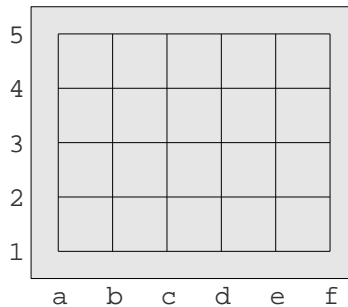


Tromp-Taylor go rules explained

There are many versions of go rules: for example, the go associations of Japan, Korea and China each have their own version. We choose to explain the Tromp-Taylor rules from <http://tromp.github.io/go.html>. These rules are short and precise. No-suicide Tromp-Taylor rules is often used by go programmers. NSTT rules are close to Chinese rules. See also https://en.wikipedia.org/wiki/Rules_of_Go.

rule 1. Go is played on a 19x19 square grid of points, by two players called **Black and White**.

comment. More generally, go can be played on any $m \times n$ grid of points such as the 5×6 grid below. The grid of points defines what is called a graph (if you haven't learned this term before, think of it as a representation of a relationship between a set of points that explains exactly which pairs of points are adjacent, or neighbours): go can be played on any finite graph.

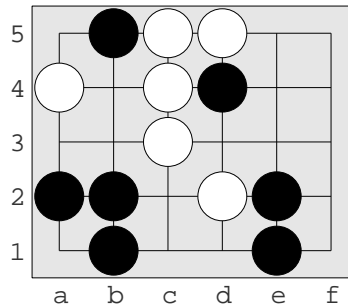


rule 2. Each point on the grid may be colored black, white or empty.

comment. more commonly, instead of coloring the points (and uncoloring them when a chain is captured), Black has black stones and White has white stones, so each point on the grid is either a black stone, a white stone, or empty.

rule 3. A point P , not colored C , is said to reach C if there is a path of (vertically or horizontally) adjacent points of P 's color from P to a point of color C .

example. Let P be the starting point P (not colored C) and let Q be the destination point (colored C). In the diagram, does $b5$ reach empty? Does $b5$ reach white?



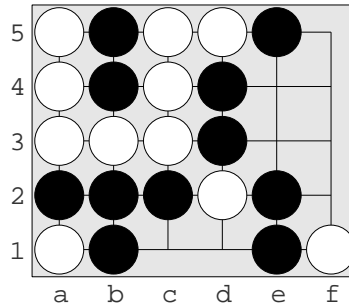
Answer: black $b5$ reaches empty with path ($P = b5, a5 = Q$). Similarly, black $b5$ reaches white with path ($P = b5, a5, a4 = Q$).

What colors (other than than white) does $c5$ reach? Answer: white $c5$ reaches black (with $(c5, b5)$ or $(c5, c4, e4)$ or $(c5, d5, d4)$) and empty with $(c5, c4, b4)$ or $(c5, c4, c3, b3)$ or $(c5, c4, c3, c2)$ or $(c5, d5, e5)$.

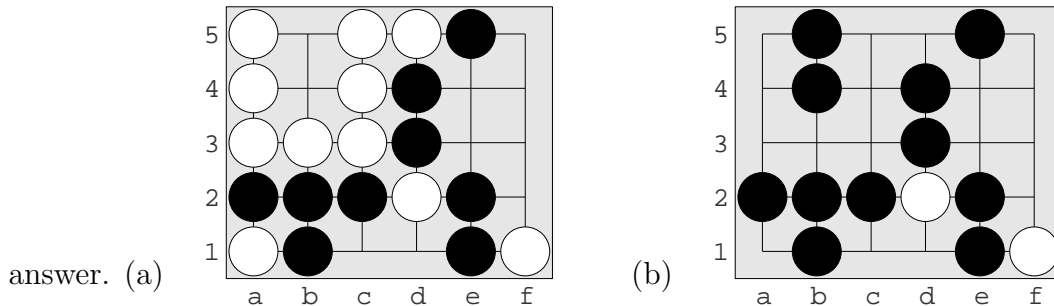
What colors (other than empty) does $b4$ reach? Answer: empty $b4$ reaches black and white.

exercise. for each point P in the diagram, what colors does P reach?

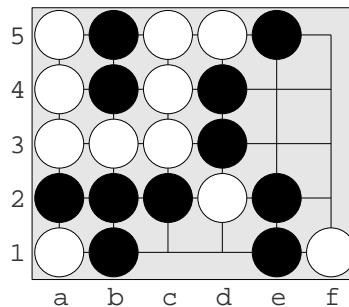
rule 4. Clearing a color is the process of emptying all points of that color that don't reach empty.



example. Show the board above (a) after clearing black (b) after clearing white.



comment. Rule 4 is often explained in terms of colored connected components of the underlying graph. For a point P with color C , the *chain* (also called *solid group* or *string*) containing P is the set of all points P' with the same color, such that there is a path of (vertically or horizontally) adjacent points of P 's color from P to P' . For example, the diagram below has 5 black chains $\{b4, b4\}$, $\{a2, b1, b2, c2\}$, $\{d3, d4\}$, $\{e1, e2\}$, $\{e5\}$ and 4 white chains $\{a1\}$, $\{a3, a4, a5, b3, c3, c4, c5, d5\}$, $\{d2\}$, $\{f1\}$.



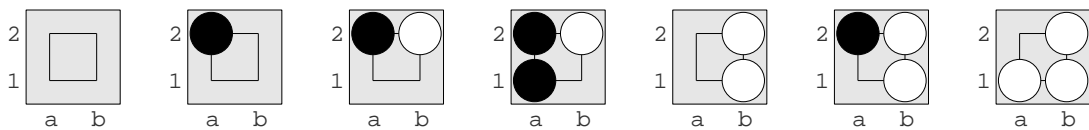
For a chain, each empty point reached by any stone in the chain is a *liberty*. The set of empty points reached will be the same for all stones in the chain, so we call that set the *liberties* of that chain. In the first diagram of rule 4, the five black chains have respectively 1, 0, 2, 3, 2 liberties while the four white chains have respectively 0, 0, 1, 1 liberties. Rule 4 can be stated like this: *capturing* is the process of removing all chains with no liberties.

rule 5. Starting with an empty grid, the players alternate turns, starting with Black.

comment. We saw an empty grid when discussing rule 1.

rule 6. A turn is either a pass or a move that doesn't repeat an earlier grid coloring.

comment. A fixed grid coloring is a *position*. A repeat of a previous coloring is *superko*. so this rule forbids *positional superko*. For example, the game below has started 1.B[a2] 2.W[b2] 3.B[a1] 4.B[b1] 5.B[a2] 6.W[a1]. By rule 6, Black cannot play 7.B[a2]: this captures the white chain and recreates the position after 1.B[a2].



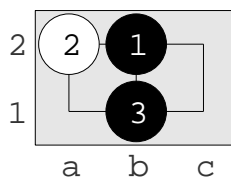
rule 7. A move consists of coloring an empty point one's own color; then clearing the opponent color, and then clearing one's own color.

comment 7a. Rule 7 can be rephrased: a move consists of putting a stone on an empty point, then removing any captured opponent chains, and then removing any captured chains of one's own.

comment 7b. Removing a captured chain of one's own is called *suicide*. The Trump-Taylor rules allow suicide: many rules sets do not. E.g. the Chinese rules are essentially Trump-Taylor rules with suicide not allowed.

comment 7c. For any fixed move, at most one of the two clearing processes can have effect: if a move captures an opponent chain, then the placed stone will have at least one liberty and suicide is not possible; if a move results in suicide, then the stone is placed in the last liberty of a player's group, so the placed stone has no adjacent empty cell, so no opponent chain was captured.

example. In the game below, if players follow Tromp-Taylor rules, move 4.W[a1] is suicide: after White places a stone at a1, the black chain still has liberties and is not captured, so the white chain at {a1,a2} has no liberties and is removed from the board. When we talk about go, we assume No-Suicide Tromp-Taylor rules, in which case 4.W[a1] is illegal. Under NSTT rules, White's only options for move 4 are 4.W[c1], 4.W[c2], or pass.

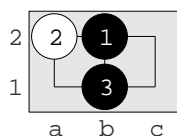


rule 8. The game ends after two consecutive passes.

comment. In practise, players usually end the game once they both agree what the final score will be if they keep playing: this happens when they agree on which chains will be dead at the end of the game.

rule 9. A player's score is the number of points of her color, plus the number of empty points that reach only her color.

comment. This rule is called *area scoring*. Japanese rules use *territory scoring*, which gives points for opponent stones captured. In most games, area scoring and territory scoring will differ by at most 1.



example. Assume that the game above continues with two consecutive passes: what is the final Tromp-Taylor score?

Answer: Black has 2 stones and 2 territory points, White has 1 stone and 0 territory points, so Black wins by 3 points.

What is the final score if both players agree that the white stone at a2 is dead?

Answer: Black wins by 6 points.

If both players continue this game perfectly (i.e. score the best they can, taking into account every possible opponent strategy), then what will the final score in this game be?

Answer: Black can kill all White chains: the game will end Black +6.

rule 10. The player with the higher score at the end of the game is the winner. Equal scores result in a tie.

example. In the 2×2 game above, Black has no legal play on move 7 and so passes. Now White can pass, so the final score is Black has no stones and no territory points, White has 3 stones and 1 territory point, so White wins by 4 points.

comment. Between player's of equal strength, in order to offset Black's first-player advantage, an extra number of points called the *komi* is added to White's score at the end of the game. The komi is agreed to by the players before the game starts. For 19×19 go the komi is often 7.5: using a non-integer komi guarantees that White's final score will be some integer plus .5, so the game will not end in a draw.