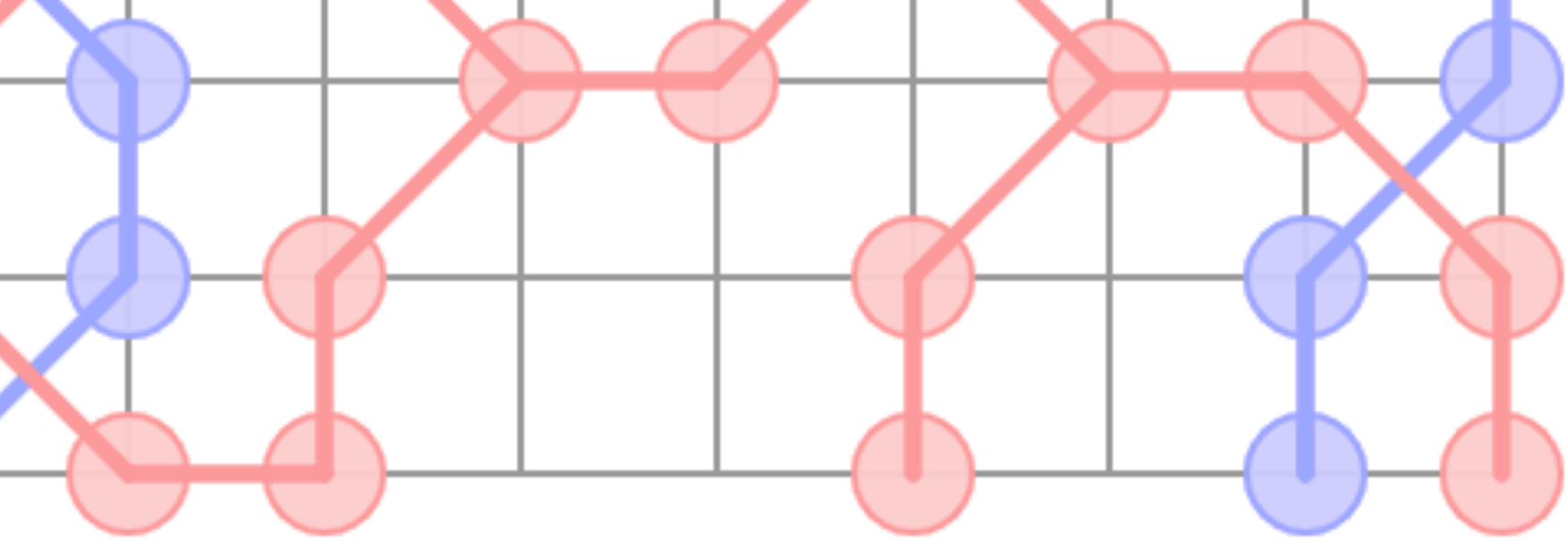
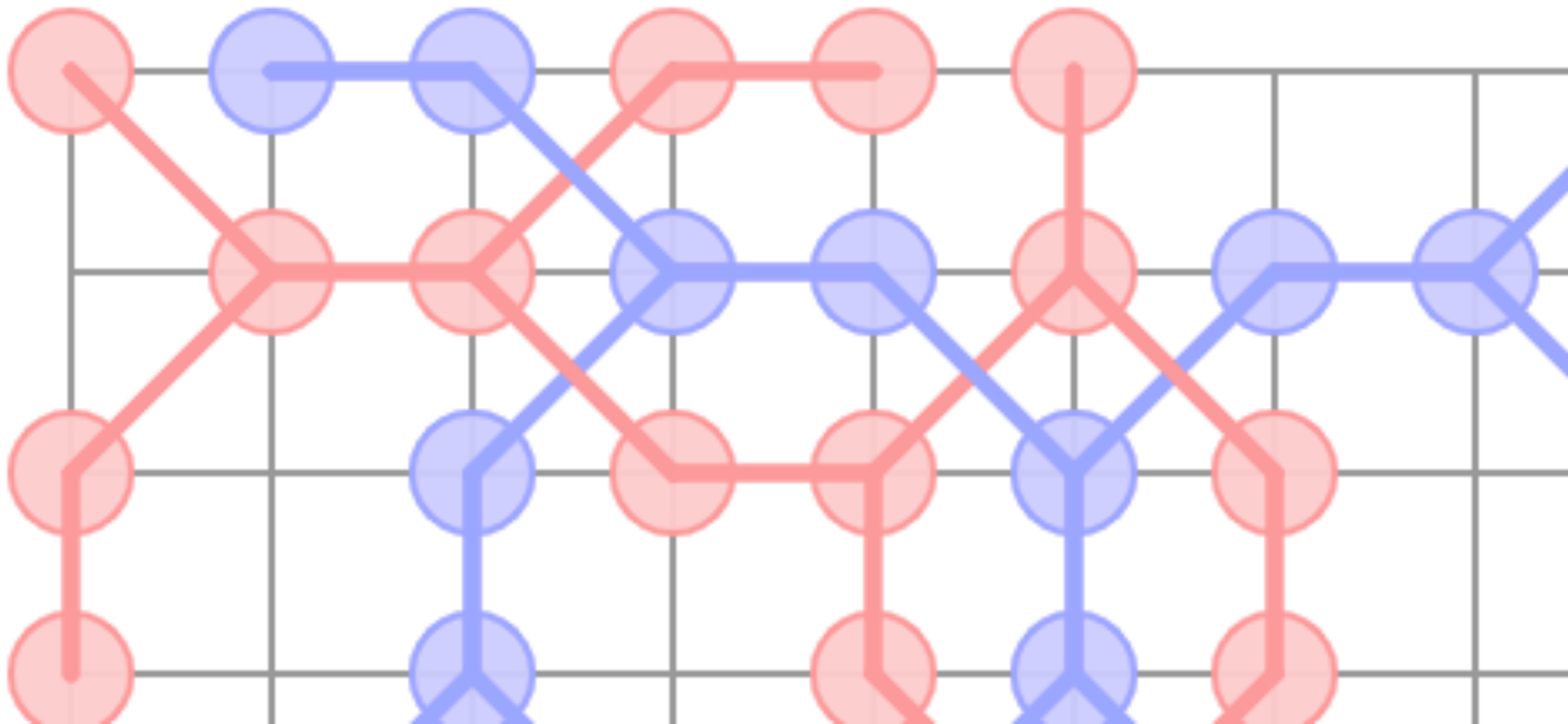


盤面分割ゲーム Separo

Separo: A Board-Dividing Game

Takashi Suwa



Separo とは

What's Separo?

- 諏訪が高 1 頃（2010年）につくった 2 人用の盤上ゲーム

  A two-player board game created by myself in my high school days

- 完全情報ゲームで，プレイヤーは各々独立に盤面をできるだけ多くの領域に分割しようとし，互いに邪魔しあう

  A game with perfect information where both players try to divide the board into as many regions as possible and hamper the other

- 友人たちにそこそこウケて当時遊んだ（黒板でできる）ほか，数年前にそのうちの 1 人がなんと対戦 AI を実装してくれた

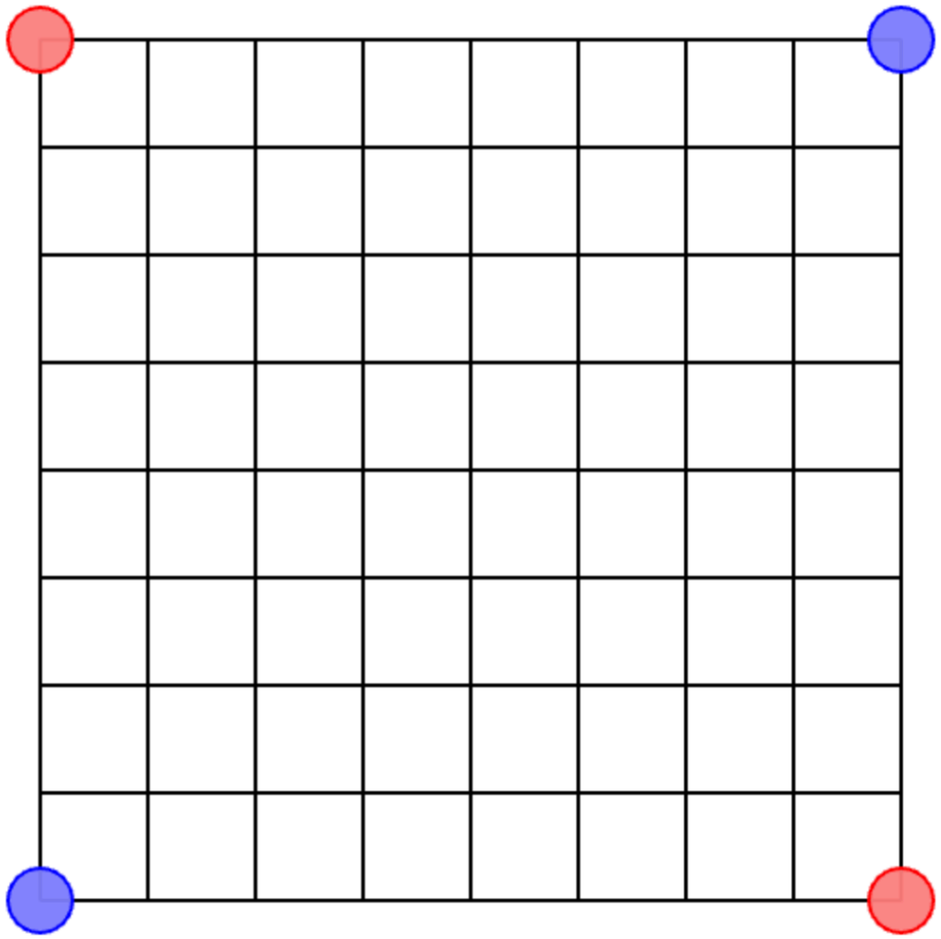
  Somewhat popular among some friends at that day,
  and one of them implemented an AI player for this game a few years ago!

ルール

Rules

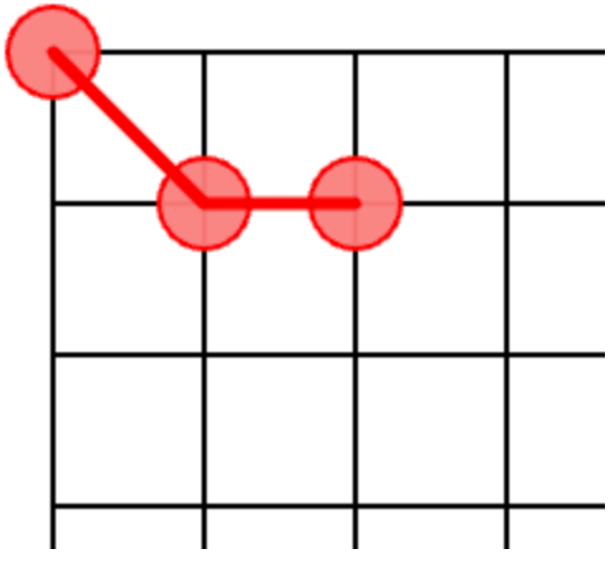
- 九路盤の四隅に両者 2 つずつ
  頂点が置いてある状態から開始

  Starts with the state where
  both players have two vertices on corners



- プレイヤーは手番時に既に盤上にある
  自分の石から枝を伸ばし，その先に
  新たな石を置く（伸ばし方は後述）

  The player at their turn extends edges from
  one of their vertices on the board and
  puts new vertices (details are explained later)



- 両色の枝が各々独立に盤面を分割

  Edges of both colors divide the board independently

最終結果の例

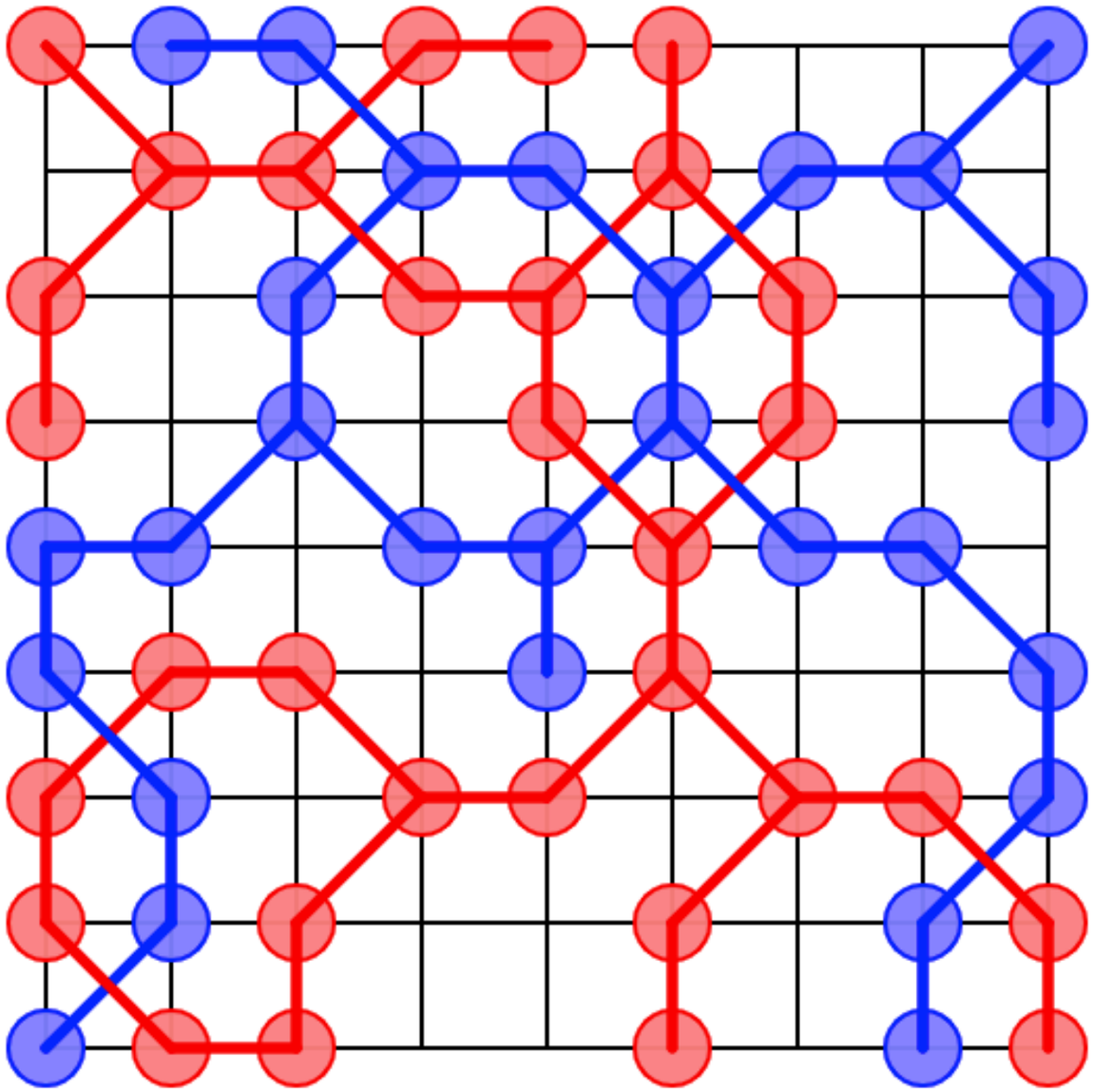
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

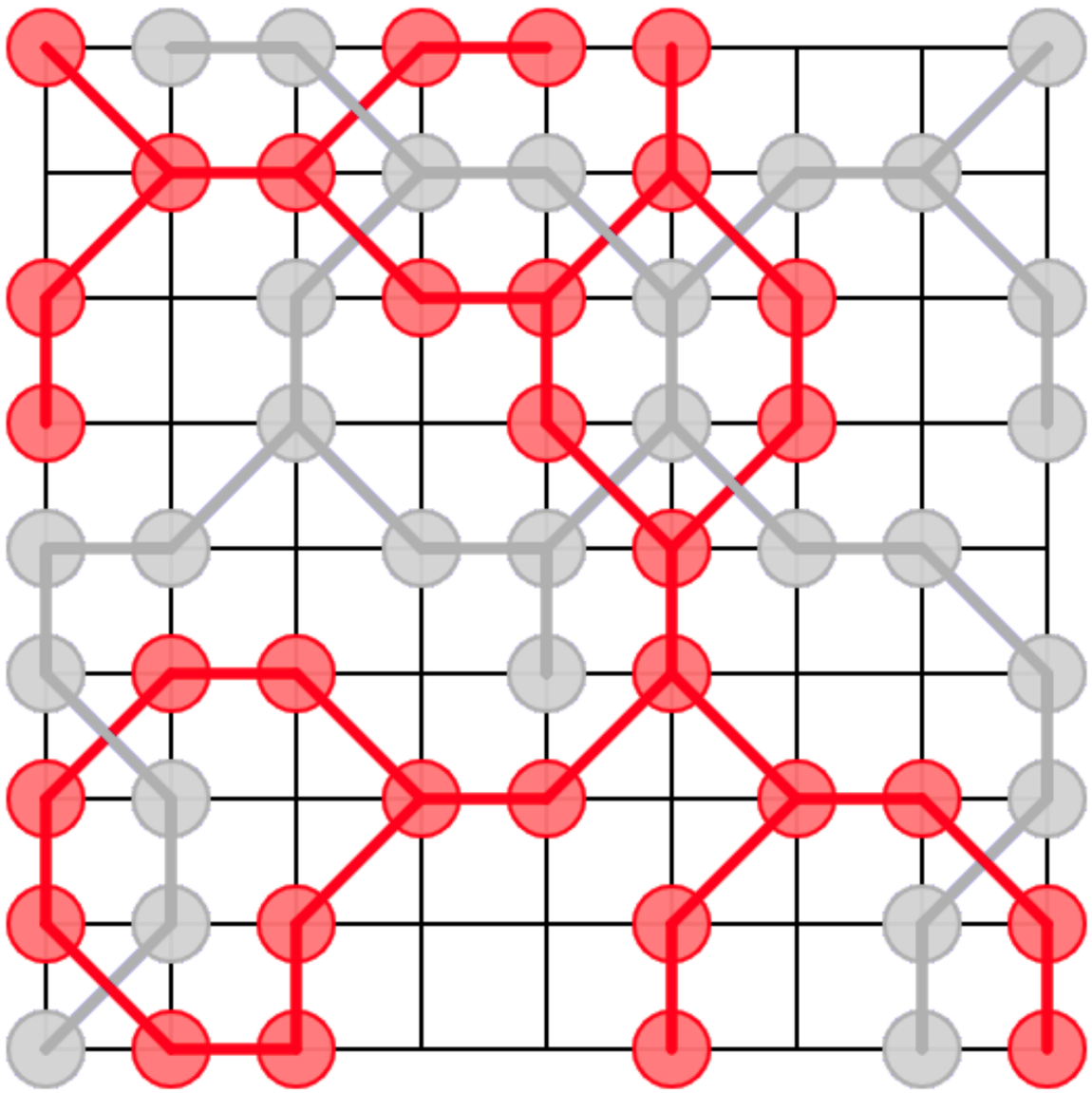
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

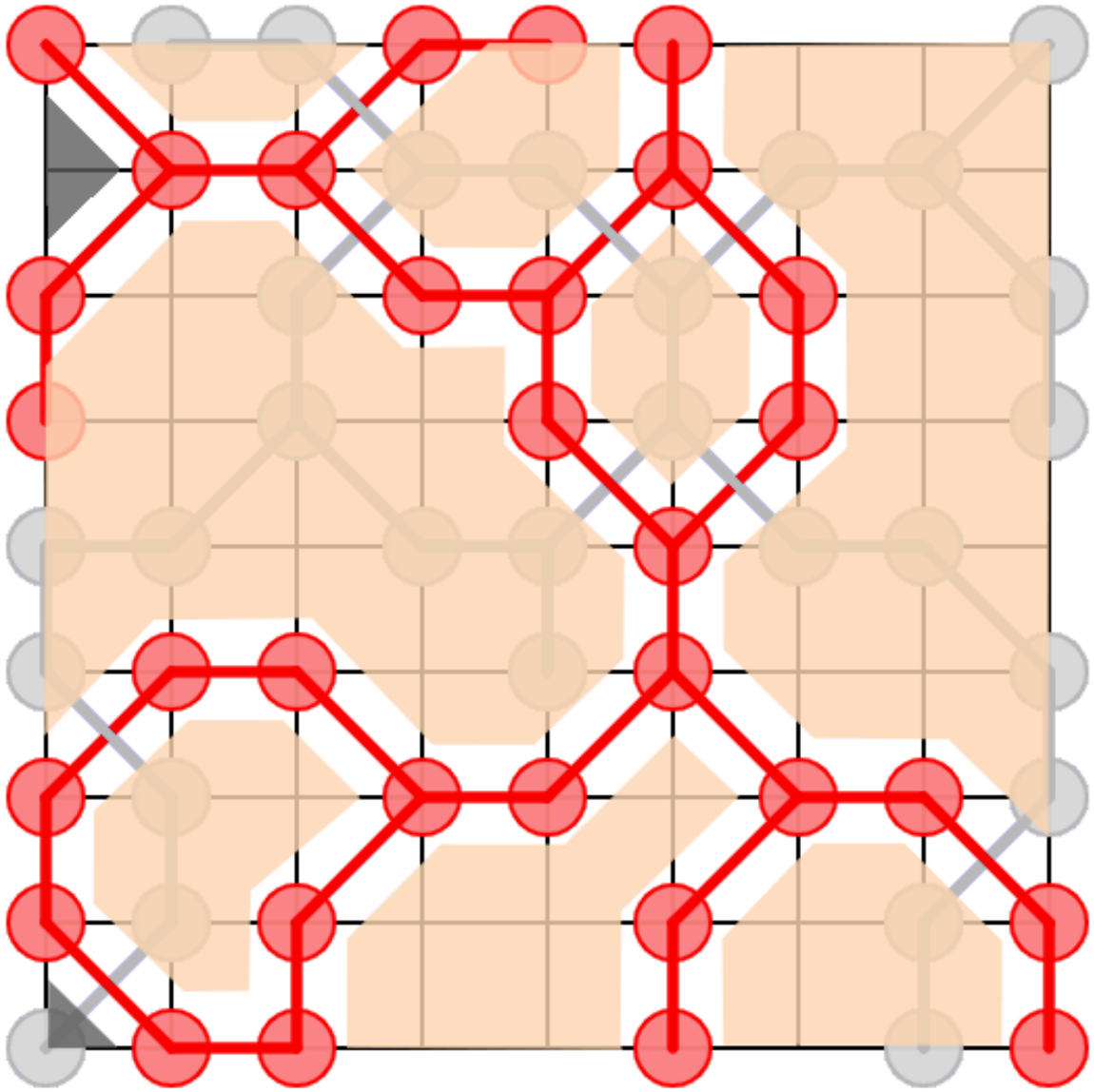
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

An example final result

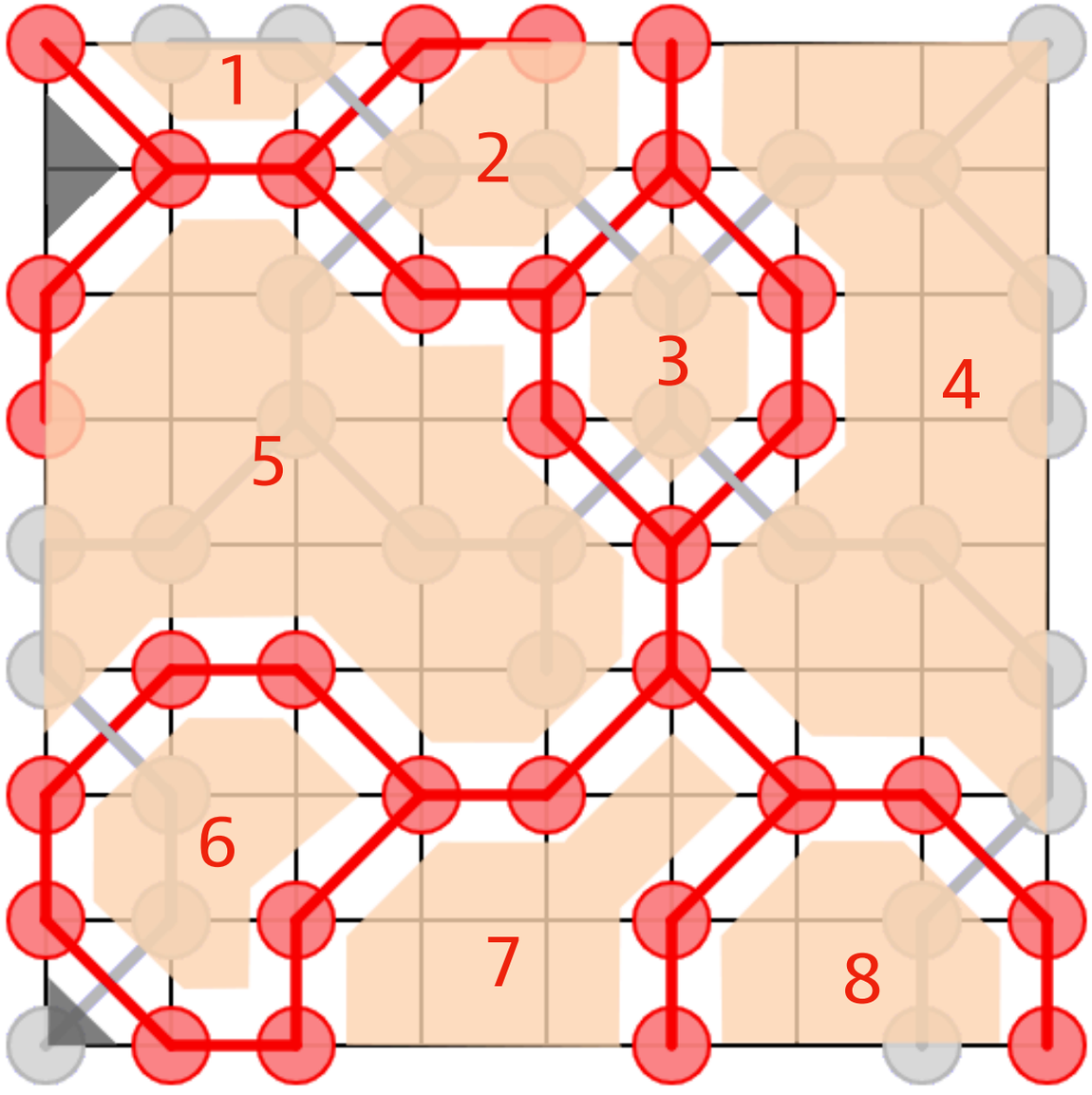
Red’s score: 8

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

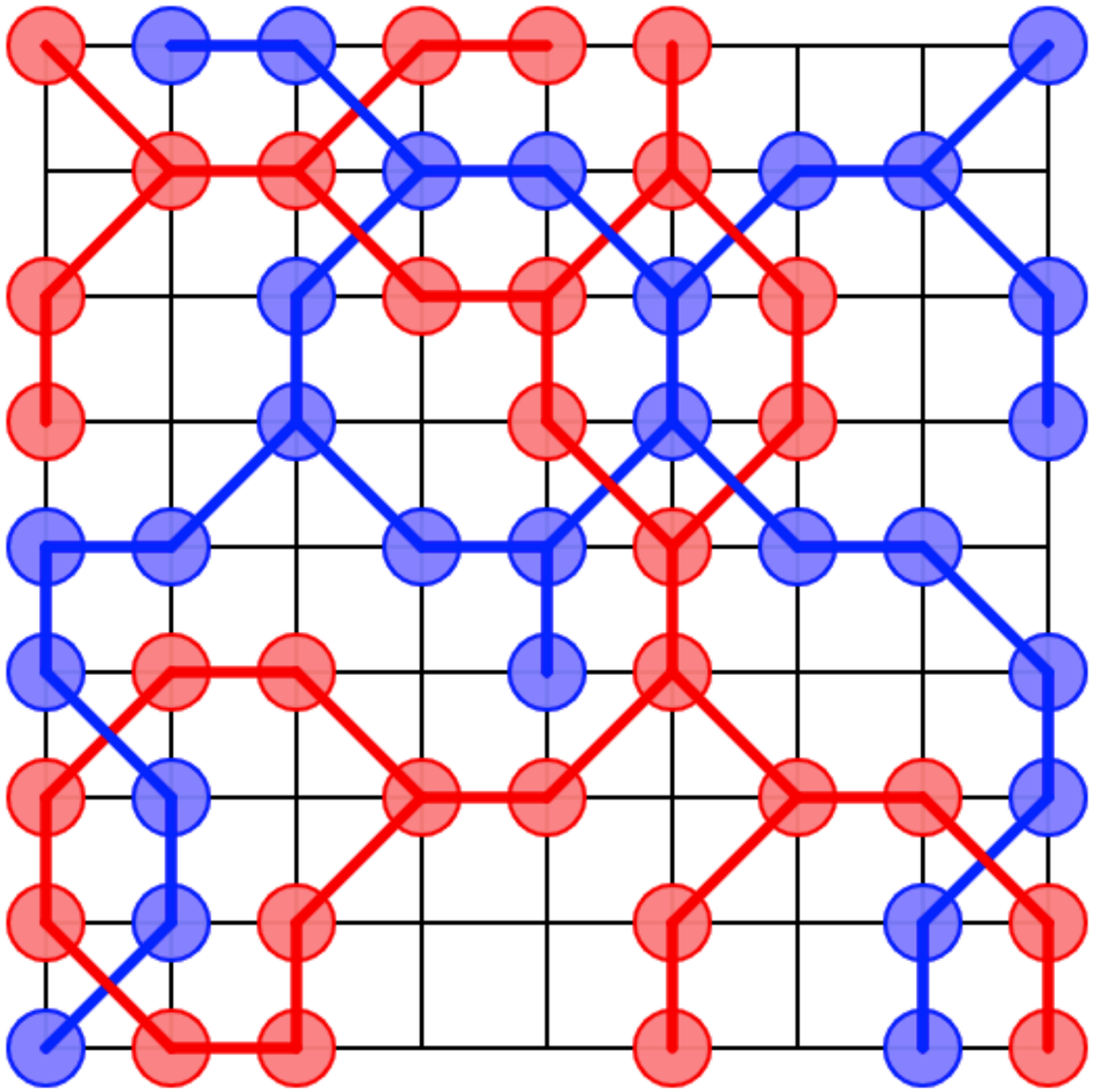
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

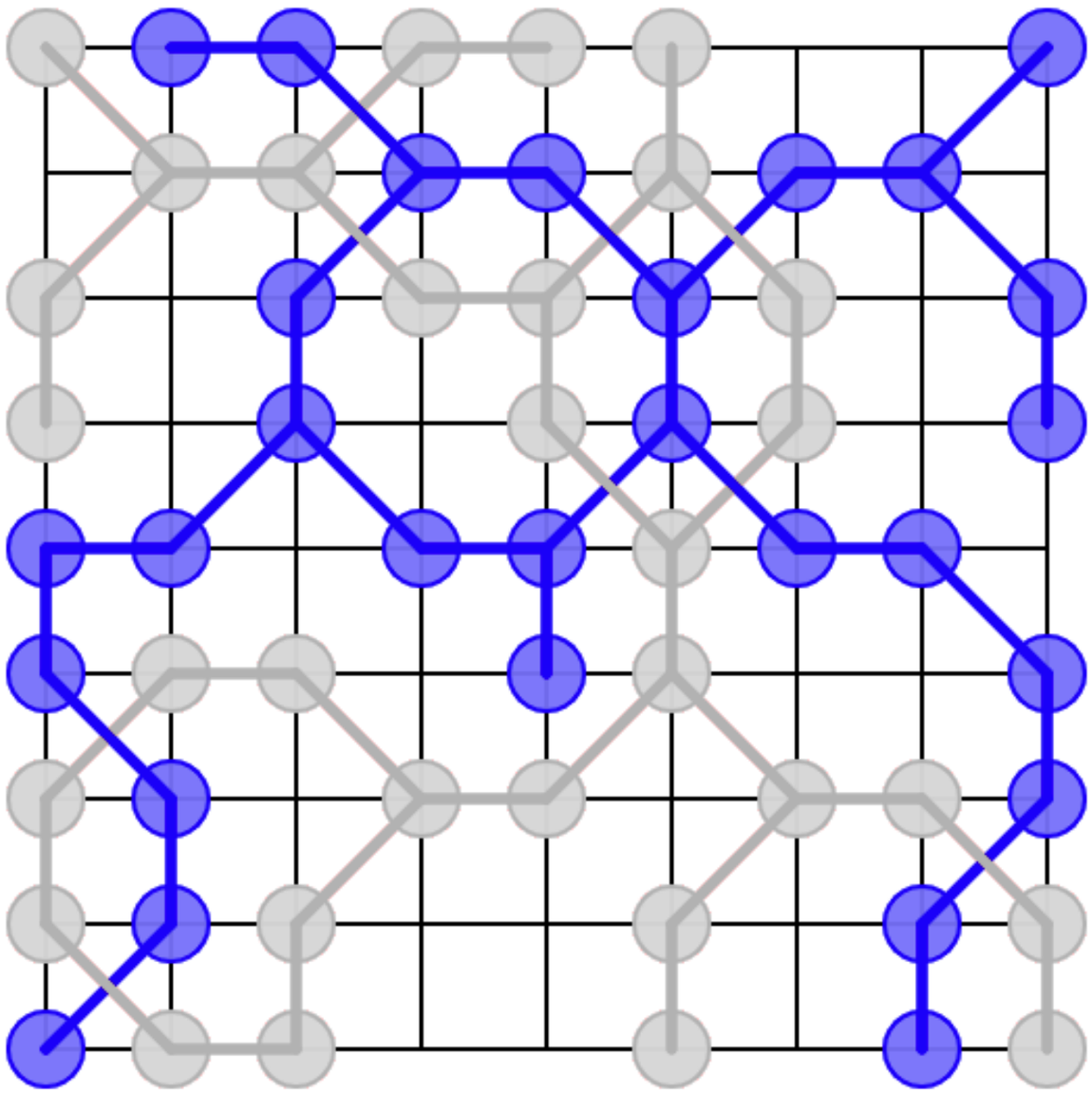
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

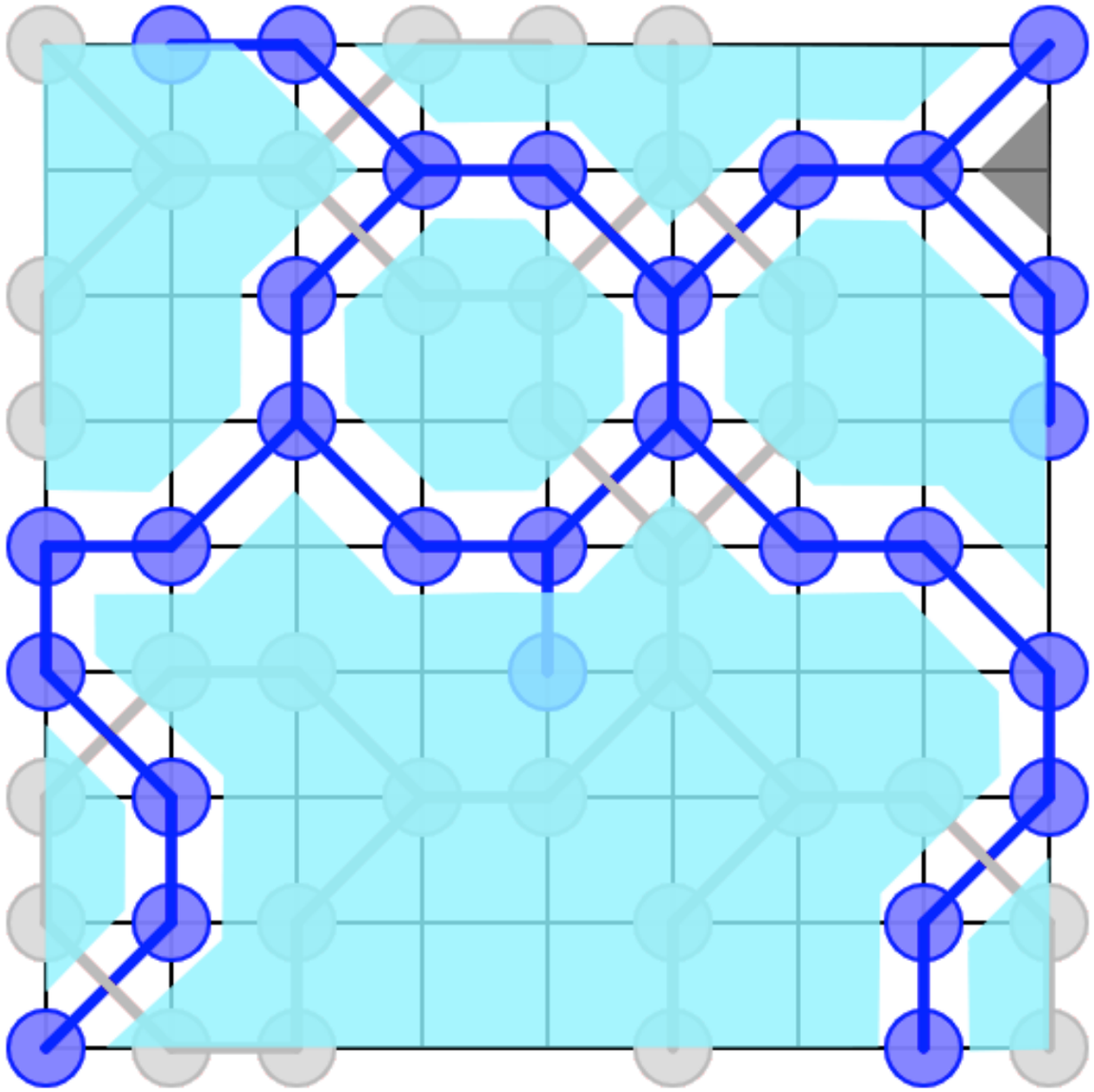
An example final result

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



最終結果の例

An example final result

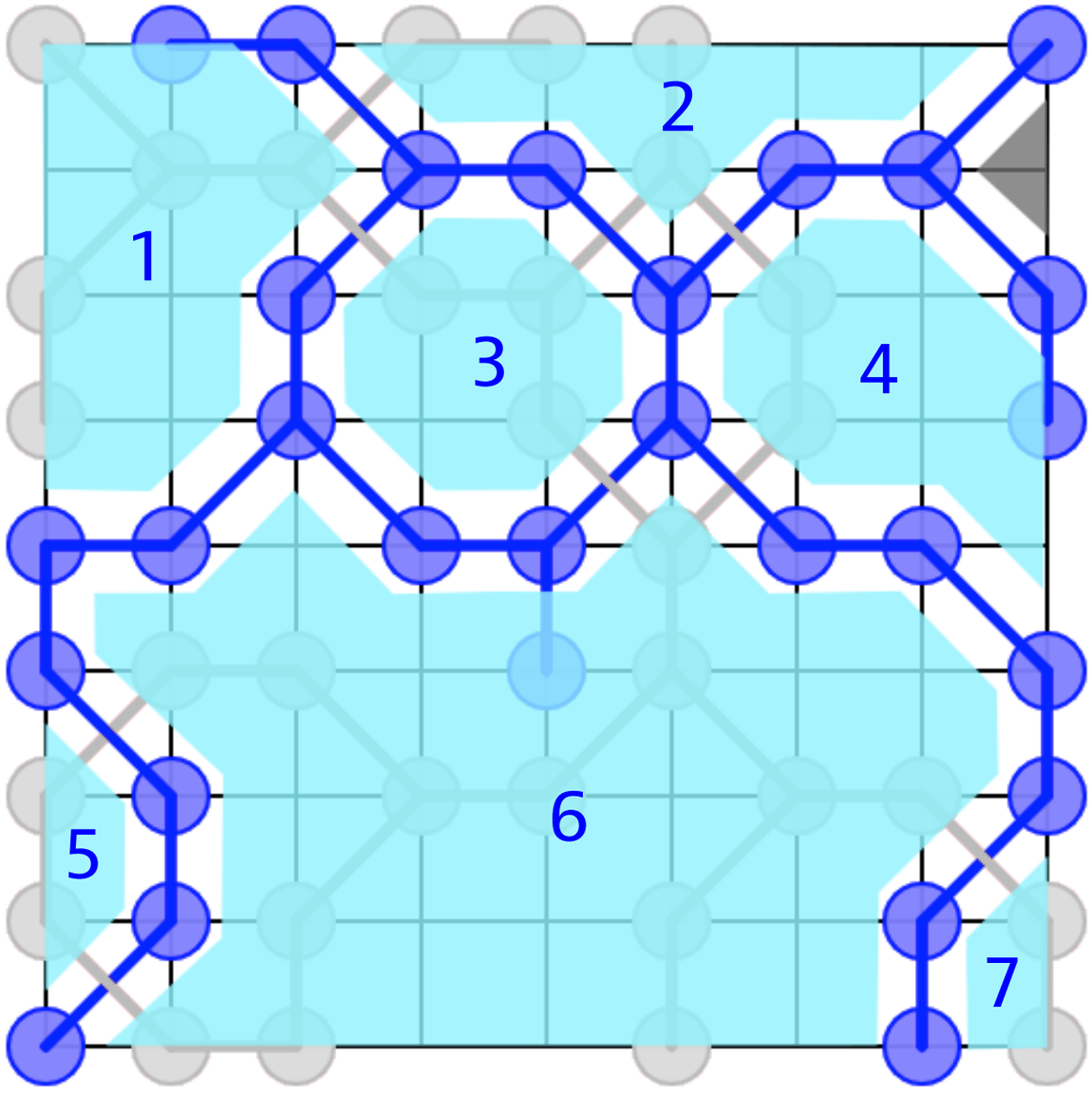
Blue’s score: 7

- 盤面が何個に分割されたかを
  色ごとに独立に数え,
  多い方が勝ち

  Count the number of regions
  divided by edges of one color
  ignoring the other color,
  and the larger wins

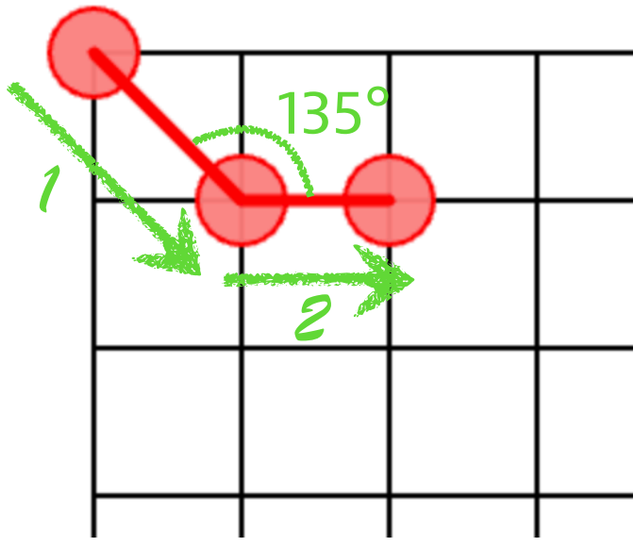
- 面積 1 以下の領域は数えない

  Regions with area ≤ 1 are
  not counted



手番での枝の伸ばし方

How to extend your edges at your turn



1. まず自分の石を 1 つ選び,
   そこから対角線方向に 1 マスにわたる枝を伸ばし,
   その先に新たな自分の石を置く

   First, select one of your vertices and extends from it a diagonal edge that spans one cell, and put a new vertex on the tip of the edge

2. 続いて 1 で置いた石から 1 の枝と 135° の角をなすように
   さらに 1 マス分枝を伸ばし，その先にまた自分の石を置く

   Then, append another new edge to the new vertex so that the added two edges form a 135° corner, and put another new vertex on the tip

   - 或いは 2 つ目の枝を伸ばした先にもともと自分の石があってもよい

     We also allow cases where one of your vertices is already on the last tip

枝の伸ばし方の制約

Restrictions on the extension of edges

- すでに石がある位置に上から新たに
  石を置けたりはしない

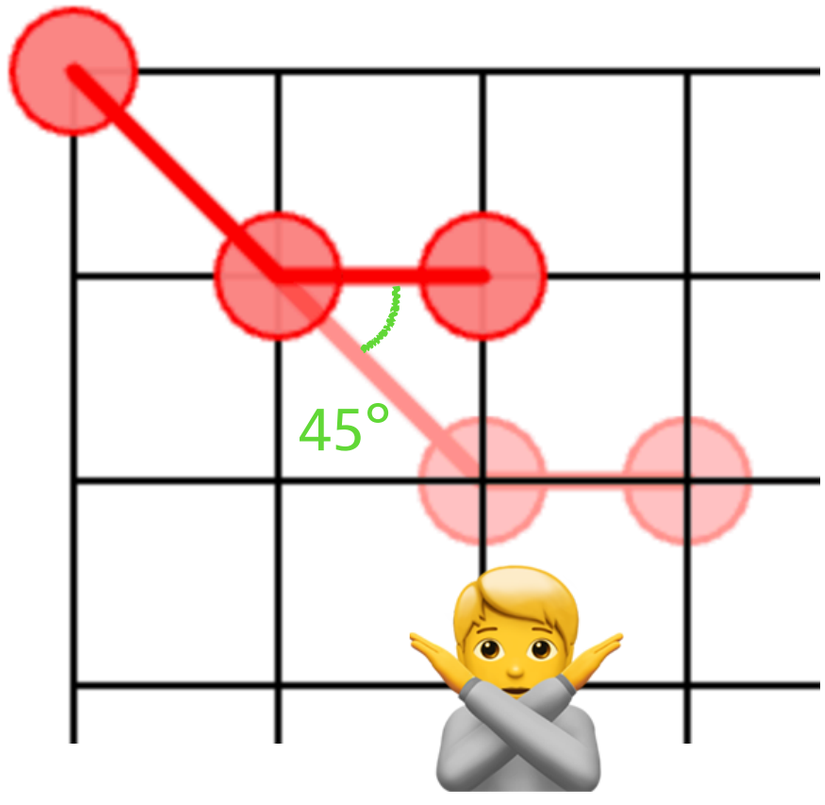
  You can’t overwrite an existing vertex by
  putting a new one

  - これにより両者が邪魔しあう

    By this rule, two players disturb each other

- 枝が 45° の角をなしてはいけない

  Your edges must not form a 45° corner



Separo の対戦 AI

An AI player of Separo

https://toruniina.github.io/separo-rs/

- 作者： Toru Niina（諏訪の友人）

  Creator: Toru Niina (a friend of mine)

- Rust 製で，Wasm にコンパイルされている

  Implemented in Rust and compiled to Wasm

- モンテカルロ木探索をやっている

  Performs Monte Carlo tree search

  - 詳細は本人の記事参照：

    See his blog post for detail:

    https://toruniina.github.io/posts/writing-board-game-ai/