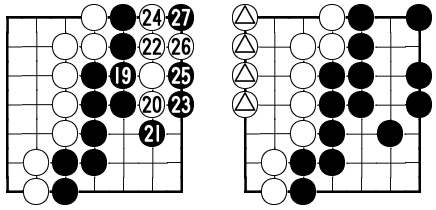
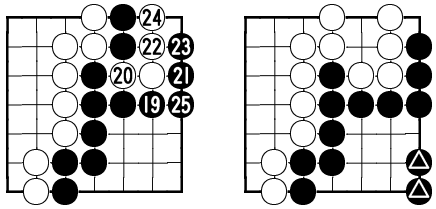
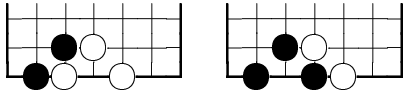


Another scenario might be that black does not connect his two chains. ⑳ cuts away the upper black chain. ㉑ is atari, but white can capture the two black stones. Successful invasion, white turned the game. At the end, black has 8 points of territory, white has 15. The upper right corner does not belong to anyone, it is a *dame* point.



No eternal games

To guarantee that a Go game will be finished in a finite number of steps, **it is not allowed to repeat a previous board position**. Here is a simple situation where the potential for infinite play occurs.

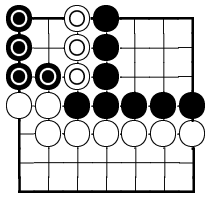


Black captures the white stone, but the capturing stone ends up in atari. However, white cannot recapture, since that would restore the previous situation. Consequently, white is obliged to play somewhere else first, thus changing the overall board position. Then, black can choose between answering the remote threat, or resolving the local situation. This is known as the *ko rule*. This sounds like a technical rule, but it leads to an interesting game dynamics by connecting remote parts of the board in the same fight. Ko fights are very much part of the strategy of the game.

More on scoring

Statistical investigation shows that black has a real advantage by moving first. Therefore, white gets compensation points, the *komi*. The actual value is unclear since we only have empirical evidence. Typical values are 5.5, 6.5 or 7.5. The half a point is used as a tie-breaker.

The following game is already in the scoring phase. Whose territory is the upper left corner? Whenever, there is uncertainty, players can decide it by continuing to play. However, for the circled chains, none of the players wants to make a move. Putting the enemy chain into atari is self-atari as well. This is mutual life, *seki*. Both chains stay on the board, but no territorial points can be made in that corner.



Black has 9 in the upper right, and white 15 in the bottom half.

Advice for beginners

These rules describe how to play valid Go games. However, they give no instructions on what are the good moves. Mastering the game is a long and gradual process. For beginners, there is only one advice: **PLAY!** In the first few games it is important to simply observe with an open mind what happens on the board, without trying too hard to win. Have fun!

Further information:
`egri-nagy.github.io/igomath/`
Contact:
`egri-nagy@aiu.ac.jp`

v2019.04.19, made with LaTeX

The rules of the game of Go

The game of Go is an ancient, abstract, two player, turn taking, pure skill, strategy board game. It is based on the concept of *surrounding*, enclosing on all sides.

> **The goal of the game is to surround more territory than the opponent.**

This can be achieved by

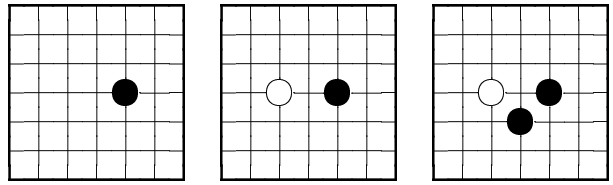
1. building walls with your stones,
2. capturing your opponent's stones.

Capturing itself is not the primary purpose of the game, but it is an efficient way of encircling more territory.

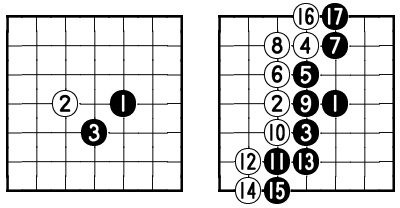
Wall building

The game played on a square grid. The standard size is 19×19. Smaller ones, 13×13 and 9×9, are used for shorter games and recommended for beginners.

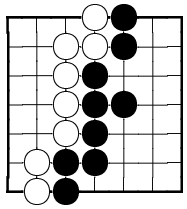
The two players are represented by black and white. Starting with black, the players take turns in placing their *stones* on empty intersections, one at a time. Here are the first 3 moves of a 7×7 game.



By numbering them, these three moves can be summarized in a single diagram. Since the stones do not move, we can record a whole game this way.

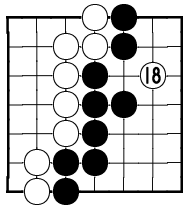


The game ends when both players pass, when they see no benefit of making more moves. Scoring this game is easy, since territory ownership is clear. More precisely, we can pick an empty intersection on the right side, and by hopping from an intersection to another, following the lines in any direction we can reach only black stones, or the edge of the board. Therefore, the right side is black's territory. Similar thinking shows that the left side belongs to white. At the end, black surrounded 19 territory points and white 13, therefore black wins this game.



This example looks like a peaceful wall building game. However, each move is a territorial threat or counter-threat. A game has the tension of a serious fight even if there is no capture.

But what happens, when white makes another move?

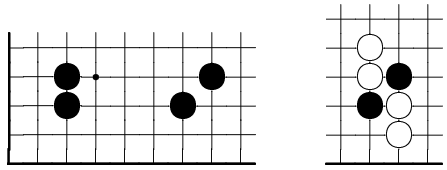


This is invasion, ⑱ is behind enemy lines. Is the right side still black's territory then? This question often confuses beginners. The answer is simple: they have to fight it out. If black can capture invading white stones, then it remains black's territory. If black fails to surround the invading stones, then white can gain more territory while reducing black's at the same time.

Capturing

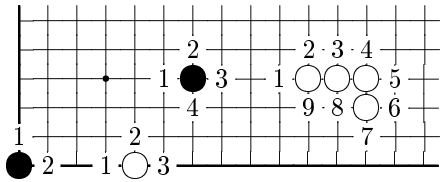
Stones are *connected* if they occupy neighbouring intersections, they 'touch' each other either horizontally or

vertically. Here are two connected stones (left), and two disconnected stones (right). There is no diagonal connection, just as there are no diagonal lines on the board. The diagonal black stones can be separated by white stones.

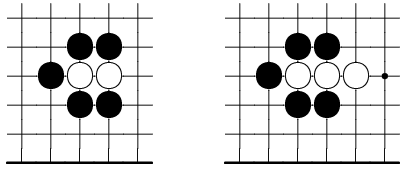


Connected stones of the same color form *chains*. In terms of surrounding, a chain is a single thing: either the whole chain remains on the board, or it gets captured. In other words, connected stones share the same fate. We can think of a single stone as a chain by itself.

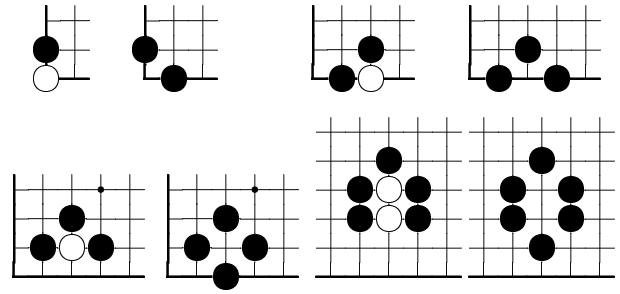
The chains need "breathing space", i.e. empty intersections in direct contact with stones in the chain. These are called *liberties*. The number of liberties is an important property of a chain, and counting liberties is crucial in tactical fights. It is a measure of how easily the chain can be surrounded. Here are four chains with their liberties counted. A single stone in a corner is very weak, better on an edge, and strongest with 4 liberties.



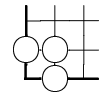
Surrounding a chain is the process of reducing its liberties. A special situation is when a chain has only one liberty left, and we say it is in *atari*. White needs to extend the chain to avoid capture.



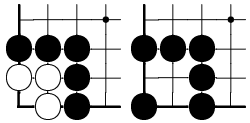
Capturing a chain is filling its last remaining liberty, when all stones in that chain are removed from the board and they are kept separately as prisoners. Here are four examples of capturing.



Self-capturing is not allowed. Black cannot make a move into the corner as that intersection is surrounded by white.



Though one can fill his/her own last liberty in order to capture an enemy chain at the same time, which creates new liberties, so the move is not a self-capture anyway.



In the scoring phase, prisoners are put back on the board into their own territories to reduce score. This way, capturing an enemy stone is worth two points. One for the surrounded point and one for reducing the enemy's territory.

Going back to the example game, here is one way how black can deal with the invasion. ㉗ captures the invading white stones. Now black has 14 points of territory and white's territory is reduced to 9, since the captured stones △ are placed inside white's territory.