats —called atari—to force the opponent into a zigzag pattern as shown in the diagram to the right. Unless the pattern runs into stones along the way, the stones in the ladder cannot avoid capture. Experienced players will recognize the futility of continuing the pattern and will play elsewhere. The presence of a ladder on the board does give a player the option to play a stone in the path of the ladder, thereby threatening to rescue his stones, forcing a response. Such a move is called a ladder breaker and may be a powerful strategic move.

A net. The chain of three black stones cannot escape in any direction.

Another technique to capture stones is the so-called net,[4] also known by its Japanese name, geta. This refers to a move that loosely surrounds some stones, preventing their escape in all directions. An example is given in the diagram to the left. It is generally better to capture stones in a net than in a ladder, because a net does not depend on the condition that there are no opposing stones in the way, nor does it allow the opponent to play a strategic ladder breaker.
A snapback. Although Black can capture the white stone by playing at the circled point, White can then snap back by playing at 1 again.

A third technique to capture stones is the snapback. In a snapback, a player sacrifices a stone in order to immediately capture several opposing stones, in effect snapping back those stones. An example can be seen on the right. As with the ladder, an experienced player will not play out such a sequence, recognizing the futility of capturing only to be captured back immediately.

**Reading ahead**

One of the most important skills required for strong tactical play is the ability to read ahead. Reading ahead consists of considering available moves to play, considering the possible responses to each move, the subsequent possibilities after each of those responses, etcetera. Some of the strongest players of the game can read up to 40 moves ahead even in complicated positions.

As explained in the section on important consequences of the basic rules, some formations of stones can never be captured and are said to be alive, while other stones may be in the position where they cannot avoid being captured and are said to be dead. Much of the practice material available to students of the game comes in the form of life and death problems, also known as tsumego. In such problems, players are challenged to find the vital move sequence that will kill a group of the opponent or save a group of their own. Tsumego are considered an excellent way to train a player's ability at reading ahead, and are available for all skill levels, some posing a challenge even to top players.

**Ko fighting**

In situations where the ko rule applies, prohibiting a player to capture to avoid repetition, a ko fight may occur. If the player who is prohibited from capture is of the opinion that the capture is important, for example because it prevents a large group of stones from being captured, the player may play a ko threat. This is a move elsewhere on the board that threatens to make a large profit if the opponent does not respond. If the opponent does respond to the ko threat, the situation on the board has changed, and the prohibition on capturing the ko no longer applies. Thus the player who made the ko threat may now recapture the ko. His opponent is then in the same situation, and can either play a ko threat as well, or concede the ko by simply playing elsewhere. If a player concedes the ko, either because he does not think it important, or because there are no moves left that could function as a ko threat, he has lost the ko, and his opponent may connect the ko.

Instead of responding to a ko threat, a player may also choose to ignore the threat and connect the ko. He thereby wins the ko, but at a cost. The choice of when to respond to a threat and when to ignore it is a subtle one, which requires a player to consider many factors, including how much is gained by connecting, how much is lost by not
responding, how many possible ko threats both players have remaining, what the optimal order of playing them is, and what the size — points lost or gained — of each of the remaining threats is.

Frequently, the winner of the ko fight does not connect the ko but instead captures one of the chains which constituted his opponent’s side of the ko. In some cases, this leads to another ko fight at a neighboring location.

References


Joseki

In Go, joseki (定 石 jöseki) are studied sequences of moves in the corner areas of the Go board, for which the result is considered balanced for both black and white sides. Because games typically start with plays in the corners, players often try to use their understanding of joseki to gain local advantages in the corners — advantages which can in turn make for a better overall position. Though less common, there are also joseki for the middle game. In Japanese, 定 (jö) means "fixed" or "set" and 石 (seki) means stones, giving the literal meaning "set stones", as in "set pattern". In Chinese, the term for joseki is 定式, dìngshì.

The concept of "balance" here often refers to an equitable trade-off between securing territory in the corner versus making good thickness toward the sides and center. In application these concepts are in fact very dynamic, and often joseki are deviated from depending on the needs of the situation, and the opportunities available. While learning joseki is a tool to defend against a local loss, players always seek to take advantage of weaknesses in the opponent's shapes, often deviating from the joseki.
Using joseki

The current body of joseki are not fixed, but patterns that have gained acceptance in professional games. That is, they form a consensus judgement that might change in the future, or with certain caveats. Hence the basic definition may be misleading for new players in that joseki can be misconstrued as foolproof and unalterable, and are otherwise optimal for all situations. Many joseki are in fact useful only for study within an artificially confined corner,[1] and in real play are only considered good form when used in proper combination with other plays on the board (i.e. other joseki and fuseki moves).

Knowing a particular joseki simply means that one knows a sequence of moves, resulting in a balance or fair trade-off between their positions. This is in practice much easier than appraising how joseki relate to the rest of the board—hence knowledge of joseki is regarded as shallow, when compared with the ability to integrate a strategy into a complex game landscape.

There is a go proverb that states that "learning joseki loses two stones in strength," meaning that rote learning of sequences is not advantageous. Rather learning from joseki should be a player's goal. Hence the study of joseki is regarded as a double-edged sword and useful only if learned (not by rote) by understanding the principles behind each move. Every joseki should be used as a specific tool that leaves the board in a particular shape.

Just as using an improper tool in machinery can be devastating, choosing the wrong joseki can easily be worse than improvising one's own moves. In his book A Way of Play for the 21st Century, Go Seigen compared choosing the proper joseki to choosing the proper medicine: Pick the right one, and you feel better. Pick the wrong one, and you die.(par.) Rui Naiwei similarly remarked that playing joseki is easy [but] choosing the right one [in a game] is hard.(par.)

A joseki may fall out of use for various reasons, some of which may often seem minor to the amateur player, and professionals may consider one variation suboptimal for a very specific reason—one which strong amateurs are not likely to exploit. There is no definitive guide to what is joseki; the situation with joseki dictionaries is similar to that of natural language dictionaries, in that some entries are obsolete and the listing is not likely to be complete.

While some claim that studying joseki is an important part of developing one's strength as a player, more regard the study of life and death to be more important.

Basic joseki

Corner joseki conventionally start with one player occupying a corner point, in an empty 19×19 area of the board, and the other player replying with an approach move (Japanese kakari). The initial play in the corner is almost always on a 3-3, 3-4, 3-5, 4-4 or 4-5 point. Other plays that have been experimented with include 5-5, 6-3 and 6-4, all of which sacrifice territory for influence.

Of those plays, the classical 3-4 point (komoku) and more contemporary 4-4 point (hoshi) are the most used. The standard approaches are at 5-3 or 5-4 to the 3-4 point, and at 3-6/6-3 to the 4-4 point. The number of subsequent variations is then quite large (of the order of ten reasonable plays for the next one).
Joseki heuristics of sound play. Playing board situation. It's important to keep in mind that go is a game involving marginal analysis and are merely from rote memorization but adapt according to the overall

After a joseki sequence has ended, a play returning to the same area may be termed a follow-up play. There is no formal theory for these, though numerous set sequences can be seen in professional play.

It is imperative that players should not play joseki merely from rote memorization but adapt according to the overall board situation. It's important to keep in mind that go is a game involving marginal analysis and joseki are merely heuristics of sound play. Playing joseki blindly will not improve one's game.

References

External links
• Joseki sequences at Sensei's Library (http://senseis.xmp.net/?Joseki)
Ko fight

A ko (コウ kō) fight is a tactical and strategic phase that can arise in the game of go.

Ko threats and ko fights

The existence of ko fights is implied by the rule of ko, a special rule of the game that prevents immediate repetition of position, by a short 'loop' in which a single stone is captured, and another single stone immediately taken back. The rule states that the immediate recapture is forbidden, for one turn only. This gives rise to the following procedure: the 'banned' player makes a play, which may have no particular good qualities, but which demands an instant reply. Then the ban has come to its end, and recapture is possible. This kind of distracting play is termed a ko threat.

If White, say, chooses to play a ko threat, and Black responds to the threat instead of ending the ko in some fashion, then White can recapture the stone that began the ko. This places Black in the same position that White was formerly in: Black can choose to give up the ko, or to find a ko threat. If Black and White alternate making ko threats with recapturing the ko, they are having a ko fight.

Outcomes

Eventually, one of three things will happen.

- One player will decide that winning the ko immediately is more important than responding to her opponent's latest ko threat. The player will move so that her opponent cannot recapture the ko, and her opponent gets to follow up on his last ko threat, effectively making two moves in one area of the board.
- One player will run out of ko threats. That player will be forced to make a play that his opponent does not have to respond to immediately, and his opponent wins the ko immediately.
- One player will decide that playing elsewhere on the board is more important than continuing the ko. The opponent can either win the ko, or play elsewhere on the board.

Practical evaluation

Before deciding to start a ko, it is worthwhile evaluating what threats are available to both players, so that one can decide which side is likely to win the ko fight. Many of the playing skills come together in ko fighting (evaluating the value of moves; reading ahead to find likely moves of the opponent and best responses; choosing the best order of moves), and it is a topic of much discussion among players. This also causes many beginners to be fearful of fighting a ko, since they are not confident of their ability to evaluate threats.

The importance of a ko varies dramatically depending on the positions of the two players. Some kos offer very little gain for either player, such as three points or less. Others control the fate of large portions of the board, sometimes even the whole board, and the outcome of those kos can determine the winner of the game. For this reason, finding and using ko threats well is a very important skill. [1]
**Ko threat strategy**

(Copied from http://senseis.xmp.net/?KoThreat.)

**Before the fight**
- Count ko threats.
- In anticipation of an upcoming ko fight, consider creating potential ko threats.
- Or, by the same token, find ways to eliminate ko threats on the part of your opponent (especially local ko threats (see an example of removing a local threat [2]), and double ko threats, meaning they work as ko threats for both sides).

**During the fight**
- If you have one or more ko threats "big enough" (threatening enough damage), so that your opponent should answer them, play the smallest one.
- If you will win the ko at your next opportunity, and a new ko begins or threatens to come about while the ko threat situation remains the same, you will be glad you only played your smallest effective threat.
- Otherwise, play the biggest one you have.

If you will lose the ko, you want to get the most you can in exchange for it.
- Try to avoid ko threats which lose points—i.e. loss-making threats.
- Try to make ko threats which are moves you would have liked to play anyway.
- Your ko threat needs to be a real threat; otherwise, it's called mukou.
- You should give absolute priority to local ko threats, which threaten to resolve the local situation in your favor regardless of the outcome of the ko, and which your opponent therefore has to answer at the risk of making the ko meaningless.

Note: There may be exceptions to the above advice. Whether to play a ko threat, and if so, which one, can be very subtle questions. See ko threat playing order for more.

**General**
- In general, when considering moves take into account the ko threat implications. Favor situations which give you more ko threats and your opponent fewer.

**Complex situations involving ko**

One curiosity is the existence of multiple kos on the same board at the same time. A double ko is a situation when two kos are potentially being fought, simultaneously and affecting the same local position. Such positions are uncommon, but do sometimes arise in actual play, affecting life and death or connection issues. Two kos cannot actually form a large loop.

A triple ko is when three kos are being fought simultaneously. In this case a long loop, of period six plays, can occur, not being ruled out by the ko rule: it is possible for the two players to continually take and retake the three kos in a fixed cyclic order. If both players judge this to be the best line of play, then the game could, theoretically, continue forever. When there are three kos on the board, it does not follow that there will be a triple ko: as long as one player can concede two out of three and still be ahead, there is no reason for the loop to persist; and normally that is true. When such a position does occur, the game is called off and the opponents begin a new game. However, this only occurs with the so-called "basic ko rule" that one cannot recapture immediately.

There are other, stronger ko rules, the main class being superko, where repeating positions of any cycle length are impossible: see Rules of Go. Such events, however, are extremely uncommon and many go players may play their whole lives without restarting a game due to a triple ko.
Such rule issues, therefore, are more a matter of principle, although considerable attention has been devoted to them: see Sensei's Library's overview [3].

External links
- Senseis on Ko [4]
- Charles Matthews in collaboration with Kim Seong-june 6 dan, series of articles; research carried out for a book on Ko fights and their evaluation [5]
- Sensei's Library on Double Ko [6]

References

Life and death

Life and death is a fundamental concept in the game of Go, where the status of a distinct group of stones is determined as either being "alive", and may remain on the board indefinitely, or "dead," where the group will be lost as "captured". The basic idea can be summarized by:

A group must have two eyes (meaning secured internal liberties) to live (meaning to survive through to the end of the game).

Explanation

The concept of Life and death is a consequence of two basic Go rules.

• A group of stones with no liberties is captured.
• A stone may not be played on a position where it will be captured directly, unless it directly captures another group.

Because of these rules, some groups can never be captured (alive), while others can't avoid capture (dead).

The group at a is not alive, but may become alive, so is unsettled. The group at b is dead. The group at c and d is alive.
Examples

See the diagram on the right, and suppose white tries to capture the black groups:

- a: White is not allowed to play a, because a white stone at a would be captured immediately.
- b: White may play b, because the black group will be captured first.
- c+d: White can not play c, because the white stone at c would be captured immediately, while the black group still has another liberty at d, so it won't be captured. The same logic holds for playing d.

The black group with the letters c and d can never be captured, and is called alive. The group can live because it has two -- separated -- inner liberties, where white can't play. A group such as b that cannot become alive is called dead. Groups that are neither alive, nor dead, are called unsettled.

e and f are eyes, g is a fake eye.

Eyes

Liberties inside a group, where the opponent cannot play, are called eyes. In the previous example, a, b, c and d are eyes. An eye may be a single empty intersection, or more of them. In the diagram on the left, the intersections marked e form a single eye, and f forms another eye. The group has two -- separated -- eye spaces. Even though white can make a move in these eyes, black could eventually capture the white stones, and each eye would thereby be reduced to a single intersection.

False eyes

An inner liberty where the opponent can still play, by capturing part of the group that encloses this liberty, is called a 'false eye' or 'deficient eye'. In the example on the left, white can play at g, and capture a black stone. The eye is then destroyed, and black has only one eye left. A group with only one eye is not alive. The black group at g is dead, because it can not form two true eyes.

Importance

Life and death situations and issues occur when an area with a group of stones surrounds a small area (<7 points) so that it may not be possible to form two separate independent "eyes". As the board fills up during the course of the game, certain groups will survive, and others may not. A group with a single eye can normally be captured, in the end, by filling first round the outside. The purpose of making two eyes is to prevent this. Novices sometimes interpret making two eyes in a narrow way, and form 'explicit' eyes one by one. This is often the wrong approach, and it is better to play generally to make a territory inside a group out of which two eyes can surely be made, if and when the opponent attacks it. Groups with seven or more points of territory will be able to form two eyes easily when attacked, unless there are some serious structural weaknesses.
Because the loss of a group can mean the loss of the game, and because the efficient use of each move is important, knowing the life and death status of one's own groups (as well as one's opponent's) is an important skill to cultivate, if one is to become a strong player. The correct, accurate plays with which to make a group secure, or to kill the opponent's group, are studied deeply by all strong players.

Status of a group

The concept of 'status' is discussed in Life and Death by James Davies. Groups of stones are divided into those that are alive, dead or unsettled. Here alive, for example, is an unconditional judgement made, that with best play from both players, the group can survive to the end of the game. That assumes the opponent starts: the alive status means that, whatever the attack made, there is an adequate defensive answer.

The unsettled status is therefore most worthy of attention. By playing first, the attacking player can kill such a group. By playing first, the defending player can save such a group. There is an enormous range of formations that are unsettled.

A group can be considered "alive", "dead", or "unsettled" based on whether two eyes can be made regardless of how the opponent plays. Naturally, one space is insufficient. Two adjacent spaces are insufficient to make two eyes as well, since putting a stone in will create one eye only. The opponent can simply fill in one of the two spots, threatening to fill in the other, forcing the player to capture that one by playing in the second one. Then, the opponent simply plays there again, killing the group. Usually this will not be done during the game, but at the end, during calculation, the group will be labeled "dead" and removed as prisoners. The only way to actually remove a group from the board is to fill its "eye space" with all but one, forcing it to capture the filling-in group by putting a stone in the last space. If the created group is not alive, then continuing this process will eventually kill the entire group.

Status of groups of three

Unsettled groups with three empty points

There are two possible groups of three, an "r" shape and three in a line. Both of these are unsettled, as whoever plays obtains the desirable result. The person trying to create two eyes can play in the middle spot (the one connected to the other two) and the other two are now eyes. If the opponent plays, he will play in the same spot, followed by an adjacent spot (the other player's piece would be captured were he to play in one of the two open spots), leaving only one empty spot left. This forces the first player to capture, leaving the dead two shape. The critical points are circled in the "Unsettled groups with three empty points" diagram.
**Status of groups of four**

There are five unique shapes with four empty points. Three are alive, one is unsettled, and one is dead.

The three alive ones are the straight line, L and Z shape. If the opponent plays in any spot, the first player can live by playing in the adjacent spot in the center two. For example, if the first player goes in either center, threatening to put an unsettled three-space line in, putting one in the other center one will do the trick. In the diagram "Groups with four empty points" black's groups in the upper corners are alive. If the opponent plays any of the circled positions, playing the other circled position will secure the status of the black group.

The unsettled shape is the four-stone pyramid, shown in the left bottom corner. Whoever plays in the circled center spot gets the desired result, so the player whose move it is wins. A two by two four square space is dead; an opponent player can easily place a piece in any space and the player will be unable to place any piece to save his territory.

**Status of groups with more than four empty points**

There are no dead shapes with more than four empty points, though there are a couple of unsettled ones.
Life and death

Unsettled groups with five empty points

A five stone plus sign (the X pentomino) and a "bulky five" (the P pentomino consisting of a square and one point off it, similar shape to a fist with the thumb extended") are the two unsettled ones. Playing in the point that touches the most others (four in the plus sign - center point, three in the "bulky five" - the one point in the square touching the outside point) will give the desired result to whoever does so.

There is only one unsettled six shape, and the rest are all alive. This one shape is the square, plus adding the two points touching any one of the corners. (Similar to the plus sign five, but add any of the four taken corner points to get the unsettled six). The opponent playing in the center point threatens to fill all but one spot with a bulky five shape, and there is no defense.

Any group surrounding more than six points is alive, but it may be necessary to respond correctly if the opponent attacks. Additionally, because of special properties of the corner, a group with more than six points might not be unconditionally alive.

Seki

Seki

There is a possibility for stones to be alive without eyes. This situations happens when two groups of otherwise dead stones face each other without being able to achieve capture.

The figure on the right shows one of the most simple seki. The black and white stones in contact with the circled points don't have any eyes and may seem dead. However, if Black tries to capture white, he needs to fill one of the circled point, which will only leads to its own capture by white. The same applies to White, who cannot fill black liberties without being captured first.
Since none of the players can kill the other, the situation is considered settled. The black and white stones are said to be alive in seki.

**Caveats**

Groups that are alive may yet die. One reason is that they may be sacrificed, in the course of a ko fight. Another way in which the ko rule enters the discussion is through the complications ko adds to the classification by status. It is quite possible for a group to be alive in ko: that is, the group is conditionally alive, the condition being to be able to win a particular ko fight relating to the control of a key intersection.

**Dead stones**

Virtually all games will have at least a few dead stones, which remain on the board at the end of the game, when both players pass. Those dead stones are then removed, in an operation often called 'cleaning', which is a separate phase of the game. The stones removed are treated exactly like other captured stones. Under Chinese rules, which use area counting, stones removed during the cleaning phase are returned to their bowls.

It is a novice mistake to carry out the capture of dead stones before it is of tactical importance to do so. Such plays, during the game, waste a turn and may also cost points.

Single stones and small groups are often sacrificed. In cases where a group is more than of sacrificial value, that group typically must make life in order for one to have a chance at winning the overall game.

Generally each side will have at most 4-5 living groups on the board at the end of the game. There is a go proverb that says that "Five groups may live, but the sixth will die" [1] which in a nutshell describes the need to emphasise connection between developing groups. The struggle for life can be solved by connection. Since each group needs two eyes, (and eyes are sometimes hard to come by) the alternative is to connect out to another group, thereby sharing both liberties and eyes.

**Aji**

Even if a group is lost, one can still use one's own dead stones for aji (potential). Ko threats are just one way in which apparently dead stones are put to good use. Expert players use a variety of 'squeezing' tactics, of which semedori, an advanced endgame technique, and shibori are two that have recognised Japanese-language names.

**References**


**External links**

- Goproblems.com site [2] has over 3000 life and death and other Go puzzles, in an interactive applet. (Also has JavaScript mode).
- GoTools [3], free (but a password will be required) Java applet for solving life-and-death problems, of professional level. Note that the applet is buggy: it often freezes, gives up, or returns the wrong result.
- Sensei's Library: Life and death [4]
Life and death

Shape

In the game of Go, shape describes the positional qualities of a group of stones. Descriptions of shapes in go revolve around how well a group creates or removes life and territory. Good shape can refer to the efficient use of stones in outlining territory, the strength of a group in a prospective fight, or making eye shapes so that a group may live. Bad shapes are inefficient in outlining territory and are heavy. Heavy groups cannot easily make eye shapes and are therefore good targets for attack. Understanding and recognizing the difference between good shape and bad is an essential step in becoming a stronger player.

Shape is not a rule; the surrounding position must always be taken into account. While it is useful for beginners to learn the common good and bad shapes presented here, sometimes a usually bad shape can be the best shape to play locally. This can be true if it forces the opponent to create an equally bad or worse shape, or if it accomplishes a specific tactical goal, such as the creation of eye-shape or the capture of an opponent's group.

"To make shape is to take a weak or defective position...and transform it into a strong one. Sometimes this can be done just by putting one stone down in the right place, but usually it takes sacrifice tactics..."[1]

Good Shapes

References

From the top left corner, clockwise: Black has a Mouth Shape in the top left corner, which white has foolishly tried to invade at c-17, putting the lone piece into a Net. Just to the right is a white Bamboo Joint. To the right of that is a Double Turn on white’s part. In the top right corner is a Small Knight’s Jump. On the right center portion of the board are two black stones that are being attacked by white at q-10. If black responds at the spot indicated by a, it would be a Pole Connection. The bottom right corner is a series of single Turns played out, and a Trumpet Connection at m-3. A Large Knight’s Jump is in the bottom left corner at g-2. On the left side of the board is a series of One Space Jumps. Just above that is a Tiger’s Mouth. In the center of the board is a Diamond shape.

- The Turn (跳ね Hane) is a move to be played when black and white stones are standing side by side and the player who plays diagonally at the end of the opponent’s group gains an advantage. This play turns the mutual walls, whereby a player can both expand ones influence and press the opponent down. The Turn at the head of two (or three) stones is used to seize the initiative and to create a thick position.\(^2\)

- The Double Turn (二段パネ Ni-dan bane), or two-step hane is two Turns played in succession. It can be an aggressive and appropriate move, but it generally exposes the group of stones to cutting.

- The Thousand Dollar Turn (千両曲がり Sentyou magari).\(^3\) The thousand dollar turn is valuable because it radiates influence into the center and one side of the board. By using its thickness, one can easily make eye-shape.\(^4\)

- The Diagonal (コスミ Kosumi) is a generally conservative move that allows the stones connected by a Diagonal to be connected, even in the event of a cut, barring outside influences, as there are two cutting points. The Diagonal can also be used to attack into a shape or to solidify border territory.

- The One Space Jump (一間トビ Ikken tobi), especially from the middle of three stones, is often the vital point in making good shape. An old Go proverb says, "Don’t try to cut the one space jump." This is for good reason, as it is difficult to disconnect without a kikashi. It can also be the vital point for destroying the enemy’s shape.\(^5\) The proverb, "my opponent’s vital point is my vital point," often applies in regard to shape.\(^6\) Another way to say it is, "what is good for black is good for white." That is, if you can play there first, then you can destroy their shape.

- The Knight’s Move (桂馬 Keima) is more fast-paced than either the diagonal move or the one-space jump. It is named after the resemblance to the movement of the Knight in Chess. It also makes a flexible and light shape and is useful in sabaki. Near the edge of the board the small knight’s move is used to secure a base or to link up stones. However this shape can easily be cut. Hence, you must consider the surrounding stones and be prepared to sacrifice one of your own stones to make good shape.\(^7\) It is sometimes called the Small Knight’s Move in order to differentiate it from the Large Knight’s Move.

- The Large Knight’s Move (大ゲイマ Ōgeima) is a more aggressive version of the Small Knight’s Move, and can be cut even more easily. It extends one square further, and is usually used in conjunction with stones already in the area that provide support for this move.

- The Pole Connection (棒づけ Bōsugi) is a connection that renders solid a series of previous free-standing stones, into a line, which allows for solidarity and more influence.

- The Ponnuki (ポン抜き Ponnuki) is a shape that has high defensive capabilities, in that, in order to cut any point of the shape, the opponent must either build up support around the shape or risk an atari when the invading stone is played without any support. It also exerts influence and support in every direction, and can be used to stage further attacks. This shape can be the result of playing with or without capturing an enemy stone - if an enemy stone was captured in the process, it is known as ponnuki; the resulting shape is a Diamond.
• The **Mouth Shape** (口 Kou) is a fundamental shape, good for forming an eye. It is half of a square, 2 stones by 2 stones in an “L”. Its vital point is across the square, on the far “corner”.

• The **Net** (下駄 Geta) is a very effective shape for preventing the escape of an enemy’s stones and for sabaki.

• The **Tiger's Mouth** (虎の口 Tora no kou), or **Hanging Connection**, is a one stone short of a **Diamond** shape. It is so-called because an attacking stone would be under atari immediately if played directly in the “mouth” of the group.

• The **Lion's Mouth** (獅の口 Shi no kou), or **Trumpet Connection**, guards against two different possible attacks on a stone by creating two **Tiger's Mouths** at the vulnerable cutting points.

• The **Bamboo Joint** (タケолуч Takefu) is safe and can only be cut if short of liberties, whereas the one-space jump is good shape for outlining territory but can be cut by de-giri (to push through then cut and capture the weak side). The Bamboo Joint is the essence of flexibility. It has the beauty of an either-or choice, so that even if the opponent attacks first, you have a safe response.

### Bad Shapes

On the top left corner is a black **Dumpling** that will be dead shortly. On the top right is a white **Empty Triangle** - if white had played at a instead of white 1, the stones would not be as threatened as they are currently. On the bottom left is a ladder shape for black (black had just played at black 2). Black will win this ladder battle due to the triangular stone at n-11, but if the n-11 piece did not exist, then white would inevitably win when the regular pattern of play extended to the edge of the board.

• The **Empty triangle** (空き三角 Akisanaka) is an undesirable formation of three stones that inefficiently adds liberties and creates a weak group.
• The **Ladder** (シチョウ Shichou) is not inherently a bad shape, but the inability to recognize when one is trapped in a ladder shape that cannot be won can be fatal.

• The **Dumpling** (団子 Dango) is a shape where a group of stones has been forced into an inefficient lump with few liberties, no eyes and limited ability to counterattack.

**References**


**Books**


Famous games and players

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Blood-vomiting Game

The blood-vomiting game (Japanese: 吐血の一局) was played during the Edo period of Japan, on June 27, 1835 between Honinbo Jowa (white) and Intetsu Akaboshi (black). It is noted for the three ghost moves that were allegedly given to Jowa during the game by ghosts, and for the premature death of the go prodigy Intetsu Akaboshi who died after coughing up blood onto the board after the game.

Ear-reddening Game

The ear-reddening game (Japanese: 耳赤の一局) was played during the Edo period of Japan, in 1846 between Honinbo Shusaku (black) and Inoue Genan Inseki (white). The game contains the "ear reddening move", so named when a doctor who had been watching the game took note to Genan as his ears flushed red when Shusaku played the move, indicating he had become upset.

"The Game of the Century"

The game of the century refers to a famous game of go between Honinbo Shusai (white) and Go Seigen (black) that was played to celebrate the 60th birthday of Honinbo Shusai. The game began on October 16, 1933 and finished on January 29, 1934. Each player was given twenty-four hours of thinking time. Shusai was the doyen of the Go world, as he was the head of the famous Honinbo Go school, the most prestigious of the schools originally founded at the behest of Shogun Tokugawa Ieyasu at the start of the 17th century. Go Seigen was famed as a prodigy, first among a generation of young new brilliant players, and would go on to become one of the most celebrated players of the 20th century. This led newspapers to dub the match the game of the century.

The tradition at the time dictated whoever played White had the right to adjourn the game at anytime, and there was no sealing of moves. This meant that Shusai, being the nominally stronger player and thus holding White, could adjourn the game whenever it was his turn to play and continue deliberating at his leisure during the adjournment. Shusai called adjournments some 13 times, all at the start of his turn to move, thus prolonging the match to a period of three months (16 October 1933-19 January 1934). For instance, on the eighth day of the match, Shusai played first and Go Seigen replied within two minutes. Shusai then thought for three and a half hours but only to adjourn the game. During these adjournments, Shusai would retreat home to study the game with his students.

He trailed throughout the game until, on the 13th day of the match, he made a brilliant move at W160, now celebrated. It was rumored that it was not Shusai but one of his students, Maeda Nobuaki, who was the author of this ingenious move. Segoe Kensaku told a reporter this, in what he thought was an off-the-record interview.¹ Maeda himself even hinted as much. When presented with the opportunities to debunk these rumors, Maeda neither denied nor confirmed them.²
Atomic Bomb Go Game

The atomic bomb go game is a celebrated game of Go that was in progress when the first atomic bomb was dropped on Hiroshima, Japan on August 6, 1945. The venue of the game was in the suburbs of Hiroshima, about 5 kilometers (3.1 mi) from ground zero.\[3\]

The game was about to enter its third and final day of play when the bomb dropped at 8.15 am. The players — Hashimoto Utaro, who was the Honinbo title holder, and Iwamoto Kaoru, who was the challenger — had replayed the game to the adjourned position but had not yet started to play on. The explosion caused disruption to the game, damage to the building, and some injuries to those attending the match. Play was resumed after the lunch break, and the game was played to a conclusion that evening. Hashimoto, holding White, won by five points.

Game 1 of the match had been played 23 to 25 July in the centre of Hiroshima. The move to further out of the city area was recommended by the police, after a drop of propaganda leaflets.

The match was continued after the war, ending in a 3-3 draw. A three-game playoff was held in 1946, won by Iwamoto in two straight games to claim the Honinbo title (becoming Honinbo Kunwa). Utaro went on to reclaim the title in 1950.\[4\]

The Honinbo title, originally the name of one of the Four go houses or state-funded academies of go that had been set up in the 17th century, had become the first of the annual titles for which professional players compete on the death of Honinbo Shusai. Wartime conditions had made the holding of annual matches problematic, since large preliminary qualifying tournaments were required to find a challenger. In 1945 the Honinbo Tournament was being run for the third time.
Lee's Broken Ladder Game

This was a match between Lee Sedol and Hong Chang-sik during the 2003 KAT cup. This game is notable for Lee's use of a broken ladder formation.

Normally playing out a broken ladder is a bad mistake, a pitfall associated with bad beginner play; the chasing stones are left appallingly weak. Between experts it should be decisive, leading to a lost game. Here in this case Lee, playing black, defied the conventional wisdom, pushing development of the ladder to capture a large group of Hong's stones in the lower-right side of the board. While the ladder was to be captured by white, white ultimately resigned.
List of go games

B Moves 67 to 74 (B: Yi Se-tol W: Hong Chang-sik)

B Moves 89 to 97 (B+R at 211)
List of go games

References

The **blood-vomiting game** (Japanese: 吐血の一局, doketsu no ikkyoku) is a famous game of go of the Edo period of Japan, played on June 27, 1835 between Honinbo Jowa (white) and Intetsu Akaboshi (black). It is noted for the three *ghost moves* that were allegedly given to Jowa during the game by ghosts, and for the premature death of the go prodigy Intetsu Akaboshi who died soon after coughing up blood onto the board after the game. Selected moves of the game are shown in diagrams.

After continually struggling to gain the post of Meijin, Honinbo Jowa had won the title over rival Inoue Genan Inseki. The rivalry between Jowa and Inseki began when a game scheduled between the two was cancelled. The game, scheduled for February 18, 1828, was to be played due to Inseki’s recent promotion to 8 dan. The game was cancelled by Jowa’s side, who claimed that Inseki did not deserve his promotion but had gained it through intrigue. This led Inseki to attempt to remove Jowa from his post. Failing to keep to an agreement, Jowa refused to give up his post to Inseki after 6 years (1834). Inseki then sent his pupil, Intetsu Akaboshi, expected to become Meijin after
Blood-vomiting game

Jowa, to play Jowa in a match. The match lasted for four days without any adjournments. Jowa won the match, and while kneeling over the board Akaboshi coughed or vomited up blood. He died within a few months. As Akaboshi was only 25 years old at the time, it is often suggested that pre-existing gastrointestinal bleeding or pulmonary disease had weakened his health, and it is possible that Akaboshi was sick for months with these diseases already.

The game

The secret Inoue house move

The secret move used by Akaboshi in the match was developed by Genan Inseki and others in the Inoue house as a taisha variation. The move, shown in the diagram, gave Akaboshi a lead by attacking the white stones in the center and being able to capture two stones later on in the game.

![Diagram of the secret move](image)

The secret move
The ghost moves

The three ghost moves were believed to have been brought to Jowa by ghosts, allowing him to come back in a game he was losing. These moves eventually led to Jowa winning by resignation.

The first two ghost moves, white 2 and 4 in the diagram below, allowed white to ignore black’s move at 1 in order to play another move at 6 due to the aji of "a".

The third ghost move was an example of good shape and bad shape with a move. The good of the move was it allowed Jowa to launch an attack that would lead to him winning, while the bad was making an empty triangle, a shape that is normally avoided because it is seldom effective.
Blood-vomiting game

The third and last ghost move.

End of the game

The end position. The ghost moves are marked in order.

[2]
Notes


External links

• Sensei's Library article on the "Blood Vomiting Game" (http://senseis.xmp.net/?BloodVomitingGame)
The **ear-reddening game** (Japanese: 耳赤の一局) is a game of go of the Edo period of Japan, played on September 11, 1846 between Honinbo Shusaku (black) and Inoue Genan Inseki (white). The game is probably Shusaku's most notable game as it contains the "ear-reddening move"- so named when a doctor who had been watching the game took note of Genan as his ears flushed red when Shusaku played the move, indicating he had become upset.

Shusaku met Genan Inseki in July 1846 when he returned to Edo after staying in Onomichi for eighteen months. Shusaku was 17 years old and a 4-dan player at the time, while Genan was nearing his fifties and was ranked at 8-dan. The first game they played, Genan allowed Shusaku to play with a two stone handicap. Realizing he had no chance of winning, Genan suspended the game without finishing it, and played another one with Shusaku simply playing black without handicap.
Ear reddening game

Shusaku made a mistake early on in the taisha joseki, but would play well throughout the rest of the game to win by 2 points.

**Taisha joseki**

The first time this joseki was documented was 24 years earlier, in 1822, and at this time go sequences which were developed were held as trade secrets. Play progressed into the taisha five-way junction, with the next two moves as shown.\[1\]
The ear-reddening move

The move gave influence to all four directions. While expanding the top, it also brings some help to the four triangulated black stones on the bottom, reduces the white thickness on the right side, and also aims at erasing or invading the left side. [2]

Notes


External links

• Sensei's Library article on the Ear Reddening Game (http://senseis.xmp.net/?EarReddeningGame)
A **Go professional** is a professional player of the game of Go. The minimum standard to acquire a professional diploma through one of the major go organisations is very high. The competition is tremendous, and prize incentives for champion players are very large. For example, the Honinbo Tournament has a grand prize of about $350,000.

Almost all professional players are from China, Japan, Korea, and Taiwan. This is because only China (Zhongguo Qiyuan), Japan (Nihon Ki-in, Kansai Ki-in), Korea (Hanguk Kiwon), and Taiwan (Taiwan Qiyuan) have professional Go organizations.

Professional rankings are separate from the amateur ratings (usually 30 kyu through 7 dan). Professional rankings are 1 dan through 9 dan (sometimes written 1p through 9p). In the past, a 1 dan professional was roughly equal to a (European) 7 dan amateur. However, since the competition to become a professional has increased since the late-90s (particularly in China and Korea), it has become the case that new 1 dan professionals are much stronger than they usually were in the past.
There have also been professional Go players from the West, specifically Romania, Austria, Germany, Russia, Hungary, Australia and the United States of America. With the proliferation of Go literature and the emigration of Go players from the East to the West, their number can only be expected to increase.

**Reaching professional level**

Professional dan rankings are normally awarded in Japan, China, South Korea or Taiwan, through one of the professional Go associations, most notably the Hanguk Kiwon (Korea) or Nihon Ki-in (Japan).

The attainment of professional qualification differs in different countries:

- In China a few amateurs are given the 1p grade as probationers, on the basis of success in amateur tournaments.
- In Japan student professionals are called *insei*, and have to play in internal insei competitions to qualify; mostly they are adolescents, and must decide whether to continue based on their chances of a career in Go, or go to university. Insei rarely take part in amateur events, but some of the top amateurs are ex-insei.
- In South Korea four amateurs become professional every year, at the top of a ferocious league system of 80 aspiring pros. Once within the professional system, promotion is based on game results.

Most professional players begin studying Go seriously when they are children, commonly reaching professional status in their mid to late teens. Some rare students achieve professional status at a much earlier age, such as Cho Chikun.

In order to qualify as a first dan professional (1p), one must have deep resources of game experience and study. In local positions, professionals are often on close ground with each other, understanding good shape, tesuji, life and death, fuseki and joseki patterns. However, in global positions they often differ in positional judgement—the global impact and interaction of josekis and differing importance of various parts of the board during the opening and middle game.

**Discrepancies among professionals**

The strength differences between professional levels is usually considered to be no more than 2-3 handicap stones. Therefore, the difference between professional dan levels corresponds to about one-third to one-fourth of a handicap stone.

Each country has different rules for promotion. Ranks may, therefore, differ somewhat from country to country.

Professionals may also differ in actual strength for a number of reasons, such as promotion not keeping up with actual gains in strength, or the fact that professional ranks (unlike kyu or amateur dan) may rise, but never fall (even if the player grows weaker). This has posed some problems, esp. with regards to international rank discernment.

There are currently over one hundred people who have the rank of 9p (the highest professional rank), though many of them no longer play competitively. A further distinction is that some 9p players regularly hold titles, others won some titles, some entered the title leagues, and many 9p never had the fortune to achieve any of the above.

Traditionally it has been uncommon for a low professional dan to beat some of the highest pro dans. But since the late-90s it has slowly become more common. This trend has been primarily credited to the result of increased competition to become a professional player in China and Korea. The result, that new 1 dan professionals are generally stronger than other 1 dans in the past.

In Japan, the *Oteai* system was reformed in 2004. The goal was to help alleviate some of the rank inflation that had crept in over the years. Today's Japanese system uses various benchmarks; for example, winning certain tournaments or a certain number of games, to be promoted by a rank. The Korean and Chinese systems have also been similarly changed in the past several years. These systems have increased the importance of international tournaments by incentivising rank promotion through international placement. Recent criticism has been given to this aspect, arguing that an individual may increase many professional ranks at once through the virtue of a single competition result (such as Piao Wenyao).
Pro and amateur dan

In theory, professional dan should beat all levels of amateur dans. In reality, the very top amateurs have proven very
able. The conventional wisdom is that such players may achieve some of the insight of a pro, though perhaps not the
detailed knowledge.

In China, Korea, and Japan, there are two distinct ranking sets, one for amateur players and one for professional
players (who receive a fee for each game they play, bonuses for winning, and fees for other related activities such as
teaching).

In the Japanese professional ranking system, distinction between ranks was traditionally considered to be roughly
one third of a handicap stone (making the difference 3 pro dan equal to one amateur dan). The strength of new
professionals (1-dan) was usually comparable to that of the highest ranked amateurs. Currently the professional
ranks are assumed to be more bunched together, covering not much more than two amateur dans; so that pro 1-dans
win some games against 9-dans. There are also a number of amateur players acknowledged as having pro 6-dan
understanding of the game.

In South Korea, there are several amateur systems in use, with the recent introduction of official 7, 6 and 5-dan
amateur ranks, each of which is somewhat stronger than the corresponding European grade. A 7-dan amateur will
have won three national events, and will be effectively of lower-ranked pro standard. The older gup system does not
easily match others. In practice, in Korean clubs, grades may be worked out against the resident strongest amateur.

The Taiwan Chi Yuan Culture Foundation also employs a dan system similar to that in Japan. It ranks its
professional players from beginner dan (初段) up to 9 dan, being the highest. However, the amateur ranking
system is established by another organization. certifies amateur player through competitions, ranking player from
beginner dan (初段) to 6 dan with 7 dan being honorary.

In Germany and the Netherlands a "classes"-system (German: "Klassen") was established. It comprised a further
subdivision into Kyu/Dan half-grades with classes 18 and 17 = amateur 1-dan with the 17 being on the stronger side.
It is still in use for club ladders where players get promoted or demoted after a won or lost game, respectively.

References

Match between two famous players. Left is Honinbo Shusai, right is Go Seigen. (Game record of the famous match here)

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This page gives an overview of well-known players of the game of Go throughout the ages. The page has been divided into sections based on the era in which the Go players played and the country in which they played. As this was not necessarily their country of birth, a flag of that country precedes every player's name. For a complete list of player articles, see Category:Go players.

The important dates that this separation is based on are:

- The establishment of the Four go houses at the start of the Tokugawa Shogunate.
- The demise of the houses in the Meiji Period (end 19th century) followed by their replacement by the Nihon Kiin in 1924.
- The start of international tournament Go in 1989

A Japanese census on go players performed in 2002 estimates that over 24 million people worldwide play go, most of whom live in Asia. Most of the players listed on this page are professionals, though some top level amateurs have been included. Players famous for achievements outside Go are listed in their own section.

17th through 19th century

In the 17th, 18th and 19th century, Go was popular in both Japan (Edo period) and China (period of the Qing Dynasty). In Korea, a Go variant called Sunjang baduk was played.

Japan

At the start of the Tokugawa Shogunate, four go academies were established. This table lists all heads of these houses, as well as some that were appointed heir but died before they became head of the house. Tokugawa also established the post of Godokoro (minister of go), which was awarded to the strongest player of a generation. Such players were dubbed Meijin (brilliant man), which was considered equal to a 9 dan professional grade. Over the 300 year period covered here, only ten players received the title of Meijin. Several other players (16 total) received the title of Jun-Meijin (half-Meijin), which is considered to equal an 8 dan professional grade and listed as such below. In some houses it was the custom that the head of the house was always named the same according to the iemoto system (家元). All heads of the house Inoue (井上) were named Inseki (因碩), heads of the house Yasui (安井) were name Senkaku (仙角) from the 4th head onward, and heads of the house Hayashi (林) were named Monnyu (門入) from the second head onward. To distinguish between these players, the names listed below are the names they had before becoming head of their house, or after their retirement. The house Honinbo (本因坊) had no such tradition, although heads would often take one character from the name of their predecessor into their own name, notably the character Shu (秀) from the 14th head onward.

<table>
<thead>
<tr>
<th>Origin</th>
<th>Name</th>
<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Honinbo Sansa (本因坊算砂)</td>
<td>1559–1623</td>
<td>Meijin, 9 dan</td>
<td>Founder and first head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>● Nakamura Doseki (中村道碩)</td>
<td>1582–1630</td>
<td>Meijin, 9 dan</td>
<td>Retrospectively seen as founder of the house Inoue.</td>
<td></td>
</tr>
<tr>
<td>● Hayashi Monnyusai (林門入斎)</td>
<td>1583–1667</td>
<td>7 or 8 dan</td>
<td>Founder and first head of the house Hayashi.</td>
<td></td>
</tr>
<tr>
<td>● Yasui Santetsu (安井算哲)</td>
<td>1589–1652</td>
<td>8 dan</td>
<td>Founder and first head of the house Yasui.</td>
<td></td>
</tr>
<tr>
<td>● Inoue Genkaku (井上玄讎)</td>
<td>1605–1673</td>
<td>7 dan</td>
<td>First head of the Inoue house on the unrevised numbering (not counting Nakamura Doseki).</td>
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<tr>
<td>Name</td>
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<tr>
<td>Yasui Sanchi</td>
<td>1617–1703</td>
<td>Meijin, 9 dan</td>
<td>Second head of the house Yasui.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Doetsu</td>
<td>1636–1727</td>
<td>7 dan</td>
<td>Third head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Dosaku</td>
<td>1645–1702</td>
<td>Meijin, 9 dan</td>
<td>Fourth head of the house Honinbo. One of the greatest players of all time, and the first Kisei (go saint); an important influence on go theory.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Doteki</td>
<td>1669–1690</td>
<td>7 dan</td>
<td>Heir to the house Honinbo. Was considered an extremely talented Go prodigy.</td>
<td></td>
</tr>
<tr>
<td>Hayashi Momnyu</td>
<td>1678–1719</td>
<td>6 dan</td>
<td>Second head of the Hayashi house.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Dochi</td>
<td>1690–1727</td>
<td>Meijin, 9 dan</td>
<td>Fifth head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Chihaku</td>
<td>1710–1733</td>
<td>6 dan</td>
<td>Sixth Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Shahaku</td>
<td>1716–1741</td>
<td>6 dan</td>
<td>Seventh head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Satsumen</td>
<td>1733–1788</td>
<td>Meijin, 9 dan</td>
<td>Ninth head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Genjo</td>
<td>1775–1832</td>
<td>8 dan</td>
<td>Eleventh head of the house Honinbo.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Jowa</td>
<td>1787–1847</td>
<td>8 dan</td>
<td>Was dubbed Kisei (go sage), played the famous “Blood Vomiting Game” with Akaboshi Intetsu.</td>
<td></td>
</tr>
<tr>
<td>Ota Yuzo</td>
<td>1807–1856</td>
<td>7 dan</td>
<td>was a close friend of Honinbo Shusaku and once played a famous sanjubango (30 game match) with him.</td>
<td></td>
</tr>
<tr>
<td>Intetsu Akaboshi</td>
<td>1810–1835</td>
<td>7 dan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honinbo Shusaku</td>
<td>1829–1862</td>
<td>7 dan</td>
<td>One of the greatest players ever, he died young. He was posthumously awarded the title of Kisei (go sage).</td>
<td></td>
</tr>
<tr>
<td>Honinbo Shuho</td>
<td>1838–1886</td>
<td>8 dan</td>
<td>Was the founder of Hoensha and the man who taught Go to Oskar Korschelt.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Shuai</td>
<td>1854–1907</td>
<td>9 dan</td>
<td>was the 17th and again 19th head of the Honinbo house. Very active and innovative in the 1890s.</td>
<td></td>
</tr>
<tr>
<td>Honinbo Shusai</td>
<td>1874–1940</td>
<td>9 dan</td>
<td>was the last inheritor of &quot;Honinbo&quot; title, and founder of the Nihon Ki-in.</td>
<td></td>
</tr>
</tbody>
</table>

*All ranks are professional dan grades unless otherwise noted.*
## China

<table>
<thead>
<tr>
<th>Origin</th>
<th>Name</th>
<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Huang Longshi (黃龍士)</td>
<td>1650s–1690s</td>
<td>Guoshou, 9 dan</td>
<td>Was considered by Go Seigen to have been at least the level of Honinbo Dosaku. He reached Guoshou* at the age of 16.</td>
</tr>
</tbody>
</table>

*Players could achieve the level of Guoshou (National Champion), which is considered to be equal to the Japanese title of Meijin.

## 20th century

### Japan

<table>
<thead>
<tr>
<th>Origin</th>
<th>Name</th>
<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kensaku Segoe (瀬越惠作)</td>
<td>1889–1972</td>
<td>9 dan</td>
<td>was famous for bringing and teaching Go Seigen and Cho Hunhyun in Japan.</td>
</tr>
<tr>
<td></td>
<td>Utao Hashimoto (橋本太郎)</td>
<td>1907–1994</td>
<td>9 dan</td>
<td>was the founder of the Kansai Ki-in.</td>
</tr>
<tr>
<td></td>
<td>Minoru Kitani (木谷実)</td>
<td>1909–1975</td>
<td>9 dan</td>
<td>was a great friend and rival to Go Seigen. Go and Kitani were the vanguard of the Shin-fuseki or &quot;New Opening&quot;, a great advance in go theory. Most prolific teacher ever. Pupils include Masao Kato, Yoshio Ishida, Hideo Otake, Kim In, Cho Chikun, Masaki Takemiya and Koichi Kobayashi.</td>
</tr>
<tr>
<td></td>
<td>Toshihiro Shimamara (島村俊廣)</td>
<td>1912–1991</td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hidehiro Miyashita (宮下秀洋)</td>
<td>1913–1976</td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dogen Handa (半田道玄)</td>
<td>1914–1974</td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Go Seigen (呉清源)</td>
<td>1914–</td>
<td>9 dan</td>
<td>Wu Qingyuan in Chinese. is considered by many the greatest player of the 20th century, perhaps the greatest of all time. He had a superb match play record, before the current era dominated by annual titles.</td>
</tr>
<tr>
<td></td>
<td>Kaku Takagawa (高川格)</td>
<td>1915–1986</td>
<td>9 dan</td>
<td>The first of only four players to receive the Honorary Honinbo title.</td>
</tr>
<tr>
<td></td>
<td>Hosai Fujisawa (藤沢朋圀)</td>
<td>1919–1993</td>
<td>9 dan</td>
<td>one of the greatest players of the '60s.</td>
</tr>
<tr>
<td></td>
<td>Eio Sakata (坂田栄男)</td>
<td>1920–2010</td>
<td>9 dan</td>
<td>his nicknames include &quot;Razor Sakata&quot;, the &quot;Master of myoushu&quot; (brilliant move). He was the former longtime holder of most championship titles with 64.</td>
</tr>
<tr>
<td></td>
<td>Shuchu Kubouchi (窪內秀知)</td>
<td>1920–</td>
<td>9 dan</td>
<td>Affiliate of the Kansai Ki-in.</td>
</tr>
<tr>
<td></td>
<td>Toshio Sakai (酒井淑夫)</td>
<td>1920–1983</td>
<td>6 dan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Masao Sugiuchi (杉内雅男)</td>
<td>1920–</td>
<td>9 dan</td>
<td>nicknamed &quot;the God of Go&quot; for his serious attitude towards Go. Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td></td>
<td>Takeo Kajiwara (梶原武雄)</td>
<td>1923–</td>
<td>9 dan</td>
<td>one of the &quot;three crows&quot;.</td>
</tr>
<tr>
<td></td>
<td>Sunao Sato (佐藤直男)</td>
<td>1924–2004</td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Born</td>
<td>Died</td>
<td>Title</td>
<td>Affiliation</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>Hideyuki Fujisawa (藤沢秀行)</td>
<td>1925–2009</td>
<td></td>
<td>9 dan</td>
<td>Honorary Kisei after winning the Kisei 6 times in a row.</td>
</tr>
<tr>
<td>Toshiro Yamabe (山部俊郎)</td>
<td>1926–2000</td>
<td></td>
<td>9 dan</td>
<td>one of the &quot;three crows&quot;.</td>
</tr>
<tr>
<td>Keizo Suzuki (鈴木圭三)</td>
<td>1927–1945</td>
<td></td>
<td>3 dan</td>
<td>one of the &quot;three crows&quot;.</td>
</tr>
<tr>
<td>Yasuro Kikuchi (加藤朋子)</td>
<td>1929–</td>
<td></td>
<td>8 dan</td>
<td>is the most famous amateur go player in Japan.</td>
</tr>
<tr>
<td>Shuozo Ohira (大平修三)</td>
<td>1930–1998</td>
<td></td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td>Naoki Miyamoto (宮本直毅)</td>
<td>1934–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Kansai Ki-in.</td>
</tr>
<tr>
<td>Shoji Hashimoto (倉本昌二)</td>
<td>1935–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Kansai Ki-In.</td>
</tr>
<tr>
<td>Yasuo Koyama (小山靖男)</td>
<td>1937–2000</td>
<td></td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td>Takeo Ando (安藤武夫)</td>
<td>1938–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Hiroaki Tōno (東野弘昭)</td>
<td>1939–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Kansai Ki-in.</td>
</tr>
<tr>
<td>Norio Kudo (工藤紀夫)</td>
<td>1940–</td>
<td></td>
<td>9 dan</td>
<td>current President for the International Go Federation. Affiliate of the Nihon Ki-In.</td>
</tr>
<tr>
<td>Kunio Ishii (石井邦生)</td>
<td>1941–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Rin Kaiho (林海峰)</td>
<td>1942–</td>
<td></td>
<td>9 dan</td>
<td>was one of Go Seigen's students. Known for winning many titles at a young age. Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Yasumasa Hane (羽根泰正)</td>
<td>1944–</td>
<td></td>
<td>9 dan</td>
<td>father of Hane Naoki.</td>
</tr>
<tr>
<td>Manfred Wimmer (マンフレッド・ウィマー)</td>
<td>1944–1995</td>
<td></td>
<td>2 dan</td>
<td>Born in Austria, became the first western Go professional in 1978, doing so with the Kansai Ki-in. Reached 2p the same year, and later brought Go to Kenya and Madagascar.</td>
</tr>
<tr>
<td>Kunihisa Honda (本田邦久)</td>
<td>1945–</td>
<td></td>
<td>9 dan</td>
<td></td>
</tr>
<tr>
<td>Masao Kato (加藤正夫)</td>
<td>1947–2004</td>
<td></td>
<td>9 dan</td>
<td>was the master of the attacking style, who died on December 30, 2004.</td>
</tr>
<tr>
<td>Yoshio Ishida (石田芳夫)</td>
<td>1948–</td>
<td></td>
<td>9 dan</td>
<td>is the youngest ever Honinbo winner and one of the strongnest players of the 1970s. TV commentator. Affiliate of the Nihon Ki-In.</td>
</tr>
<tr>
<td>Shigeru Baba (馬場滋)</td>
<td>1949–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Goro Miyazawa (宮沢晋樹)</td>
<td>1949–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Shuzo Awaji (淡路修三)</td>
<td>1949–</td>
<td></td>
<td>9 dan</td>
<td>famous for his Go school. Affiliate of the Nihon Ki-In.</td>
</tr>
<tr>
<td>Akira Ishida (石田正彦)</td>
<td>1949–</td>
<td></td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
</tr>
<tr>
<td>Masaki Takemiya (武宮正樹)</td>
<td>1951–</td>
<td></td>
<td>9 dan</td>
<td>is famous for his 'cosmic style', aiming for territory in the center of the board rather than the sides. Affiliate of the Nihon Ki-In.</td>
</tr>
<tr>
<td>Name</td>
<td>Year</td>
<td>Title</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Koichi Kobayashi (小林光一)</td>
<td>1952-</td>
<td>9 dan</td>
<td>has the third most titles in Japan with 57. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Cho Chikun (조치훈, 趙治勳)</td>
<td>1956-</td>
<td>9 dan</td>
<td>Cho Chihun in Korean, is among the best players of the late 20th century - passed Sakata in late 2002 for most titles in Japan with 66. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>O Rissei (王立誠)</td>
<td>1958-</td>
<td>9 dan</td>
<td>one of the first Taiwanese Go players to become a professional in Japan. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Hiroshi Yamashiro (山城宏)</td>
<td>1958-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Satoshi Kataoka (片岡聡)</td>
<td>1958-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Satoru Kobayashi (小林悟)</td>
<td>1959-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>O Meien (王銘琬)</td>
<td>1961-</td>
<td>9 dan</td>
<td>famous for his &quot;Meien-isms&quot;, a special way of opening a game. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Michael Redmond (マイケル・レッドモンド)</td>
<td>1963-</td>
<td>9 dan</td>
<td>is the only (as of February 2008) non-Asian (American) to attain rank of 9-dan. TV commentator for the Japanese network NHK. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Shinichi Aoki (青木一)</td>
<td>1965-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Norimoto Yoda (佐田紀基)</td>
<td>1966-</td>
<td>9 dan</td>
<td>Has one of the best track records in international tournaments for Japan. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Toshiya Imamura (今村俊也)</td>
<td>1966-</td>
<td>9 dan</td>
<td>Affiliate of the Kansai Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Hideki Komatsu (小松英樹)</td>
<td>1967-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Kikayo Aoki (青木喜久代)</td>
<td>1968-</td>
<td>8 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Hans Reinhard Pietsch</td>
<td>1968-2003</td>
<td>6 dan</td>
<td>Known for spreading Go around the world.</td>
<td></td>
</tr>
<tr>
<td>Tomoyasu Mimura (三村警保)</td>
<td>1969-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Michihiro Morita (森田道博)</td>
<td>1970-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Cho Sonjin (조선진, 趙善津)</td>
<td>1970-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Ryu Shikun (류식훈, 柳時薰)</td>
<td>1971-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Kimio Yamada (山田規三生)</td>
<td>1972-</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Satoshi Yuki (結城聡)</td>
<td>1972-</td>
<td>9 dan</td>
<td>The third youngest player to become a professional, and second youngest professional for the Kansai Ki-in. Affiliate of the Kansai Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Catalin Taranu (タラヌ・カタリン)</td>
<td>1973-</td>
<td>5 dan</td>
<td>One of Romania's best players and a pro in Japan. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Yukari Yoshihara (梅澤由香里)</td>
<td>1973-</td>
<td>5 dan</td>
<td>The Go player who supervised the production of the manga Hikaru no Go. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Player Name</td>
<td>Year – –</td>
<td>Rank</td>
<td>Affiliation</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
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<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>Shinya Nakamura (仲邑信也)</td>
<td>1973–</td>
<td>8 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Atsushi Kato (加藤充志)</td>
<td>1974–</td>
<td>8 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Shinji Takao (高尾弐路)</td>
<td>1976–</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Naoki Hane (羽根直樹)</td>
<td>1976–</td>
<td>9 dan</td>
<td>In 2002, Hane broke the record for fastest promotion to 9 dan in Nihon Ki-in history. Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Han Zenki (潘善琪)</td>
<td>1977–</td>
<td>7 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Tomochika Mizokami (溝上知覧)</td>
<td>1977–</td>
<td>7 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Keigo Yamashita (山下次郎)</td>
<td>1978–</td>
<td>9 dan</td>
<td>Has an innovative style harking back to shinfuseki. Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Kaori Aoba (青葉かおり)</td>
<td>1978–</td>
<td>4 dan</td>
<td>First professional to be defeated by a Go engine with a conventional handicap. Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Kim Shushun (김수준, 金秀俊)</td>
<td>1979–</td>
<td>7 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>So Yokoku (蘇耀国)</td>
<td>1979–</td>
<td>8 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Cho U (張栩)</td>
<td>1980–</td>
<td>9 dan</td>
<td>In 2003, Cho U broke the record for fastest promotion to 9 dan in Nihon Ki-in history. Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Takehisa Matsumoto (松本武久)</td>
<td>1980–</td>
<td>6 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Rin Kono (河野臨)</td>
<td>1981–</td>
<td>9 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Ko Reibun (孔令文)</td>
<td>1981–</td>
<td>5 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Atsushi Tsuruyama (裏山淳志)</td>
<td>1981–</td>
<td>6 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Kana Mannami (万波佳奈)</td>
<td>1983–</td>
<td>3 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Taiki Seto (瀬戸大樹)</td>
<td>1984–</td>
<td>6 dan</td>
<td>Affiliate of the Kansai Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Nobuaki Anzai (安斎伸彰)</td>
<td>1985–</td>
<td>4 dan</td>
<td>Affiliate of the Nihon Ki-in.</td>
<td></td>
</tr>
<tr>
<td>Ko Iso (黄鴻祖)</td>
<td>1987–</td>
<td>7 dan</td>
<td>Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Yuta Iyama (井山裕大)</td>
<td>1988–</td>
<td>9 dan</td>
<td>Became the youngest title holder ever in 2005 after winning the Agon Cup. 34th Meijin. Affiliate of the Nihon Ki-In.</td>
<td></td>
</tr>
<tr>
<td>Daisuke Murakawa (村川大介)</td>
<td>1990–</td>
<td>3 dan</td>
<td>The youngest Kansai Ki-in pro ever. Affiliate of the Kansai Ki-in.</td>
<td></td>
</tr>
</tbody>
</table>
## China

<table>
<thead>
<tr>
<th>Origin</th>
<th>Name</th>
<th>DoB–DoD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>中国</td>
<td>Chen Zude (陈祖德)</td>
<td>1944–</td>
<td>9 dan</td>
<td>was the chairman of Zhongguo Qiyuan from 1992–2003 and is also the current president of the association. Famous for popularizing the Chinese fuseki.</td>
</tr>
<tr>
<td></td>
<td>Nie Weiping (聂卫平)</td>
<td>1952–</td>
<td>9 dan</td>
<td>Challenged for many top international titles in the late 1980s. Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Cao Dayuan (曹大元)</td>
<td>1962–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Ma Xiaochun (马晓春)</td>
<td>1962–</td>
<td>9 dan</td>
<td>A top player in China during the 1990s. Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Qian Yuping (钱宇平)</td>
<td>1966–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Yu Bin (俞斌)</td>
<td>1967–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Shao Weigang (邵evenodd)</td>
<td>1973–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Chang Hao (常昊)</td>
<td>1976–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Zhou Heyang (周鹤洋)</td>
<td>1976–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Luo Xihe (罗洗河)</td>
<td>1977–</td>
<td>9 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Wang Lei (王磊)</td>
<td>1978–</td>
<td>8 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Ding Wei (丁伟)</td>
<td>1979–</td>
<td>8 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Huang Yizhong (黄奕中)</td>
<td>1981–</td>
<td>6 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Kong Jie (孔杰)</td>
<td>1982–</td>
<td>9 dan</td>
<td>3 world championship titles. One of current top 3 players in the world. Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Qiu Jun (邱峻)</td>
<td>1982–</td>
<td>8 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Tang Li (唐莉)</td>
<td>1982–</td>
<td>1 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Hu Yaoyu (胡耀宇)</td>
<td>1982–</td>
<td>8 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Gu Li (古力)</td>
<td>1983–</td>
<td>9 dan</td>
<td>7 World championship titles; One of top 3 players in the world. He had exceptional record between 2008 and 2010. He lost to Lee Sedol in 2011 BC card cup final. Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Xie He (谢赫)</td>
<td>1984–</td>
<td>5 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Liu Xing (刘星)</td>
<td>1984–</td>
<td>6 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Wang Xi (王檄)</td>
<td>1984–</td>
<td>6 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td></td>
<td>Chen Yaoye (陈耀烨)</td>
<td>1989–</td>
<td>9 dan</td>
<td>Youngest professional 9 dan at 17 years of age. Affiliate of the Zhongguo Qiyuan.</td>
</tr>
<tr>
<td>Name</td>
<td>DOB–DOD</td>
<td>Peak rank</td>
<td>Notes</td>
<td></td>
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<td>--------------------</td>
<td>---------</td>
<td>-----------</td>
<td>-------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Li Zhe (李喆)</td>
<td>1989–</td>
<td>4 dan</td>
<td>Affiliate of the Zhongguo Qiyuan.</td>
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### Korea

<table>
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<tr>
<th>Origin</th>
<th>Name</th>
<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kang Cheol-min (강철민,姜哲民)</td>
<td>1939–2002</td>
<td>8 dan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kim In (김인, 金寅)</td>
<td>1943–</td>
<td>9 dan</td>
<td>Won several titles during the 60s and 70s. Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Ha Chanseok (하찬석, 河燦錫)</td>
<td>1948–</td>
<td>8 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Jimmy Cha (차민수, 車敏洙)</td>
<td>1951–</td>
<td>4 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Cho Hunhyun (조훈현, 崔薰鉉)</td>
<td>1953–</td>
<td>9 dan</td>
<td>The strongest Go player in South Korea during the 1970s up to the period of domination from his student Lee Chang-ho. Holder of the most titles by a professional player. Also holder of the most consecutive title defense, winning the Paewang title 16 times in-a-row. 9 time world champion.</td>
</tr>
<tr>
<td></td>
<td>Seo Bongsoo (서봉수, 徐奉洙)</td>
<td>1953–</td>
<td>9 dan</td>
<td>was Cho Hunhyun's biggest rival in the 80s. Known for his excessive list of runner up titles. Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Yoo Changhyuk  (유창혁, 劉昌赫)</td>
<td>1966–</td>
<td>9 dan</td>
<td>6 time world champion. Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>An Choyoung (안조영, 安祚永)</td>
<td>1979–</td>
<td>9 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Mok Jin-seok (목진석, 睦鎭碩)</td>
<td>1980–</td>
<td>9 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td></td>
<td>Alexandre Dinerchtein (디너차티안 알렉산드르)</td>
<td>1980–</td>
<td>3 dan</td>
<td>The first Russian professional Go player. Affiliate of the Hanguk Kiwon.</td>
</tr>
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Go players

<table>
<thead>
<tr>
<th>Origin</th>
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<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>🇻🇪</td>
<td>Diana Koszegi (코세기 디아나)</td>
<td>1983–</td>
<td>1 dan</td>
<td>The first Hungarian professional Go player. Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Park Jungsang (박정상, 朴正祥)</td>
<td>1984–</td>
<td>9 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Hong Minpyo (홍민표, 洪民杓)</td>
<td>1984–</td>
<td>5 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Pak Yeong-hun (박영훈, 朴永訓)</td>
<td>1985–</td>
<td>9 dan</td>
<td>A young and established Korean go professional. He reached 9 dan after 5 years, making him the youngest Korean 9 dan professional ever. 3 time world champion. Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Kim Dong Hee (김동희, 金東熙)</td>
<td>1985–</td>
<td>2 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Won Seong-jin (원성진, 元晟溱)</td>
<td>1985–</td>
<td>9 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Song Tae Kon (홍태곤, 宋泰坤)</td>
<td>1986–</td>
<td>9 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Heo Young-ho (허영호, 许映皓)</td>
<td>1986–</td>
<td>5 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
</tr>
<tr>
<td>🇰🇷</td>
<td>Yun Junsang (윤준상, 尹俊相)</td>
<td>1987–</td>
<td>6 dan</td>
<td>Affiliate of the Hanguk Kiwon.</td>
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</table>

Taiwan

<table>
<thead>
<tr>
<th>Origin</th>
<th>Name</th>
<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>🇹🇼</td>
<td>Zhou Junxun (周俊勳)</td>
<td>1980–</td>
<td>9 dan</td>
<td>Affiliate of the Taiwan Qiyuan.</td>
</tr>
<tr>
<td>🇹🇼</td>
<td>Lin Zhihan (林至瀚)</td>
<td>1980–</td>
<td>8 dan</td>
<td>Affiliate of the Taiwan Qiyuan.</td>
</tr>
<tr>
<td>🇹🇼</td>
<td>Chen Shien (陳詩淵)</td>
<td>1985–</td>
<td>7 dan</td>
<td>Affiliate of the Taiwan Qiyuan.</td>
</tr>
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</table>

In the West
<table>
<thead>
<tr>
<th>Origin</th>
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<th>DOB–DOD</th>
<th>Peak rank</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Csaba Mérő</td>
<td>1979–</td>
<td>6 dan</td>
<td>Amateur 6 dan. First under 18 European Youth Champion.</td>
</tr>
<tr>
<td>Romania</td>
<td>Dragoș Băjenaru</td>
<td>1980–</td>
<td>6 dan</td>
<td>Amateur 6 dan.</td>
</tr>
<tr>
<td>China</td>
<td>Jie Li (李捷)</td>
<td>1981–</td>
<td>9 dan</td>
<td>Amateur player from the American Go Association.</td>
</tr>
<tr>
<td>Russia</td>
<td>Ilya Shikshin</td>
<td>1979–</td>
<td>7 dan</td>
<td>Amateur 7 dan. Two times European Go Champion, 2 times Under 12 European Youth Champion.</td>
</tr>
<tr>
<td>Russia</td>
<td>Artem Kachanovskyy</td>
<td>1990–</td>
<td>6 dan</td>
<td>Amateur 6 dan. 2nd of the 2010 European Go Championship, 2008 under 18 European Youth Champion.</td>
</tr>
<tr>
<td>Romania</td>
<td>Cornel Burzo</td>
<td>1979–</td>
<td>6 dan</td>
<td>Amateur 6 dan.</td>
</tr>
<tr>
<td>Romania</td>
<td>Cristian Pop</td>
<td>1990–</td>
<td>7 dan</td>
<td>Amateur 7 dan.</td>
</tr>
<tr>
<td>Germany</td>
<td>Pal Balogh</td>
<td>1990–</td>
<td>6 dan</td>
<td>Amateur 6 dan. 2 times under 18 European Youth Champion</td>
</tr>
</tbody>
</table>

References


External links

- Sensei’s Library:ProfessionalPlayersGoStyles (http://senseis.xmp.net/?ProfessionalPlayersGoStyles)
- Gobase.org (http://www.gobase.org)
- Recent pro games, daily updates (http://www.go4go.net/v2/)
- Western go professionals (http://learnbaduk.com/western-go-professionals.html) – A list of western go professionals
Honinbo Shusaku

<table>
<thead>
<tr>
<th><strong>Honinbo Shusaku</strong></th>
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<tbody>
<tr>
<td><strong>Full name</strong></td>
</tr>
<tr>
<td><strong>Kanji</strong></td>
</tr>
<tr>
<td><strong>Born</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Died</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Teacher</strong></td>
</tr>
<tr>
<td><strong>Rank</strong></td>
</tr>
</tbody>
</table>

Honinbo Shusaku (本因坊秀策 Hon’inbō Shūsaku, born as Kuwabara Torajirō (桑原虎次郎Kuwabara Torajirō), June 6, 1829 – August 10, 1862) was a professional Go player and is considered by many to be the greatest player of the golden age of Go in the mid-19th century.

**Biography**

He was nicknamed "Invincible" after he earned a perfect score for 19 straight wins in the annual castle games. Some say that he was not stronger than his teacher, Honinbō Shuwa, who by convention did not play in the castle games. In addition out of respect for the elderly teacher, Shusaku refused to play with white against his teacher thus there is no clear gauge of the difference in strength between them. Shusaku, for example, had a plus score against Ōta Yūzo but still found him a tough opponent, while Shuwa beat him easily.

Only two people have the title "Go-Saint" (Kisei), and Shusaku is one, the other being Honinbō Dosaku (1645–1702). While this title initially might have been given to Honinbo Jowa, it was revoked due to his political maneuvering. Even today he is considered one of the best go players ever to have lived.

**Early years**

He was born on the island of Innoshima near the town of Onomichi, Hiroshima Prefecture, Japan to a merchant, Kuwabara Wazo. Lord Asano, the daimyo of the region, became his patron after playing a game with him, and allowed him to study under Lord Asano's personal trainer, the priest Hoshin, a player of professional level.

In 1837, at age 8, Shusaku was already almost a player of professional caliber. He left home to join the Honinbō school (the most important institute in the game of Go in Japan at the time having produced the Go Saint Dosaku and many Meijins) officially as a student of Honinbo Jowa but his study would mainly be with senior students. On January 3, 1840, he received his shodan (first dan) professional diploma.
Meteoric rise

In 1840 Shusaku left Edo and returned to his home for a period of over a year. In the following years, he made steady progress up the ranks, reaching 4 dan in 1844, after which he again returned home for a prolonged period. In April–May 1846, returning to Edo, he played against Gennan Inseki, arguably the strongest player of that time. Shusaku played with a handicap of two stones, but Gennan found that Shusaku was too strong, so he called off the game. A new game was started with Shusaku just playing black, the ear-reddening game. Gennan played a new joseki (opening variation in a corner), and Shusaku erred in responding. He fought back hard, but still by the time of the middlegame, all the people watching the game thought Gennan was winning, except for one, a doctor. He admitted that he was not skilled in go, but noticed that Gennan's ears became red after a certain move by Shusaku, a sign that Gennan was surprised. In the end, Shusaku won the game by two points.

Returning to Edo, Shusaku not only got promoted to 5 dan, but he was also made the official heir of Honinbo Shuwa, who was to become the head of the Honinbo house. Shusaku declined at first, citing his obligations towards Lord Asano as the reason. After that issue was settled, Shusaku accepted.

As the official heir to the head of the Honinbo house, Shusaku had an eminent position. His grade also increased, he finally reached 7 dan, although it is not known exactly when—some think in 1849 while others say in 1853. After forcing his main rival and friend Ōta Yūzo to take a handicap, he was generally accepted to be the strongest player with the exception of Shuwa.
Sanjubango

In 1853, a group of players gathered in a mansion in Edo. The players were Yasui Sanchi, Ito Showa, Sakaguchi Sentoku, Hattori Seitetsu, and Ōta Yūzo. They were discussing Shusaku, to the point where they had come to the idea that Shusaku was the strongest player of the time, but Ota did not agree. He said he was in the middle of a series of games with Shusaku, tied at 3 apiece. Akai Gorosaku, who was a famous sponsor of Go during the time, had heard this and decided to sponsor an unheard of 30-game go competition between Ota and Shusaku (see Sanjubango). The series had begun in 1853, when Ota was 46 and a 7 dan, while Shusaku was 24 years old and a 6 dan. The games were played once a week, faster than a typical 10-game match. Ota was doing well until the 11th game, when Shusaku started to fight back. Ota was behind by 4 games after the 17th game. The 21st game was played in July, but the 22nd game was not played until October of that year, a reason of which is not known. The 22nd game was played in Ota's house, which was different than the others, considering they were played in more neutral venues. Ota had lost once more, and the venue was changed to a more neutral one. It is believed, however, the 23rd game, was fixed. It had lasted almost 24 straight hours, and had resulted in a tie. It saved Ota from embarrassment. It was thought as a great achievement, having a tie after taking white, so much that it was used, along with Shusaku's calling up for the castle games, as an excuse to adjourn the match.

Death and legacy

In 1862, a cholera epidemic swept through Japan. Shusaku tended the patients within the Honinbō house, and fell ill himself, dying of it on August 10. He was only 33 years old.

Shusaku's name is connected to the Shusaku fuseki, a certain method of opening the game on black, which was developed to perfection (but not invented) by him, and was the basis of the popular opening style up to the 1930s.

Shusaku is also remembered by the Shusaku number, an equivalent of the Erdős number for Go players.

Fiction

In the manga and anime series Hikaru no Go, Shusaku discovered the spirit of fictional Go player Fujiwara-no-Sai. Shusaku became the medium through which Sai played the great games ascribed to Shusaku.

Further reading

- Honinbo Shusaku – Complete Game Collection, ISBN 7-80548-915-7

External links

- Sensei's Library [1]
- Daily Yomiuri article [2]
- Gobase player stats and games listing [3]

References

### Go Seigen

<table>
<thead>
<tr>
<th>Go Seigen</th>
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<tbody>
<tr>
<td><strong>Full name</strong></td>
</tr>
<tr>
<td><strong>Chinese</strong></td>
</tr>
<tr>
<td><strong>Pinyin</strong></td>
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<tr>
<td><strong>Born</strong></td>
</tr>
<tr>
<td><strong>Fujian Province, China</strong></td>
</tr>
<tr>
<td><strong>Residence</strong></td>
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<tr>
<td><strong>Teacher</strong></td>
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<tr>
<td><strong>Pupil</strong></td>
</tr>
<tr>
<td><strong>Turned pro</strong></td>
</tr>
<tr>
<td><strong>Retired</strong></td>
</tr>
<tr>
<td><strong>Rank</strong></td>
</tr>
<tr>
<td><strong>Affiliation</strong></td>
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</table>

*Wu Qingyuan* (吳 清 源, Pinyin: Wú Qīngyuán[^1], born May 19, 1914[^2]), generally known in the West by his Japanese name *Go Seigen*, is considered by many players to be the greatest player of the game of Go in the 20th century.

### Biography

Born May 19, 1914 in Fuzhou, Fujian Province, southeast China, Go Seigen did not start learning the game of Go until he was nine, a relatively late age for a professional (Honinbo Dosaku first learned Go at seven and Honinbo Shusaku before he was six). His father, who had taken Go lessons from Honinbo Shuho while studying in Japan, was responsible for introducing him to the game. Go Seigen quickly excelled and soon became known as a Go prodigy. By the time he was 12, less than three years after first learning the game, he was already of professional strength, as evidenced by his games against the visiting Japanese player Iwamoto Kaoru, 6p in 1926. The next year, he was able to reach a draw in a two-game match against another Japanese professional, Inoue Kohei, 5p. In 1928, still only 14 years old, he twice defeated Hashimoto Utaro, 4p. Go Seigen's reputation spread to Japan, then the leading Go powerhouse, and a movement was started there to bring him to Japan. He subsequently immigrated to Japan in 1928, at the invitation of Baron Kihachiro Okura and Inukai Tsuyoshi (later prime minister of Japan), and embarked on a professional career. He was tutored by Segoe Kensaku, the same teacher as Hashimoto Utaro and Cho Hunhyun.

Go Seigen began his rise to the top of professional Go world early. By the time he was 18 he was already a top-flight player belonging to a very small elite. In 1933, along with his great friend Kitani Minoru, Go Seigen developed and popularized the *Shinfuseki* that broke away from the traditional opening patterns. It is for this very important contribution that Go Seigen and Kitani Minoru are recognized as the fathers of modern Go.

Starting in 1939, Go Seigen began a spectacular series of Jubango matches against other top players of the day. It was through these matches that Go Seigen convincingly demonstrated an overwhelming dominance over his contemporaries. Go Seigen had only one formal disciple - Rin Kaiho, Honorary Tengen. Go Seigen's star began to fade in the early 1960s due to health reasons and he had to virtually retire from playing professional Go by 1964. However, Go Seigen remained active in the Go community through teaching, writing, and promoting Go around the world.
Go Seigen

**Professional record**

Go Seigen is commonly considered to be among the best to have ever played the game and the best player of the 20th century. He dominated professional Go for more than a quarter of a century. He maintained a brilliant match record and successively defeated all the leading players of the day in a series of notable jubango (contest between two players consisting of ten games), even forcing them down to handicaps.[3] Some of the defeated were Kitani Minoru, Karigane Junichi, Hashimoto Utaro, Iwamoto Kaoru, Fujisawa Hosai, Sakata Eio, and Takagawa Kaku. Go lost just one jubango, and that was against Fujisawa Hosai. However, the match was played with Fujisawa taking the josen handicap throughout, and Fujisawa only managed to win with a score of 6 to 4. Some ten years later, Go Seigen took revenge on Fujisawa by beating him in two consecutive jubango with lopsided scores of 7-2 and 5-1 respectively. One must note that these jubango matches were all played without komi, and indeed the same applied to the vast majority of games Go Seigen played during his career. Go Seigen won the Oteai six times, and won a special Nihon Ki-in championship tournament in 1933.

A table of Go's jubango record is below.

<table>
<thead>
<tr>
<th>Opponent</th>
<th>Record</th>
<th>Dates Played</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitani Minoru 5p</td>
<td>3 - 3 (started even, abandoned after Kitani was promoted to 6p; handicap not changed)</td>
<td>1933 - 34</td>
</tr>
<tr>
<td>Kitani Minoru 7p</td>
<td>6 - 4 (started even, Kitani was beaten down to sen-ai-sen handicap after 6 games (5-1))</td>
<td>1939 - 40</td>
</tr>
<tr>
<td>Karigane Junichi 8p</td>
<td>4 - 1 (started even, abandoned to avoid possible embarrassment for Karigane, since one more loss would mean Karigane having to play with sen-ai-sen handicap)</td>
<td>1941 - 42</td>
</tr>
<tr>
<td>Fujisawa Kuranosuke 6p, later renamed Fujisawa Hosai</td>
<td>4 - 6 (started with Fujisawa playing with josen handicap; handicap not changed)</td>
<td>1942 - 44</td>
</tr>
<tr>
<td>Hashimoto Utaro 8p</td>
<td>6 - 3 - 1 (started even, Hashimoto was beaten down to sen-ai-sen handicap after 8 games (6-2))</td>
<td>1946 - 48</td>
</tr>
<tr>
<td>Iwamoto Kaoru 8p</td>
<td>7 - 2 - 1 (started even, Iwamoto was beaten down to sen-ai-sen handicap after 6 games (5-1))</td>
<td>1948 - 49</td>
</tr>
<tr>
<td>Against a team of ten players</td>
<td>8 - 1 - 1 (this was a 10-game match, but not a jubango)</td>
<td>1949 - 50</td>
</tr>
<tr>
<td>Hashimoto Utaro 8p</td>
<td>5 - 3 - 2 (started with Hashimoto playing with sen-ai-sen handicap, handicap not changed)</td>
<td>1950 - 51</td>
</tr>
<tr>
<td>Fujisawa Hosai 9p</td>
<td>7 - 2 - 1 (started even, Fujisawa was beaten down to sen-ai-sen handicap after 9 games (6-2-1))</td>
<td>1951 - 52</td>
</tr>
<tr>
<td>Fujisawa Hosai 9p</td>
<td>5 - 1 (abandoned after Fujisawa was beaten down from sen-ai-sen handicap to josen handicap)</td>
<td>1952 - 53</td>
</tr>
<tr>
<td>Sakata Eio 8p</td>
<td>6 - 2 (abandoned after Sakata was beaten down from sen-ai-sen handicap to josen handicap)</td>
<td>1953 - 54</td>
</tr>
<tr>
<td>Takagawa Kaku 8p</td>
<td>6 - 4 (started even, Takagawa was beaten down to sen-ai-sen handicap after 8 games (6-2))</td>
<td>1955 - 56</td>
</tr>
</tbody>
</table>
Style
Go Seigen was notable for his fast-paced development & playing, fighting style, positional judgment and accurate reading. He settled his groups quickly, got to the big points first, and regularly used much less time in a game than his opponents. He was exceptional at using thickness and making large exchanges. His reading was fast and accurate, and his intuition and positional judgment were often praised. It was also noted that he rarely lost a ko fight that he initiated. Like many players of his time he mastered the Shusaku Opening before switching to his later style.

Theory
In addition to being a peerless match player, Go Seigen has also made great contributions to Go theory, especially in the area of fuseki. He is well known, along with Kitani Minoru, as one of the two leading exponents and innovators of the shinfuseki, a period of revolutionary experimentation in the opening of the game that broke away from traditional moves. Go attributed some of his ideas to Honinbo Shuei, for whom he had much respect. As a result of their substantial contributions to Go theory, Go Seigen and Kitani Minoru are regarded as the founders of modern Go. He was inventor of the notable and revolutionary uchimagari (inward bending) avalanche joseki variation. It was first played during a match against Takagawa Kaku in 1957.

Matches against the Honinbos
During the 1950s, apart from playing the jubango, Go Seigen participated in many three-game special matches against the Honinbo title holders and other notable players. His opponents in these matches included many illustrious names, such as Hashimoto Utaro, Sakata Eio, Takagawa Shukaku, and the ex-Honinbo Iwamoto Kaoru. Go Seigen was also matched against Kubouchi Shuchi, a player from the Kansai Ki-in who had a strong individual style. In these matches, Go Seigen demonstrated an equal dominance over his rivals. He had an excellent record against Takagawa, whose main achievement was winning the Honinbo title for nine consecutive years. In the period between 1951 and 1960, Go won 22 of their games, and Takagawa won 13. By 1960, Sakata had emerged as Go Seigen's most serious rival, but the results of their games between 1950 and 1960 told the same kind of story. Go had 14 wins to Sakata's 9 and one jigo, or draw. It's very important to note that in the games they played then, there was no Komi (in modern era, Black's initial advantage of moving first is offset by komi of 6.5-7.5 points). Because Go Seigen held white most of the time, his record is even more impressive than it appears.

End of career and retirement
In the summer of 1961, Go Seigen was struck by a motorcycle and was hospitalized for two months and again for a longer period a year later. He suffered nerve damage, and his stamina and concentration greatly deteriorated as a result. The accident marked the beginning of the end for Go Seigen's career, as he was unable to play effectively in grueling long matches due to nausea and dizziness. He gradually played less and less and went into virtual retirement in 1964, although he did not "officially" retire until 1983.

Since retirement, Go Seigen has remained active in the Go community by teaching, writing, and promoting the game around the world. He has authored a number of books on Go, some of which include A Way of Play for the 21st Century, Modern Joseki Application Dictionary, and Fuseki and Middle-game Attack and Defence. Go Seigen still holds study sessions with other professional players such as O Rissei, Michael Redmond, Rui Naiwei, and others.

In 1987, Go Seigen was awarded the Grand Cordon of the Order of the Rising Sun, 3rd Class, Gold Rays with Neck Ribbon for his lifetime contributions to the game of Go.

In 1999 Mr. Teramoto, Go Seigen's manager, told Go writer Pieter Mioch "He [Go Seigen] is one of three Go players who will still be notable several hundred years from now. The other two are Dosaku (1677 – 1702) and Shusaku (1829 – 1862)."
Chinese film director Tian Zhuangzhuang filmed a 2006 biopic on Go Seigen entitled The Go Master.

**Notable game against Honinbo Shusai**

In 1933, Go Seigen won a special Nihon Ki-in tournament to have the opportunity to play a game against Honinbo Shusai Meijin. At that juncture, Honinbo Shusai embodied the highest Go authority and tradition in Japan. In addition to inheriting the hereditary title of Honinbo, he was also the holder of the prestigious position of Meijin. The game between Go Seigen and Shusai was thus highly anticipated. The newspapers thought it would be a good business idea to publicize the game as a confrontation between Japan and China. As a consequence, Go Seigen became the unfortunate victim of rising Japanese nationalism. Before and during the game, he was often harassed and threatened by nationalists, and the windows of his house were smashed in.

The game itself began on October 16, 1933 with Go Seigen taking black and lasted for a period of almost three months. During the opening of the game, Go Seigen caused quite a sensation by playing his first three moves at 3-3 (San San), 4-4 (Hoshi) and center (Tengen) points. Such a fuseki had never before been witnessed in a professional game, and the newspapers covering the game recorded top sales all throughout the match. This marked one of the seminal events that pushed the "Shin Fuseki" movement into the mainstream.

The match ended with Honinbo Shusai winning by two points. However, his victory was surrounded by controversies. At the time of the match, the tradition dictated that the player holding white had the right to adjourn the game at anytime, and there was no sealing of moves before adjournment. This meant that Shusai, being the nominally stronger player and thus holding white, could adjourn the match whenever it was his turn to move and continue deliberating at home before the match resumed. Shusai shamelessly abused this privilege by adjourning the game more than a dozen times, all at his turn to play. For instance, on the eighth day of the match, Shusai played first, and Go Seigen replied within two minutes, Shusai then thought for three and a half hours, only to adjourn the game. It was no secret that Shusai, during adjournments, discussed and studied the game with his students to come up with the best moves. Go Seigen was therefore put into an especially adverse position for having to take on the entire Honinbo establishment.

Shusai had been trailing all throughout the match when, on the 13th day of the game, he made a brilliant move that in a single stroke brought him back into the game and guaranteed his victory. However, it was widely rumored that it was not Shusai but one of his students - Maeda Nobuaki - who authored this ingenious move. Even Maeda himself hinted that this move was indeed his idea. Years later, when presented with the opportunities to debunk this rumor, he neither confirmed nor denied it. The game became known as the game of the century.

Five years later in 1938, Go Seigen's great friend Kitani Minoru also played a notable game against Honinbo Shusai (see *The Master of Go* by Yasunari Kawabata). Due in no small part to having witnessed the treatment Go Seigen received from Shusai in their previous match, Kitani Minoru demanded that the moves be sealed before each adjournment. Initially, Shusai's camp opposed this, but Kitani vehemently insisted, and Shusai eventually gave in. Kitani won that game by a comfortable margin of five points.
Go Seigen

Rank Promotion Record

<table>
<thead>
<tr>
<th>Rank</th>
<th>Year</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dan</td>
<td>(Was given 3 dan when turning professional.)</td>
<td></td>
</tr>
<tr>
<td>2 dan</td>
<td>(Was given 3 dan when turning professional.)</td>
<td></td>
</tr>
<tr>
<td>3 dan</td>
<td>1929</td>
<td>Ranking conferred after a series of evaluation games.</td>
</tr>
<tr>
<td>4 dan</td>
<td>1930</td>
<td></td>
</tr>
<tr>
<td>5 dan</td>
<td>1932</td>
<td></td>
</tr>
<tr>
<td>6 dan</td>
<td>1934</td>
<td></td>
</tr>
<tr>
<td>7 dan</td>
<td>1939</td>
<td></td>
</tr>
<tr>
<td>8 dan</td>
<td>1942</td>
<td></td>
</tr>
<tr>
<td>9 dan</td>
<td>1950</td>
<td>Via special recommendation by the Nihon Kiin.</td>
</tr>
</tbody>
</table>

Titles, runners-up & awards

<table>
<thead>
<tr>
<th>Title</th>
<th>Years Held</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saikyo</td>
<td>1959, 1961 (joint with Sakata Eio)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Years Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Meijin</td>
<td>1962</td>
</tr>
<tr>
<td>NHK Cup</td>
<td>1976</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Award</th>
<th>Years Won</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honorary Member of the Nihon Ki-in</td>
<td>1983?</td>
</tr>
<tr>
<td>Okura Prize</td>
<td>1967</td>
</tr>
</tbody>
</table>

Notes

[1] His original name was Wu Quan. A new name, Qing Yuan was created for him based on his old name ("Quan" means spring, fountain and "Qing Yuan" means clear and pure source of water).


External links

- Gobase player stats and games listing (http://gobase.org/information/players/?pp=Go+Seigen)
- PDF-file of a series of his own now famous games commented almost move by move by the master himself (http://www.wingsgoclub.org/books/go-seigen-book.pdf)
- Curated topic collecting articles about Go Seigen (http://www.scoop.it/t/go-seigen)
Computer Go is the field of artificial intelligence (AI) dedicated to creating a computer program that plays Go, a traditional board game.
Performance

Go has long been considered a difficult challenge in the field of AI and is considerably more difficult to solve than chess. Mathematician I. J. Good wrote in a 1965 *New Scientist*[^1]

“Go on a computer? – In order to programme a computer to play a reasonable game of Go, rather than merely a legal game – it is necessary to formalise the principles of good strategy, or to design a learning programme. The principles are more qualitative and mysterious than in chess, and depend more on judgment. So I think it will be even more difficult to programme a computer to play a reasonable game of Go than of chess.”

The first Go program was written by Albert Zobrist in 1968 as part of his thesis on pattern recognition. It introduced an influence function to estimate territory and Zobrist hashing to detect ko.

Recent developments in Monte Carlo Tree Search and machine learning have brought the best programs to high dan level on the small 9x9 board. In 2009, the first such programs appeared which could reach and hold low dan-level ranks on the KGS Go Server also on the 19x19 board.

In 2012, the best Go program on KGS is ranked 6 dan[^2] In 1998, very strong players were able to beat computer programs at handicaps of 25–30 stones, an enormous handicap that few human players would ever take. There was a case in the 1994 World Computer Go Championship where the winning program, Go Intellect, lost all 3 games against the youth players on a 15-stone handicap.[^3] In general, players who understood and exploited a program's weaknesses could win with much larger handicaps than typical players.[^4]

Recent results

In 2008, thanks to an efficient message-passing parallelization, MoGo[^5] won one game[^6] (out of three) against Catalin Taranu, 5th dan pro, in 9x9 with standard time settings (30 minutes per side). MoGo was running on a cluster provided by "Bull" (32 nodes with 8 cores per node, 3 GHz); the machine was down during one of the lost games. The results of this event were approved by the French Federation of Go[^7]. MoGo also played a 19x19 Game against Catalin Taranu and lost in spite of 9 stones handicap. However, MoGo was in good position during most of the game, and lost due to a bad choice in a ko situation at the end. The machine used for this event (the IAGO challenge, organized by the company "Recitsproque") is a good one, but far from the top level in industry.

On August 7, 2008, the computer program MoGo running on 25 nodes (800 cores, 4 cpus per node with each core running at 4.7 GHz to produce 15 Teraflops[^8]) of the Huygens cluster in Amsterdam beat professional Go player Myungwan Kim (8p) in a nine stone handicap game on the 19x19 board on the KGS Go Server. MoGo won by 1.5 points. Mr. Kim used around 13 minutes of time while MoGo took around 55; however, he felt that using more time would not have helped him win. In after-game commentary, Kim estimated the playing strength of this machine as being in the range of 2–3 amateur dan.[^9] MyungWan and MoGo played a total of 4 games of varying handicaps and time limits, each side winning two games. The game records are accessible on KGS where MoGo played as MogoTitan. In a rematch on September 20, Kim won two games giving MoGo nine stones.[^10] On August 26, 2008, Mogo beat an Amateur 6d with five stones of handicap, this time running on 200 cores of the Huygens cluster.[^11]

On September 4, 2008, the program Crazy Stone running on an 8-core personal computer won against 30 year-old professional, Kaori Aoba (4p), receiving a handicap of eight stones. The time control was 30 seconds per move. White resigned after 185 moves. The game was played during the FIT2008 conference in Japan.[^12]

In February 2009, MoGo won two 19x19 games against professional Go players in the Taiwan Open 2009. With a 7-stones handicap the program defeated Zhou Junxun (9p), and with a 6-stones handicap it defeated Li-Chen Chien (1p).[^13]

On February 14, 2009, Many Faces of Go running on a 32-core Xeon cluster provided by Microsoft won against James Kerwin (1p) with a handicap of seven stones. The game was played during the 2009 AAAS general meeting in Chicago.[^14]
On August 7, 2009, Many Faces of Go (version 12) resigned against Myungwan Kim (8p) in a 7-stone handicap game. Many Faces was playing on a 32 node system provided by Microsoft. The “Man vs. Machine” event was part of the 2009 US Go Congress, which was held in Washington DC from August 1 to August 9.

On August 21 and 22, 2009, Zhou Junxun (9p) beat Many Faces of Go, MoGo, and Zen in full-board 7-stone games, beat MoGo in an even 9×9 game, and won one and lost one even 9×9 game against Fuego.

On July 20, 2010, MoGoTW won an even 9×9 game as white against Zhou Junxun (9p).

On July 20, 2010, at the 2010 IEEE World Congress on Computational Intelligence in Barcelona Spain computer program Zen played professional 4 dan Ping-Chiang Chou of Taiwan 19×19 Go. Yamato of Japan wrote Zen. Zen had 6 stone handicap. Each side had 45 minutes. Zen won the game.

On July 28, 2010, at the 2010 European Go Congress in Finland computer program MogoTW played European professional 5 dan Catalin Taranu 19×19 Go. MogoTW had a 7 stone handicap. The computer won. MogoTW is a joint project between the MoGo team and a Taiwanese team.

In December 2010, computer program Zen reached the rank 4 dan on the server KGS. Japanese programmer Yoji Ojima writes Zen.

In June 2011, computer program Zen19D reached the rank of 5 dan on the server KGS, playing games of 15 seconds per move. The account which reached that rank uses a cluster version of Zen running on a 26-core machine. In June 2011, computer program Zen19S achieved a rank of 4 dan on the KGS Go server. Zen19S plays at 20 minutes main time and then 30 seconds per move. In June 2011, Zen19S played 518 games. A player can download the games of Zen19S from the KGS server. The player can study the games to find the program’s weakness and try to exploit it.

Zen matches against Ohashi Hirofumi and Takemiya Masaki were announced in February 2012. On March 17, 2012 Zen beats Takemiya 9p at 5 stones by eleven points followed by a stunning twenty point win at a 4 stone handicap. Takemiya remarked “I had no idea that computer go had come this far.”

In March 2012, computer program Zen19D reached the rank of 6 dan on the KGS Go server, playing games of 15 seconds per move. The account which reached that rank uses a cluster version of Zen running on a 28-core machine. The Zen version which achieved that rank is 9.2d10.

### Obstacles to high-level performance

For a long time it was a widely held opinion that computer Go posed a problem fundamentally different to computer chess insofar as it was believed that methods relying on fast global search compared to human experts combined to relatively little domain knowledge would not be effective for Go. Therefore, a large part of the computer Go development effort was during these times focused on ways of representing human-like expert knowledge and combining this with local search to answer questions of a tactical nature. The result of this were programs that handled many situations well but which had very pronounced weaknesses compared to their overall handling of the game. Also, these classical programs gained almost nothing from increases in available computing power *per se* and progress in the field was generally slow.

A few researchers grasped the potential of probabilistic methods and predicted that they would come to dominate computer game-playing, but many others considered a strong Go-playing program something that could be achieved only in the far future, as a result of fundamental advances in general artificial intelligence technology. Even writing a program capable of automatically determining the winner of a finished game was seen as no trivial matter.

The advent of programs based on Monte Carlo search starting in 2006 changed this situation in many ways, although the gap between professional human players and the strongest Go programs remains considerable.
Size of board
The large board (19x19, 361 intersections) is often noted as one of the primary reasons why a strong program is hard to create. The large board size is a problem to the extent that it prevents an alpha-beta searcher without significant search extensions or pruning heuristics from achieving deep look-ahead.

So far, the largest game of Go being completely solved has been played on a 5x5 board. It was achieved in 2002, with black winning by 25 points (the entire board), by a computer program called MIGOS (MIni GO Solver).[25]

Most moves are possible
Continuing the comparison to chess, Go moves are not as limited by the rules of the game. For the first move in chess, the player has twenty choices. Go players begin with a choice of 55 distinct legal moves, accounting for symmetry. This number rises quickly as symmetry is broken and soon almost all of the 361 points of the board must be evaluated. Some are much more popular than others, some are almost never played, but all are possible.

Additive nature of the game
As a chess game progresses (as well as many other games such as checkers, draughts, and backgammon), pieces disappear from the board, simplifying the game. Each new Go move, on the contrary, adds new complexities and possibilities to the situation, at least until an area becomes developed to the point of being 'settled'.

On the other hand, it is argued that as chess enters certain endgames, databases must be employed by computers to deal with added complexities. Without an agreed definition of 'complexity,' this issue must remain in dispute. "Over the years, much has been written about the weakness of computers in the endgame — of how they were so short-sighted with respect to the creation of passed pawns, or unwilling to centralize their king when it was the only logical thing to do." [from the section on 'Computer Chess' by Graham Burgess, in the Mammoth Book of Chess, Carroll & Graf 1997]

Techniques in chess that cannot be applied to Go
The general weakness of computer Go programs compared with computer chess programs has served to generate research into many new programming techniques. The techniques which proved to be the most effective in computer chess have generally shown to be mediocre at Go.

Evaluation function
While a simple material counting evaluation is not sufficient for decent play in chess, it is often the backbone of a chess evaluation function, when combined with more subtle considerations like isolated/doubled pawns, rooks on open files (columns), pawns in the center of the board and so on. These rules can be formalized easily, providing a reasonably good evaluation function that can run quickly.

These types of positional evaluation rules cannot efficiently be applied to Go. The value of a Go position depends on a complex analysis to determine whether or not the group is alive, which stones can be connected to one another, and heuristics around the extent to which a strong position has influence, or the extent to which a weak position can be attacked.

More than one move can be regarded as the best depending on which strategy is used. In order to choose a move, the computer must evaluate different possible outcomes and decide which is best. This is difficult due to the delicate trade-offs present in Go. For example, it may be possible to capture some enemy stones at the cost of strengthening the opponent's stones elsewhere. Whether this is a good trade or not can be a difficult decision, even for human players. The computational complexity also shows here as a move might not be immediately important, but after many moves could become highly important as other areas of the board take shape.


**Combinatorial problems**

Sometimes it is mentioned in this context that various difficult combinatorial problems (in fact, any NP-complete problem) can be converted to Go-like problems on a sufficiently large board; however, the same is true for other abstract board games, including chess and minesweeper, when suitably generalized to a board of arbitrary size. NP-complete problems do not tend in their general case to be easier for unaided humans than for suitably programmed computers: it is doubtful that unaided humans would be able to compete successfully against computers in solving, for example, instances of the subset sum problem. Hence, the idea that we can convert some NP-complete problems into Go problems does not help in explaining the present human superiority in Go.

**Endgame**

Given that the endgame (yose) contains fewer possible moves than the opening (fuseki) or middle game, one could suppose that it was easier to play, and thus that computers should be easily able to tackle it. In chess, computer programs perform worse in chess endgames because the ideas are long-term, unless the number of pieces is reduced to an extent that allows taking advantage of solved endgame tablebases.

The application of surreal numbers to the endgame in Go, a general game analysis pioneered by John H. Conway, has been further developed by Elwyn R. Berlekamp and David Wolfe and outlined in their book, *Mathematical Go* (ISBN 978-1-56881-032-4). While not of general utility in most playing circumstances, it greatly aids the analysis of certain classes of positions.

Nonetheless, although elaborate study has been conducted, Go endgames have been proven to be PSPACE-hard. There are many reasons why they are so hard:

- Even if a computer can play each local endgame area flawlessly, we cannot conclude that its plays would be flawless in regard to the entire board. Additional areas of consideration in endgames include sente and gote relationships, prioritization of different local endgames, territory counting & estimation, and so on.

- The endgame may involve many other aspects of Go, including 'life and death', which are also known to be NP-hard.\(^{[26]}\)[27]

- Each of the local endgame areas may affect one another. In other words, they are dynamic in nature although visually isolated. This makes it much more difficult for computers to deal with. This nature leads to some very complex situations like Triple Ko \(^{[28]}\), Quadruple Ko \(^{[29]}\), Molasses Ko \(^{[30]}\) and Moonshine Life \(^{[31]}\).

Thus, it is very unlikely that it will be possible to program a reasonably fast algorithm for playing the Go endgame flawlessly, let alone the whole Go game.\(^{[32]}\)

**Why humans are (still) better at Go**

Go has features that might be easier for humans than computers.\(^{[33]}\) The pieces never move about (as they do in Chess), nor change state (as they do in Reversi). Some speculated that these features make it easy for humans to "read" (predict possible variations) long sequences of moves, while being irrelevant to a computer program, but no rigorous cognitive neuroscientific evidence currently exists to back this hypothesis.

In those rare Go positions known as "ishi-no-shita"\(^{[34]}\), in which stones are repeatedly captured and re-played on the same points, humans have reading problems because sometimes the length of the looping steps can be too large for human memory, while they are easy for computers.
**Order of play**

Current, Monte-Carlo-based, Go engines can have difficulties in solving problems when the order of moves is important. [35]

**Tactical search**

One of the main concerns for a Go player is which groups of stones can be kept alive and which can be captured. This general class of problems is known as life and death. The most direct strategy for calculating life and death is to perform a tree search on the moves which potentially affect the stones in question, and then to record the status of the stones at the end of the main line of play.

However, within time and memory constraints, it is not generally possible to determine with complete accuracy which moves could affect the 'life' of a group of stones. This implies that some heuristic must be applied to select which moves to consider. The net effect is that for any given program, there is a trade-off between playing speed and life and death reading abilities.

With Benson's algorithm, it is possible to determine the chains which are unconditionally alive and therefore would not need to be checked in the future for safety.

**State representation**

An issue that all Go programs must tackle is how to represent the current state of the game. For programs that use extensive searching techniques, this representation needs to be copied and/or modified for each new hypothetical move considered. This need places the additional constraint that the representation should either be small enough to be copied quickly or flexible enough that a move can be made and undone easily.

The most direct way of representing a board is as a 1 or 2-dimensional array, where elements in the array represent points on the board, and can take on a value corresponding to a white stone, a black stone, or an empty intersection. Additional data is needed to store how many stones have been captured, whose turn it is, and which intersections are illegal due to the Ko rule.

Most programs, however, use more than just the raw board information to evaluate positions. Data such as which stones are connected in strings, which strings are associated with each other, which groups of stones are in risk of capture and which groups of stones are effectively dead are necessary to make an accurate evaluation of the position. While this information can be extracted from just the stone positions, much of it can be computed more quickly if it is updated in an incremental, per-move basis. This incremental updating requires more information to be stored as the state of the board, which in turn can make copying the board take longer. This kind of trade-off is indicative of the problems involved in making fast computer Go programs.

An alternative method is to have a single board and make and take back moves so as to minimize the demands on computer memory and have the results of the evaluation of the board stored. This avoids having to copy the information over and over again.
System design

New approaches to problems
Historically, GOFAI (Good Old Fashioned AI) techniques have been used to approach the problem of Go AI. More recently, neural networks are being looked at as an alternative approach. One example of a program which uses neural networks is WinHonte.\[36\]

These approaches attempt to mitigate the problems of the game of Go having a high branching factor and numerous other difficulties.

Computer Go research results are being applied to other similar fields such as cognitive science, pattern recognition and machine learning.\[37\] Combinatorial Game Theory, a branch of applied mathematics, is a topic relevant to computer Go.\[37\]

Design philosophies
The only choice a program needs to make is where to place its next stone. However, this decision is made difficult by the wide range of impacts a single stone can have across the entire board, and the complex interactions various stones' groups can have with each other. Various architectures have arisen for handling this problem. The most popular use:

- some form of tree search,
- the application of Monte-Carlo methods,
- the application of pattern matching,
- the creation of knowledge-based systems, and
- the use of machine learning.

Few programs use only one of these techniques exclusively; most combine portions of each into one synthetic system.

Minimax tree search
One traditional AI technique for creating game playing software is to use a minimax tree search. This involves playing out all hypothetical moves on the board up to a certain point, then using an evaluation function to estimate the value of that position for the current player. The move which leads to the best hypothetical board is selected, and the process is repeated each turn. While tree searches have been very effective in computer chess, they have seen less success in Computer Go programs. This is partly because it has traditionally been difficult to create an effective evaluation function for a Go board, and partly because the large number of possible moves each side can make each leads to a high branching factor. This makes this technique very computationally expensive. Because of this, many programs which use search trees extensively can only play on the smaller 9×9 board, rather than full 19×19 ones.

There are several techniques, which can greatly improve the performance of search trees in terms of both speed and memory. Pruning techniques such as alpha-beta pruning, Principal Variation Search, and MTD-f can reduce the effective branching factor without loss of strength. In tactical areas such as life and death, Go is particularly amenable to caching techniques such as transposition tables. These can reduce the amount of repeated effort, especially when combined with an iterative deepening approach. In order to quickly store a full-sized Go board in a transposition table, a hashing technique for mathematically summarizing is generally necessary. Zobrist hashing is very popular in Go programs because it has low collision rates, and can be iteratively updated at each move with just two XORs, rather than being calculated from scratch. Even using these performance-enhancing techniques, full tree searches on a full-sized board are still prohibitively slow. Searches can be sped up by using large amounts of domain specific pruning techniques, such as not considering moves where your opponent is already strong, and selective extensions like always considering moves next to groups of stones which are about to be captured. However, both of these options introduce a significant risk of not considering a vital move which would have changed the course of the
Results of computer competitions show that pattern matching techniques for choosing a handful of appropriate moves combined with fast localized tactical searches (explained above) are sufficient to produce a competitive program. For example, GNU Go is competitive.

**Knowledge-based systems**

Novices often learn a lot from the game records of old games played by master players. There is a strong hypothesis that suggests that acquiring Go knowledge is a key to make a strong computer Go. For example, Tim Kinger and David Mechner argue that "it is our belief that with better tools for representing and maintaining Go knowledge, it will be possible to develop stronger Go programs." They propose two ways: recognizing common configurations of stones and their positions and concentrating on local battles. "... Go programs are still lacking in both quality and quantity of knowledge."[38]

After implementation, the use of expert knowledge has been proved very effective in programming Go software. Hundreds of guidelines and rules of thumb for strong play have been formulated by both high level amateurs and professionals. The programmer's task is to take these heuristics, formalize them into computer code, and utilize pattern matching and pattern recognition algorithms to recognize when these rules apply. It is also important to have a system for determining what to do in the event that two conflicting guidelines are applicable.

Most of the relatively successful results come from programmers' individual skills at Go and their personal conjectures about Go, but not from formal mathematical assertions; they are trying to make the computer mimic the way they play Go. "Most competitive programs have required 5–15 person-years of effort, and contain 50–100 modules dealing with different aspects of the game."[39]

This method has until recently been the most successful technique in generating competitive Go programs on a full-sized board. Some example of programs which have relied heavily on expert knowledge are Handtalk (later known as Goemate), The Many Faces of Go, Go Intellect, and Go++, each of which has at some point been considered the world's best Go program.

Nevertheless, adding knowledge of Go sometimes weakens the program because some superficial knowledge might bring mistakes: "the best programs usually play good, master level moves. However, as every games player knows, just one bad move can ruin a good game. Program performance over a full game can be much lower than master level."[39]

**Monte-Carlo methods**

One major alternative to using hand-coded knowledge and searches is the use of Monte-Carlo methods. This is done by generating a list of potential moves, and for each move playing out thousands of games at random on the resulting board. The move which leads to the best set of random games for the current player is chosen as the best move. The advantage of this technique is that it requires very little domain knowledge or expert input, the trade-off being increased memory and processor requirements. However, because the moves used for evaluation are generated at random it is possible that a move which would be excellent except for one specific opponent response would be mistakenly evaluated as a good move. The result of this are programs which are strong in an overall strategic sense, but are weak tactically. This problem can be mitigated by adding some domain knowledge in the move generation and a greater level of search depth on top of the random evolution. Some programs which use Monte-Carlo techniques are Fuego [40], The Many Faces of Go v12 [41], Leela [42], MoGo [5], Crazy Stone, MyGoFriend [43], Olga and Gobble.

In 2006, a new search technique, *upper confidence bounds applied to trees* (UCT [44]), was developed and applied to many 9x9 Monte-Carlo Go programs with excellent results. UCT uses the results of the *play outs* collected so far to guide the search along the more successful lines of play, while still allowing alternative lines to be explored. The UCT technique along with many other optimizations for playing on the larger 19x19 board has led MoGo to become
one of the strongest research programs. Successful early applications of UCT methods to 19x19 Go include MoGo, Crazy Stone, and Mango [45]. MoGo won the 2007 Computer Olympiad and won one (out of three) blitz game against Guo Juan, 5th Dan Pro, in 9x9 Go. The Many Faces of Go [46] won the 2008 Computer Olympiad after adding UCT search to its traditional knowledge-based engine.

**Machine learning**

While knowledge-based systems have been very effective at Go, their skill level is closely linked to the knowledge of their programmers and associated domain experts. One way to break this limitation is to use machine learning techniques in order to allow the software to automatically generate rules, patterns, and/or rule conflict resolution strategies. This is generally done by allowing a neural network or genetic algorithm to either review a large database of professional games, or play many games against itself or other people or programs. These algorithms are then able to utilize this data as a means of improving their performance. Notable programs using neural nets are NeuroGo and WinHonte.

Machine learning techniques can also be used in a less ambitious context to tune specific parameters of programs which rely mainly on other techniques. For example, Crazy Stone learns move generation patterns from several hundred sample games, using a generalization of the Elo rating system.[47]

**Computer programs**

- AYA [48] by Hiroshi Yamashita
- Crazy Stone by Rémi Coulom (sold as Saikyo no Igo in Japan)
- Fuego [40], an open source Monte Carlo program
- GNU Go, an open source classical Go program
- Go++ [49] by Michael Reiss (sold as Strongest Go or Tuyoi Igo in Japan)
- Go Intellect by Ken Chen
- Handtalk/Goemate, developed in China by Zhixing Chen (sold as Shudan Taikyoku in Japan)
- Haruka by Ryuichi Kawa (sold as Saikouhou in Japan)
- Indigo by Bruno Bouzy
- Katsunari by Shin-ichi Sei
- KCC Igo, from North Korea (sold as Silver Star or Ginsei Igo in Japan)
- Leela [42] by David Fotland (sold as AI Igo in Japan)
- MyGoFriend [43] by Frank Karger
- Pachi [51] open source Monte Carlo program by Petr Baudíš, online version Peepo [52] by Jonathan Chetwynd, with maps and comments as you play
- Smart Go [53] by Anders Kierulf, inventor of the Smart Game Format
- Zen [54] by Yoji Ojima aka Yamato (sold as Tencho no Igo in Japan); parallel version by Hideki Kato.
Competitions among computer Go programs

Several annual competitions take place between Go computer programs, the most prominent being the Go events at the Computer Olympiad. Regular, less formal, competitions between programs occur on the KGS Go Server \(^{[55]}\) (monthly) and the Computer Go Server \(^{[56]}\) (continuous).

Prominent go-playing programs include Fuego, North Korean Silver Star/KCC Igo, ZhiXing Chen's Handtalk, Michael Reiss's Go++ and David Fotland's Many Faces of Go. GNU Go is a free computer Go implementation which has also won computer competitions.

History

The first computer Go competitions were sponsored by USENIX. They ran from 1984 to 1988. These competitions introduced Nemesis, the first competitive Go program from Bruce Wilcox, and G2.5 by David Fotland, which would later evolve into Cosmos and The Many Faces of Go.

One of the early drivers of computer Go research was the Ing Prize, a relatively large money award sponsored by Taiwanese banker Ing Chang-ki, offered annually between 1985 and 2000 at the World Computer Go Congress (or Ing Cup). The winner of this tournament was allowed to challenge young players at a handicap in a short match. If the computer won the match, the prize was awarded and a new prize announced: a larger prize for beating the players at a lesser handicap. The series of Ing prizes was set to expire either 1) in the year 2000 or 2) when a program could beat a 1-dan professional at no handicap for 40,000,000 NT dollars. The last winner was Handtalk in 1997, claiming 250,000 NT dollars for winning an 11-stone handicap match against three 11–13 year old amateur 2–6 dans. At the time the prize expired in 2000, the unclaimed prize was 400,000 NT dollars for winning a 9-stone handicap match.\(^{[57]}\)

Many other large regional Go tournaments ("congresses") had an attached computer Go event. The European Go Congress has sponsored a computer tournament since 1987, and the USENIX event evolved into the US/North American Computer Go Championship, held annually from 1988-2000 at the US Go Congress.

Japan has recently started sponsoring its own computer Go competitions. The FOST Cup was held annually from 1995 to 1999 in Tokyo. That tournament was supplanted by the Gifu Challenge, which was held annually from 2003 to 2006 in Ogaki, Gifu. The UEC Cup has been held annually since 2007.

Rule Formalization Problems in computer-computer games

When two computers play a game of Go against each other, the ideal is to treat the game in a manner identical to two humans playing while avoiding any intervention from actual humans. However, this can be difficult during end game scoring. The main problem is that Go playing software, which usually communicates using the standardized Go Text Protocol (GTP), will not always agree with respect to the alive or dead status of stones.

While there is no general way for two different programs to "talk it out" and resolve the conflict, this problem is avoided for the most part by using customized rulesets such as variations on Chinese or Tromp-Taylor rules in which continued play (without penalty) is required until there is no more disagreement on the status of any stones on the board. In practice, such as on the KGS Go Server, the server can mediate a dispute by sending a special GTP command to the two client programs indicating they should continue placing stones until there is no question about the status of any particular group (all dead stones have been captured). The CGOS Go Server usually sees programs resign before a game has even reached the scoring phase, but nevertheless supports a modified version of Tromp-Taylor rules requiring a full play out.

It should be noted that these rulesets create a small risk that a program which was in a winning position at the traditional end of the game (when both players have passed), could be penalized for poor play that is made after the game was technically over, but this is not a common occurrence.
The main drawback to the above system is that some rule sets (such as the traditional Japanese rules) penalize the players for making these extra moves, precluding the use of additional playout for two computers. Nevertheless, most modern Go Programs support Japanese rules against humans and are competent in both play and scoring (Fuego, Many Faces of Go, SmartGo, etc.). Historically, another method for resolving this problem was to have an expert human judge the final board. However, this introduces subjectivity into the results and the risk that the expert would miss something the program saw.

Testing

Many programs are available that allow computer Go engines to play against each other and they almost always communicate via the Go Text Protocol (GTP). GoGUI and its addon gogui-twogtp can be used to play two engines against each other on a single computer. SmartGo and Many Faces of Go also provide this feature. To play as wide a variety of opponents as possible, the KGS Go Server allows Go engine vs. Go engine play as well as Go engine vs. human in both ranked and unranked matches. CGOS is a dedicated computer vs. computer Go server.

References

[15] Computer program Zen with 6 stone handicap beat professional 4 dan Ping-Chiang Chou of Taiwan (http://www.senseis.xmp.org/SPECIAL_EDITION!)
[17] Computer program MogoTW with 7 stone handicap beat European professional 5 dan Catalin Taranu (http://senseis.xmp.net/?KGSBotRatings)
[18] Crazy Stone defeated 4-dan professional player with a handicap of 8 stones. (http://www.senseis.xmp.org/MoGo)
[19] Crazy Stone defeated 4-dan professional player with a handicap of 8 stones. (http://www.senseis.xmp.org/MoGo)
[22] Crazy Stone defeated 4-dan professional player with a handicap of 8 stones. (http://www.senseis.xmp.org/MoGo)
[23] Computer program Zen with 6 stone handicap beat professional 4 dan Ping-Chiang Chou of Taiwan (http://www.senseis.xmp.org/SPECIAL_EDITION!)
[24] Computer program MogoTW with 7 stone handicap beat European professional 5 dan Catalin Taranu (http://senseis.xmp.net/?KGSBotRatings)
[26] Sensei's Library: MoGo (http://senseis.xmp.net/?MoGo)
[27] Crazy Stone defeated 4-dan professional player with a handicap of 8 stones. (http://www.senseis.xmp.org/MoGo)
[28] Computer program Zen with 6 stone handicap beat professional 4 dan Ping-Chiang Chou of Taiwan (http://www.senseis.xmp.org/SPECIAL_EDITION!)
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[57] Computer program MogoTW with 7 stone handicap beat European professional 5 dan Catalin Taranu (http://senseis.xmp.net/?KGSBotRatings)
[58] Sensei's Library KGS Bot Ratings (http://senseis.xmp.net/?KGSBotRatings)
Further reading

• article describing the techniques underlying Mogo (http://www.pleinsud.u-psud.fr/specialR2008/en/12_GOthique.pdf)

**External links**

• Mick's Computer Go Page (http://www.reiss.demon.co.uk/webgo/compgo.htm)
• Extensive list of computer Go events (http://www.computer-go.info/events/index.html)
• All systems Go (http://mechner.com/david/compgo/sciences/) by David A. Mechner (1998), discusses the game where professional Go player Janice Kim won a game against program Handtalk after giving a 25-stone handicap.
• Computer Go bibliography (http://www.cs.ualberta.ca/~games/go/compgobiblio/)
• Another Computer Go Bibliography (http://www.xs4all.nl/~janrem/Artikelen/Artikelen.html)
• Computer Go mailing list (http://www.computer-go.org/mailman/listinfo/computer-go/)
• Published articles about computer Go on Ideosphere (http://www.ideosphere.com/fx-bin/Claim?claim=GoCh) gives current estimate of whether a Go program will be best player in the world
• Information on the Go Text Protocol (http://www.lysator.liu.se/~gunnar/gtp/) commonly used for interfacing Go playing engines with graphical clients and internet servers
• The Computer Go Room on the K Go Server (http://www.gokgs.com) (KGS) for online discussion and running "bots"
• Two Representative Computer Go Games (http://www.cs.ualberta.ca/~mmueller/cgo/survey/twogames.html), an article about two computer Go games played in 1999, one with two computers players, and the other a 29-stone handicap human-computer game
• Cracking Go, by Feng-hsiung Hsu, IEEE Spectrum magazine, October 2007 (http://www.spectrum.ieee.org/oct07/5552) argues why it should be possible to build a Go machine stronger than any human player
Go and mathematics

The game of Go is one of the most popular games in the world and is on par with games such as chess, in any of its Western or Asian variants, in terms of game theory and as an intellectual activity. It has also been argued to be the most complex of all games, with most advocates referring to the difficulty in programming the game to be played by computers and the large number of variations of play.\[1\] While the strongest computer chess software has defeated top players (Deep Blue beat the world champion Garry Kasparov in 1997), the best Go programs routinely lose to talented children and consistently reach only the 1-10 kyu range of ranking. Many in the field of artificial intelligence consider Go to be a better measure of a computer's capacity for thought than chess.\[2\]

As a result of its elegant and simple rules, the game of Go has long been an inspiration for mathematical research. Chinese scholars of the 11th century already published work on permutations based on the go board. In more recent years, research of the game by John H. Conway led to the invention of the surreal numbers and contributed to development of combinatorial game theory (with Go Infinitesimals\[3\] being a specific example of its use in Go).
Legal positions

Since each location on the board can be either empty, black, or white, there are a total of $3^N$ possible board positions on a board with N intersections. Tromp and Farnebäck show that on a 19×19 board, about 1.2% of board positions are legal (no stones without liberties exist on the board), which makes for $3^{361} \approx 2.08168199382 \times 10^{170}$ legal positions "of which we can expect all digits to be correct" (i.e. because the convergence is so fast). As the board gets larger, the percentage of the positions that is legal decreases. Go (with Japanese ko rules) is a two player un-bounded EXPTIME-complete game. Rule variations that places a polynomial bound on the length of the game produces a PSPACE-complete game. The complexity of Go with superko rules remains an open question.

<table>
<thead>
<tr>
<th>Game size</th>
<th>Board size N (intersections)</th>
<th>$3^N$</th>
<th>Percent legal</th>
<th>Maximum legal game positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2×2</td>
<td>4</td>
<td>81</td>
<td>70%</td>
<td>57</td>
</tr>
<tr>
<td>3×3</td>
<td>9</td>
<td>19,683</td>
<td>64%</td>
<td>12,675</td>
</tr>
<tr>
<td>4×4</td>
<td>16</td>
<td>43,046,721</td>
<td>56%</td>
<td>24,318,165</td>
</tr>
<tr>
<td>5×5</td>
<td>25</td>
<td>8.47×10^{11}</td>
<td>49%</td>
<td>4.1×10^{11}</td>
</tr>
<tr>
<td>9×9</td>
<td>81</td>
<td>4.4×10^{38}</td>
<td>23.4%</td>
<td>1.039×10^{38}</td>
</tr>
<tr>
<td>13×13</td>
<td>169</td>
<td>4.3×10^{80}</td>
<td>8.66%</td>
<td>3.72497923×10^{79}</td>
</tr>
<tr>
<td>19×19</td>
<td>361</td>
<td>1.74×10^{172}</td>
<td>1.196%</td>
<td>2.08168199382×10^{170}</td>
</tr>
<tr>
<td>21×21</td>
<td>441</td>
<td>2.57×10^{210}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Game tree complexity

The computer scientist Victor Allis notes that typical games between experts last about 150 moves, with an average of about 250 choices per move, suggesting a game-tree complexity of $10^{360}$. For the number of theoretically possible games, including games impossible to play in practice, Tromp and Farnebäck give lower and upper bounds of $10^{1048}$ and $10^{10171}$ respectively. The most commonly quoted number for the number of possible games, $10^{700}$, is derived from a simple permutation of 361 moves or 361! = $10^{768}$. Another common derivation is to assume N intersections and L longest game for $N^L$ total games. For example, 400 moves, as seen in some professional games, would be one out of $361^{400}$ or $1 \times 10^{1023}$ possible games.

The total number of possible games is a function both of the size of the board and the number of moves played. While most games last less than 400 or even 200 moves, many more are possible.

<table>
<thead>
<tr>
<th>Game size</th>
<th>Board size N (intersections)</th>
<th>N!</th>
<th>Average game length L</th>
<th>$N^L$</th>
<th>Maximum game length (# of moves)</th>
<th>Lower Limit of games</th>
<th>Upper Limit of games</th>
</tr>
</thead>
<tbody>
<tr>
<td>2×2</td>
<td>4</td>
<td>24</td>
<td>3</td>
<td>64</td>
<td>386,356,909,593</td>
<td>10^{360}</td>
<td></td>
</tr>
<tr>
<td>3×3</td>
<td>9</td>
<td>3.6×10^{7}</td>
<td>5</td>
<td>5.9×10^{4}</td>
<td></td>
<td>10^{1048}</td>
<td></td>
</tr>
<tr>
<td>4×4</td>
<td>16</td>
<td>2.1×10^{13}</td>
<td>9</td>
<td>6.9×10^{10}</td>
<td></td>
<td>10^{10171}</td>
<td></td>
</tr>
<tr>
<td>5×5</td>
<td>25</td>
<td>1.6×10^{25}</td>
<td>15</td>
<td>9.3×10^{20}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9×9</td>
<td>81</td>
<td>5.8×10^{120}</td>
<td>45</td>
<td>7.6×10^{85}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13×13</td>
<td>169</td>
<td>4.3×10^{304}</td>
<td>90</td>
<td>3.2×10^{200}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19×19</td>
<td>361</td>
<td>1.0×10^{768}</td>
<td>200</td>
<td>3×10^{511}</td>
<td>10^{48}</td>
<td>10^{1048}</td>
<td></td>
</tr>
<tr>
<td>21×21</td>
<td>441</td>
<td>2.5×10^{76}</td>
<td>250</td>
<td>1.3×10^{661}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The total number of possible games can be estimated from the board size in a number of ways, some more rigorous than others. The simplest, a permutation of the board size, $(N)_L$, fails to include illegal captures and positions. Taking $N$ as the board size ($19 \times 19 = 361$) and $L$ as the longest game, $(N)_L$ forms an upper limit. A more accurate limit is presented in the Tromp/Farnebäck paper.

<table>
<thead>
<tr>
<th>Longest game L ($19 \times 19$)</th>
<th>$(N)_L$</th>
<th>Lower Limit of games</th>
<th>Upper Limit of games</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>361</td>
<td>361</td>
<td>White resigns after first move</td>
</tr>
<tr>
<td>50</td>
<td>2.1\times 10^{126}</td>
<td>7.5\times 10^{127}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>1.4\times 10^{249}</td>
<td>5.6\times 10^{255}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>6.4\times 10^{367}</td>
<td>4.2\times 10^{383}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>1.9\times 10^{481}</td>
<td>3.2\times 10^{511}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>8.2\times 10^{587}</td>
<td>2.4\times 10^{639}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>2.8\times 10^{684}</td>
<td>7.8\times 10^{766}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>350</td>
<td>3.6\times 10^{760}</td>
<td>1.3\times 10^{895}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>361</td>
<td>1.4\times 10^{788}</td>
<td>1.8\times 10^{923}</td>
<td>Longest game using 181 black and 180 white stones</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>n/a</td>
<td>1.0\times 10^{1023}</td>
<td>Longest professional games</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>n/a</td>
<td>5.7\times 10^{1278}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>n/a</td>
<td>3.2\times 10^{2557}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47 million</td>
<td>n/a</td>
<td>$10^{108}$</td>
<td>361$^3$ moves</td>
<td></td>
</tr>
<tr>
<td>$10^{38}$</td>
<td>n/a</td>
<td>$10^{1048}$</td>
<td>$10^{10171}$</td>
<td>Longest game</td>
</tr>
</tbody>
</table>

From this table, we can see that $10^{300}$ is an overestimate of the number of possible games that can be played in 200 moves and an underestimate of the number of games that can be played in 361 moves. It can also be noted that since there are about 31 million seconds in a year, it would take about 2¼ years, playing 16 hours a day at one move per second, to play 47 million moves. As to $10^{48}$, since the future age of the universe is projected to be less than 1000 trillion years $^{11}$ and no computer is projected to compute anything close to a trillion Teraflops (one yottaflop), any number higher than $10^{39}$ is beyond possibility of being played.

### Positional complexity

Many of the commonly seen opening strategies, joseki and tactical shapes which aid skillful play have been developed over thousands of years of play and taught to successive generations rather than discovered through individual play. There are many positional situations in Go which are recognizable by an experienced player that are hard to recognize otherwise. Once players gain knowledge of these patterns in play, they then must ponder how to apply them in accordance with the position of the board as it stands and the recognizable patterns already in place. Thus, the traditions of Go strategical theory utilized by most stronger players are taught to beginners and help to limit the scope of variation in actual play while deepening strategy.
Notes

[1] AGA – top ten reason to play Go

References

• AGA. “Top Ten Reasons to Play Go” (http://www.usgo.org/resources/topten.html).
• Tromp, John (2005). "Number of legal Go positions (up to 19×19)” (http://www.cwi.nl/~tromp/go/legal.html).
• Tromp, John (1999). "Number of 2×2 games with [[Rules of Go/positional superko (http://groups.google.com/group/rec.games.go/browse_thread/thread/161ff6e5922e1124/c90e5b4a61ea0602?qin=st)]]”.

External links

• Combinatorics of Go (http://view.samurajdata.se/psview.php?id=87eb7119&page=1&size=full) online viewer
• Go and Mathematics (http://www.msoworld.com/mindzine/news/orient/go/special/gomath.html)
Go equipment

Go equipment consists of the objects that are necessary in order to play the game of Go. Although the equipment is simple, there is a varying degree of quality and material used in making the equipment, from the economical to the extremely valuable.
History

The oldest known surviving Go equipment is a board carved from rock that dates from the Han Dynasty in China. Other examples of ancient equipment can be found in museums in Japan and Korea.

Equipment

Board

The Go board, called the goban 碁 盤 in Japanese, is the playing surface on which to place the stones. The standard board is marked with a 19x19 grid. Smaller boards include a 13x13 grid and a 9x9 grid used for shorter games that are often used to teach beginners. Some 19x19 boards have a 13x13 grid on the reverse side. 17x17 was used in historical times. Chinese boards are generally square; Japanese and Korean boards are slightly longer than wide, so that they appear square when viewed from a normal playing position. In Asian go parlors, the tables are slightly lower than the typical game table so that the players can clearly see the positions of the stones.

Traditional Japanese goban usually follow the dimensions:

<table>
<thead>
<tr>
<th></th>
<th>mm</th>
<th>inch</th>
<th>Japanese units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board width</td>
<td>424.2</td>
<td>16 23/32</td>
<td>1.4 shaku 尺</td>
</tr>
<tr>
<td>Board length</td>
<td>454.5</td>
<td>17 29/32</td>
<td>1.5 shaku 尺</td>
</tr>
<tr>
<td>Board thickness</td>
<td>151.5</td>
<td>5 31/32</td>
<td>0.5 shaku 尺</td>
</tr>
<tr>
<td>Line spacing width-wise</td>
<td>22</td>
<td>7/8</td>
<td>7.26 bu 分</td>
</tr>
<tr>
<td>Line spacing length-wise</td>
<td>23.7</td>
<td>15/16</td>
<td>7.82 bu 分</td>
</tr>
<tr>
<td>Line thickness</td>
<td>1</td>
<td>1/32</td>
<td>0.3 bu 分</td>
</tr>
<tr>
<td>Star point marker diameter</td>
<td>4</td>
<td>5/32</td>
<td>1.2 bu 分</td>
</tr>
<tr>
<td>Stone diameter</td>
<td>22.5</td>
<td>29/32</td>
<td>7.5 bu 分</td>
</tr>
</tbody>
</table>

(1 inch = 25.4 mm; 1 shaku = 100 bu = 303 mm)

Go boards fall into several types or styles.

- Economical boards comprise paper, plastic, or laminate, which can easily be folded away and stored. They are often used by beginners or for when one does not have a proper set available. A board can be hand-drawn on a stiff piece of cardboard for the super-economical.
- Boards that comprise fabric, paper, or plastic may be rolled into a tube and easily carried along with stones to make a portable set. Some materials hold strongly onto the warp though and need to be weighted at the corners to make the board usable when unrolled.
- Magnetic sets are also available, which comprise metal boards and stones that include magnets. They are useful for traveling. Large magnetic boards are also available for demonstration purposes, during lectures and other presentations.
Go equipment

- Wooden boards, one to two inches thick, are commonly used. They are known as "table boards" because they are placed on tables (compare "floor board" below.) The wood grain is pleasing to the eye, and the stones make a nice sound when placed firmly on the board. Portable boards can be made with hinges or slots. Some have grids on the reverse. Boards have been made from almost every type of wood, which includes particle board with or without veneer. Wood, such as spruce or katsura, that has a light color with a fine grain that does not compete with the grid lines is considered most suitable. The most valued boards are made from kaya, which is a mellow yellow. Also available are bamboo boards, which appeal to those who are interested in a fast-growing sustainable material. The tensile strength of bamboo is comparable to that of steel[1] making it very durable but also heavier than other wooden boards of the same size.[2]

- A wooden floor board with legs is the most traditional, elegant, and expensive of all boards. Historically, to play on these boards, the Japanese would sit on tatami mats. These boards are still used for important tournament games in Asia. Chinese versions of floor boards are not always made from blocks of wood, and more closely resemble a small table with an inlaid go board. The legs raise the board to the correct height. The board can range from 14–21 cm high. The thickest boards are the most elegant. The undersides often have a square recesses (heso) to prevent warping and to amplify the sounds of the stones hitting the surface. The best boards are made from Miyazaki kaya, which is rare. These are classified according to the quality of the wood grain. Itame refers to a bent or irregular grain; masame refers to consistent grain that runs straight across the top of the board. Masame boards are further classified as tenmasa (the top grain is straight, but grain along the cut end is curved, as in the illustration), and most-prized tenchimasa (grain is straight along the cut end as well as on top.) Prices of kaya boards range from $1,000 to $20,000 plus. Boards made of other woods, such as Alaskan spruce, Agathis, or katsura are cheaper, around $500 to $2,000.

Taking care of boards

Wooden boards should be properly stored to prevent pieing, discoloration, woodworm, mold and other serious wear; prolonged exposure to sunlight can bleach the board. Boards that are transported between climates are likely to warp or crack if not stored with humidity levels similar to those in their places of origin (boards from humid countries should be stored in humid places). Wooden boards should be covered after use with a silk cloth to keep dust off. As chemical cleaning agents could damage or alter the board, wiping with a dry or slightly moist cloth is the best way to clean the board. Fine boards receiving heavy use should periodically be treated with carnauba wax.

Stones

Go stones, or go-ishi, are round objects placed on the board. They are coloured black or white, for each player, and normally number 181 for black and 180 for white or sometimes 180 each.

There are two styles or shapes of stones depending on where a player obtains them from:

- The Japanese and Korean style, which is lens shaped (i.e. biconvex). This is the most popular style.
- The Chinese style, called yunzi, or 'cloud', because they are normally flat underneath and convex on top. This style is less common outside of China. Flat bottom stones can be useful for post-game analysis; by placing stones upside down, players can easily keep track of which stones were part of the original game. However, they are harder to pick up when clearing them from the board.

The material varies. Some stones are made out of plastic, glass, porcelain or marble, but the traditional Japanese and Korean stones are made out of slate for black and clamshell for white. Chinese style stones can be made of glass, but to be considered true yunzi it must be sintered. The exact recipe is a well-kept secret and was in fact lost for a time in the early 20th century due to instability of the country.
**Stone dimensions**
Stone thickness can also vary, being as low as 4 millimeters or as high as 12.8 millimeters, with most between 7.0 mm and 10.1 mm for biconvex and 5–7 mm for single convex. Thick slate and shell stones can last for generations, slowly becoming thinner from handling, and gradually acquiring an ivory-like patina. The diameter of the stones is standardized to around 22 mm ±1 mm, which can fit almost all Go boards. Black stones are slightly larger in diameter to compensate for optical illusion of the white stones appearing larger when placed with black stones of the same diameter. This mostly applies to Korean and Japanese stones – Chinese stones tend to be sometimes larger in diameter, but they do come in different standard sizes. A Chinese "large" size is about 23 mm in diameter while "medium" is about 22 mm. Chinese board dimensions is also accordingly larger to accommodate them. See also some comparative measurements of various go stone sets.[3]

For the most expensive clamshell and slate Go stones, stone thickness is carefully controlled and ranked according to size. Typical stone sizes are size 25 (7.0 mm thick) to size 37 (10.4 mm), and even thicker stones are available for a correspondingly much higher price. Commonly used shell and slate Go stone thicknesses are size 32 (8.8 mm) and size 33 (9.2 mm) for most individuals and size 36 (10.1 mm) for professionals. Stones thicker than 10.1 mm are difficult to place on the board, while many Go players prefer stones that are 8.8 and 9.2 mm thick, considering these the optimum thickness for aesthetic and practical reasons.

**Plastic stones**
Generally, these are the cheapest stones available. They range from flat, counter shaped to the typical lens shape. Price ranges from around $5–$30.

One specific type of plastic stone is called the Ing stone, manufactured by the Ing Chang-ki Wei-chi Education Foundation. These are the official stones of the Ing Foundation and have some extra weight to them due to metal inserted in the middle of the stone. They are 10 mm thick and sometimes come in an Ing Bowl, specially designed to count them. (Ing rules require each player to start with exactly 180 stones.)

Stones can be made from Melamine resin. This is a stable compound used in making countertops and other kitchenware and is considered safe.

**Starch stones**
Yellow Mountain Imports sells stones made of a starch compound described as antibacterial and biodegradable. They are very similar in appearance to plastic stones. A bi-convex set retails for around $14 in 2011.

**Porcelain stones**
These are among the cheapest stones available for single convex stones, ranging from under $10 to $15. They often mimic the shape and size of Yunzi stones.

**Glass stones**
The most widely used and most economical. They range from thinner flat-bottomed style, to a symmetrical lens shape. Glass stones have the correct weight and can be grasped with ease. White stones are polished and black ones are buffed to a matte finish, giving a feel somewhat like slate and clam stones. Price ranges from $15 to $80 for glass stones with bowls. A cheap alternative is to buy glass 'gems' at an arts and crafts store; a full set of stones will cost $5 to $10.
**Slate and clamshell stones**

These are usually the most expensive stones one can get, since each stone is handmade using mechanical grinding and polishing equipment. The black stones are made of slate, while the white stones are made from clamshells. Due to a single clam shell yielding only a limited amount of stones (around three), white stones are expensive to produce. The clamshells used to make the white stones used to be farmed from Japan, but since the supply is dwindling, most clamshells are harvested from Baja California in Mexico. These stones have three grades, depending on the stripe or grain pattern of the white stones. All grades use the same uniform black slate stones. Shell stones may also rarely be made out of the giant clam (shako in Japanese) shell, as well as a clam shell that has a slight purple tint. Clamshell stones are cut as cylinders using a diamond coring drill, then professionally ground, sanded, shaped, and polished into the final product. Shell and slate stones are natural products that provide the ultimate in Go stone aesthetics, and even the lowest grade are far more expensive than the common plastic, glass, and ceramic stones. The price for a set of shell and slate stones ranges from $200 to over $5,000 according to grade, thicker stones by large costing progressively more within each grade, especially within the Yuki grade.

- **Jitsuyo** (practical, standard, or utility-grade) are stones with a coarse grain across the stone, with 7 or 8 wide stripes. The stones are cut near the joint of the shell.
- **Tsuki** (moon-grade) are stones with a finer grain pattern, with more and thinner stripes covering about 70% of the stone. They are cut around the middle of the shell. These are considered the ‘in-between’ quality.
- **Yuki** (snow-grade) are stones with a uniform, fine, straight grain across the stone, with many fine stripes covering at least 80% of the stone. They are cut from near the edge of the shell. These are considered the best by Japanese tastes, and are the most expensive, considering it is difficult to cut a stone with a great deal of thickness since the edge of the shell is mostly thin. The price ranges from $200 to over $5,000, the thicker stones costing more.

**Yunzi stones**

Yunzi is a style of stone first produced in the Tang Dynasty in China by sintering a trade-secret mixture of mineral compounds including agate (resulting in the slightly yellow-green hue of traditional yunzi stones). The term "yunzi" traditionally applies to stones made of this material, but can refer to any single-convex stone of average Chinese dimensions (slightly larger than a Japanese stone). The art of making Yunzi was lost in the 1920s when the Chinese Civil War spread to Yunnan province, but in the late 1960s it was rediscovered by the now state-managed Yunzi Company. Yunzi are delicately made with a jade-like luster yet are neither brittle nor slippery. The black and white pieces each have their special qualities. The white pieces are opaque with a tint of yellow or green. The black pieces are dark, and when held to the light hue a translucent green hue. With new technology, Yunzi stones can now be made pure white without any discolorations.

**Stone etiquette**

When not making a move, one should leave one's stones in the bowl. During the opponent's turn, it is considered rude for players to rattle stones in the bowl. It is also considered improper to hold a handful of stones. The "correct" procedure is to decide upon one's move, then remove one stone from the bowl and place it on the board. This produces the minimal amount of distraction for one's opponent.

When removing a stone from its bowl to make a move, place a flat hand on the edge of the bowl, with the fingers gently entering the bowl. Pick up a stone chopstick-style with the index and middle fingers, holding the stone between the index fingernail and the middle fingertip. The fingers extend almost straight, and the thumb is not tucked in.

When placing the stone, take care that long sleeves are brushed up to avoid knocking stones already played. To place the stone on the board, as soon as the fingertip of index finger is about to reach the surface of the board, it slips to the side, allowing the middle finger to aim the stone down towards the surface and connect (the other fingers and thumb naturally spread outwards). With a little practice a stone can be placed gracefully and forcefully and with a big click.
The keys to a loud click are the force of the middle finger and the late release of the stone. Once the stone has been placed, the middle finger and hand slowly lifts off the stone (trying to avoid wobbling the stone) and gently retreats back to the player.[4]

Although it is permissible to place one's stone at times with a loud, satisfying "thwack", one who does so with every move would be considered crude or vulgar. For instance, when submitting to an opponent's threat, a quiet placement is more in keeping with circumstances; probing moves or clever responses may be slid slyly into place. The ability to express oneself in the manner of making a move explains why one of the names for the game is "hand talk" ("shudan" in Japanese, "shoutan" in Chinese).

**Taking care of stones**

New stones (of any variety except slate and clamshell) should be washed in warm (soapy) water to remove any oils or chalk by-products of their manufacture or storage protection, then dried thoroughly. Do not use soap when cleaning clamshell stones; new clamshell stones should not need cleaning. New slate stones should be cleaned of excess mineral oil with a cotton cloth. When using stones, one should not slap the stones down too hard. When finished, they should be either kept in their bowls or original packaging and stored away from sunlight and heat. Placing a soft cloth in the bottom of the bowl can help to minimize chipping of stones.

**Bowls**

Go bowls, or go-ke are the containers for the stones. Although not strictly needed to play Go, bowls nevertheless play an important role in storing the stones, and captured stones can be placed on the lids. Bowls are identical, with one holding the white stones and one holding the black stones.

A bowl's lid is usually rather loose and not tightly fitted. Players traditionally turn the lid upside down and keep stones there that they have captured from the opponent. The lid is placed so it's easily visible by the opponent, so each player knows how many prisoners the opponent has that are physically removed from the playing board.

The Go bowl can be made of several different materials.

- **Plastic:** Very cheap, they can be cylinder shaped or square shaped. The price is around $5. Quart size plastic food storage containers can also be used.
- **Straw:** Mostly used by the Chinese. They are made of woven straw. The price is around $10-25.
- **Wood:** The most common material used to make bowls. The type of wood used affects the price considerably. Mulberry is one of the most striking and expensive. Intermediate woods are quince (karin in Japanese), kaya, cherry, keyaki, and rosewood. Cheaper ones are made out of beech or chestnut. Bamboo also makes for a nice, low-cost bowl. The bowl can be polished. The best bowls are carved from a single piece of wood and have their grains highlighted. The price range varies from $50 to thousands of dollars.

Not all bowls can fit a full set of stones. Most can only hold stones with a thickness of up to 10 mm. Larger and more expensive bowls hold stones of thickness of up to 12 mm since one would buy thicker and more expensive stones to match the quality of the bowl. The bowls of highest quality and price are traditionally used only for the best shell and slate stones, of Yuki (snow-grade) quality. Lesser quality wood bowls likewise are used for Jitsuyo (standard-grade) and Tsuki (moon-grade) shell and slate stones, and glass stones are traditionally stored in the least expensive wood bowls or in plastic bowls.

A list of woods used in Japanese Go bowls with photographs is available.[5]
Go equipment

References
[4] How to hold and play a go stone (http://senseis.xmp.net/?HowToHoldAndPlayAGoStone)

External links
- Guide to Go equipment (http://www.samarand.net/equipment.html)
- Some FAQs on Go stones (http://www.gofigure.de/shop/go_faq_gostones.php) and Go boards (http://www.gofigure.de/shop/go_faq_goboard.php)
- Making Your Own Equipment and taking care of it (http://senseis.xmp.net/?MakingYourOwnEquipment)
The **International Go Federation** is an international organization that connects the various national Go federations around the world. It is usually referred to as **IGF**.

### Role

The role of the IGF is to promote the sport of Go throughout the world, promote amicable relations among members and improve world Go organization. It does so by carrying out the following activities:

- Organizing the World Amateur Go Championship and other international Go tournaments;
- Publishing and distributing to members up-to-date information on world Go activities, through bulletins or on the IGF website;
- Other activities pertaining to the international development of Go.

### Policies

The IGF is an apolitical and non-religious organization, and strives to promote fair play amongst all players.

### History

The Japan Go Association organized the first World Go Amateur Championship in Japan, in 1979. Many of the top Go players from around the world and representatives from the major National Go Associations attended the event. Its success led to the founding of the International Go Federation on March 18, 1982, with Shizuo Asada presiding over the original 29 founding members.

On April 7, 2006, the IGF became a member of the General Association of International Sports Federations (GAISF).

The IGF is a founding member of the IMSA (International Mind Sports Association).

The IGF organizes the yearly World Amateur Go Championship, which attracts over 65 countries.
Members
As of May 2012 the IGF has 74 member nations: 37 in Europe, 17 in Asia, 15 in the Americas, 3 in Africa and 2 in Oceania. It also has four Association Members, which cover multiple countries: the World Pair Go Association, the Federación Iberoamericana de Go, the European Go Federation and the Ing Changki Wei-Chi Education Foundation.[3]

IGF Presidents
1. Shizuo Asada, Professional Go Player and founding President of the IGF, 1982–1997
2. Fumio Watanabe, 1997–2001
6. Hiromu Okabe, Chairman of the Board of Directors for the Nihon Ki-in, President of the Denso Corporation, 2007–2009
7. Otake Hideo, Chairman of the Board of Directors for the Nihon Ki-in, 2009–2010
9. Koichiro Matsuura, President of World Pair Go Association and former Director General of UNESCO, 2012–present

References
[1] https://intergofed.org/about-the-igf/structure.html IGF’s structure

External links
Official website (http://www.intergofed.org)


File:Flag of Israel.svg Source: http://en.wikipedia.org/w/index.php?title=File:Flag_of_Israel.svg License: Public Domain Contributors: “The Provisional Council of State Proclamation of the Flag of the State of Israel” of 25 Tishrei 5709 (28 October 1948) provides the official specification for the design of the Israeli flag. The color of the Magen David and the stripes of the Israeli flag is not precisely specified by the above legislation. The color depicted in the current version of the image is typical of flags used in Israel today, although individual flags can and do vary. The flag legislation officially specifies dimensions of 220 cm x 160 cm. However, the sizes of actual flags vary (although the aspect ratio is usually retained).
