Craquelure

An abstract game for 2 players by Kashio Fujii

Components

- One disk (the game is meant to be played on a computer). Its radius is 1, in coordinates with the center at (0, 0).

Definitions

Region a part of the disk bounded by lines. Each region is neutral, Blue or Red.

Part each of the three pieces one cut makes. Every part becomes a new region.

Settled region a region that can no longer be cut so that all three parts reach the minimum area. Nobody can cut it, so its colour stays to the end of the game. A neutral region that becomes settled goes to the opponent at the end of the turn (see On Your Turn). Diagrams show settled regions with fine diagonal stripes.

Goal arcs the three arcs A, B and C into which the rim is divided. Each arc boundary sits in the middle of the rim of one of the three outer regions.

Grid none. A cut may start at any point of the disk, with real-number coordinates.

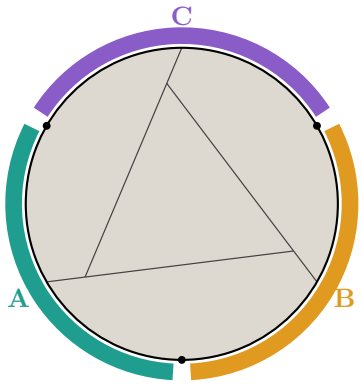
Direction step none. Rays may point at any real-number angle (in degrees).

Minimum area 0.5% of the disk's area. Areas are given as a percentage of the whole disk.

In the demo you can change the starting shape (pinwheel or three sectors), the grid's shape (square, triangular or none) and how fine it is, the number of directions per turn (a divisor of 360 that is a multiple of 3, or real-number angles) and, with 3 or 6 directions, which direction they start from, and the minimum area (on or off, and its value). The values above are the standard settings.

Setup

- The disk starts divided by three lines into four neutral regions (the **pinwheel**). The lines run in from three points of the rim 120° apart (top, lower left, lower right) and end on one another, leaving an equilateral triangle in the middle.
- The central triangle and the three outer regions are each exactly a quarter of the disk. Each outer region touches two arcs; the triangle touches none.
- Choose your color. Blue moves first.



End of the Game

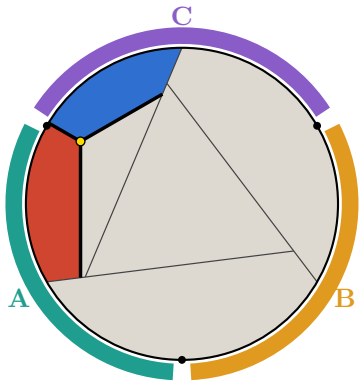
- You win when a group of your own regions, joined by shared edges, touches all three arcs.
- Every move also hands regions to your opponent, so a move can complete your opponent's connection instead; then your opponent wins. The two players can never both be connected at once.

Swap (Pie Rule)

- After Blue's first move, Red may choose to **swap**, once. The players trade colors; the board stays as it is, and Red (the player who made the first move) is to move.
- If Red does not swap, Red simply makes a move.
- So Blue avoids a first move that is too strong (it would be swapped) and looks for one that leaves it content either way.

On Your Turn

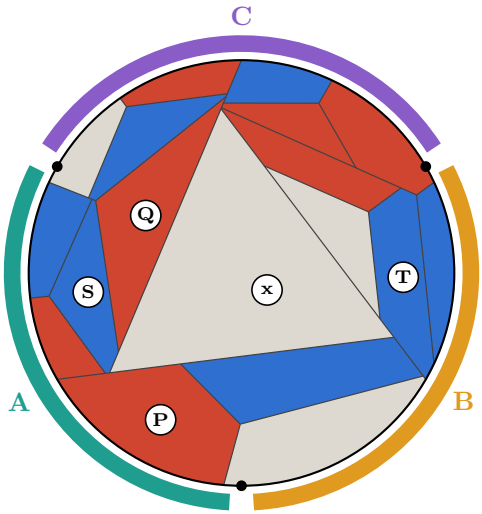
- Choose a neutral region or one of your opponent's regions. You may not cut your own.
- From a point inside it, draw three rays 120° apart out to the region's edge, splitting it into three parts. The point may be anywhere inside the region (but not on a line). With a grid or a direction step set, the point and the rays follow them.
  - Cutting a neutral region: one part becomes yours, one becomes your opponent's, and one stays neutral.
  - Cutting an opponent's region: one part becomes yours, and the other two stay theirs.
- A ray may not end on an existing vertex or on an arc boundary.
- Every part must be at least the minimum area.
- At the end of your turn, any neutral region that has become settled goes to your opponent.



Cutting a neutral region: three rays 120° apart from the yellow point split it into three parts. One becomes the mover's (Blue), one the opponent's (Red), and one stays neutral.

Example of Play

In the position below it is Red's turn, and Red can win with this one move. Which region would you cut, and how?



Red to move. x is the central triangle (neutral).

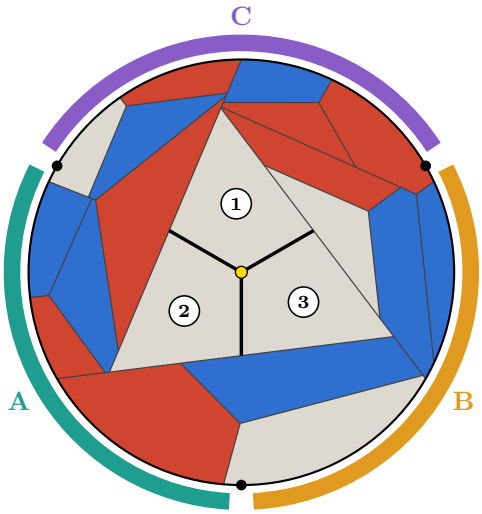
Reading the connections

Red has a group touching arc A (the one containing P) and a group touching arcs B and C (containing Q). If the two join, Red touches all three arcs and wins. Both groups border the central triangle x.

But so do Blue's. Blue's group touching A and C (containing S) and its group touching B (containing T) both border x as well. x is where the two players' connections meet.

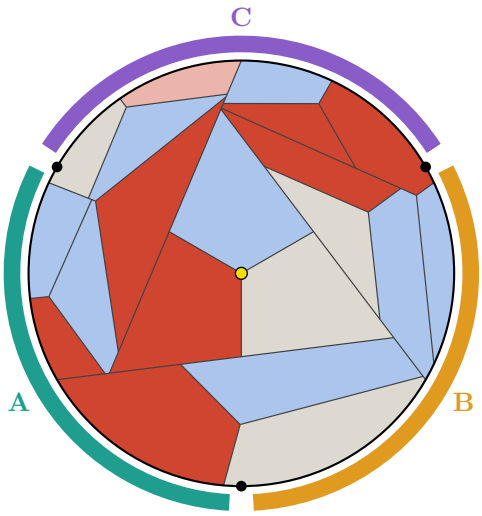
The answer

The answer is to draw the rays from the centre of x, $(0, 0)$, at 30°, 150° and 270°, cutting x into three equal parts (8.33% each), and to make part 2 Red, part 1 Blue and part 3 neutral (in the record, `0,0,30,BRN`).



Three rays from the yellow point cut x into parts 1, 2 and 3 (numbered in the order the record lists their colours).

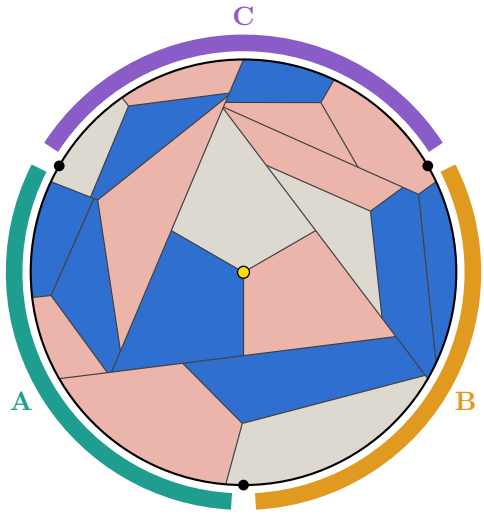
Part 2 borders all four groups, P, Q, S and T. Part 1 borders only Q, and part 3 only T. Making part 2 Red joins P and Q, and Red touches A, B and C: Red wins.



Red wins. The dark red regions are the group joining all three arcs.

Anything else loses

Make part 2 Blue, and it joins S and T: Blue's connection is complete and Blue wins (in the record, `0,0,30,NBR`).



Part 2 made Blue (part 3 Red): Blue wins.

Leaving part 2 neutral loses too. At 8.33% it can still be cut, so it stays neutral, but it is Blue's turn: Blue cuts it, takes a part touching both S and T, and wins.

The central triangle is where the connections gather. When you cut it, join your own groups with your own part, and make sure the part you give away and the part you leave neutral do not help your opponent. That is how this position is won.

Strategy Tips

Settle your parts a part smaller than three minimum areas (1.5%) can never be cut again. Settle your own part and your opponent cannot break into it. Strong players settle their own part on nearly every move.

The part you give and the part you leave every move hands your opponent a part. Make sure it does not help their connection, and that a part you leave neutral does not become settled and go to them.

The central triangle the only region that borders all three outer regions. It touches no arc, but many connections of both players run through it.

Spokes a thin settled part that touches an arc and reaches the hub of the board (with the pinwheel, the central triangle). It is a path nobody can cut, and very strong. A first move that makes a spoke is usually swapped.

Design Note: The Starting Shape

At first the game started from three sectors, the disk cut by three radii.

Played in depth, it turned up a move right next to the centre, almost parallel to a radius. It makes a thin settled part that covers a whole radius, from the centre to an arc, tying the centre (which all three sectors share) to that arc in a way nobody can cut. We called such a part a spoke.

A first move making a spoke left the second player almost no defence. Even with the swap, if the first player made no spoke, the second player could often win by cutting at the centre on move two, so for both players the game was settled by one very precise early move. That was a flaw.

So the start became today's pinwheel: the three lines are shifted to leave an equilateral triangle in the middle. As the lines no longer meet at one point, one part can no longer tie the centre to an arc at a stroke. Something like a spoke can still be made, but it only reaches from an arc to the central triangle, so winning with it takes several moves and leaves the opponent time to answer. The three-sector start can still be chosen in the demo's settings.