Don’t Connect 5

“The essence of strategy is choosing what not to do”
— Michael Porter

You and your friend Eric are bored playing the classic *“Five in a Row”* game, so both of you decided to make the game more interesting by adding the following rule changes:

- The game now happens on the vertices of a hexagonal grid instead of a board.
- Unlike the classic game, connections do not have to go in a straight line(and there is no straight line to go…) - any path is a connection.
- And you win when you con - ???

“Wait!”, your other friend Kevin interrupted. Kevin has always been bad at the connect 5 game, so he demanded that you and Eric make it a **Don’t Connect 5 game.**

The following are the (actual) rules

- *The board is a hexagonal grid with radius 4*
- *Three players take turns to place stones of their color on the vertices. Each player may choose to pass and not place a stone*
- *The game ends when no stone is placed for three consecutive turns, either because there is no space or no player chooses to make a move.*
- *Score is calculated by the following method for each player:*
    - *For each connected component formed by the stones placed down by the player, the diameter(length of the longest path) in the component is calculated.*
    - *Depending on how many stones are there in the longest path, a score is added to the player’s final score*
    -

#stones	*<3*	*3*	*4*	*5*	*>5*
score	*0*	*1*	*3*	*0*	*0*

    - *The scores from all of a player’s connect components are summed, giving the total score.*

You are to implement one function, `bot_move`

`bot_move` takes parameters

- The current board: a dictionary of {(x, y, z):id}, where x, y, z is the hexagonal coordinate and id is the player id(0, 1, or 2)
- Your player number(0, 1, or 2)

`Bot_move` should output a 3-tuple of hexagonal coordinates, the position of your next move; or `None`, if no move is intended to be taken.

Instructions for using the visualizer

- Run `hex_grader.py` and the game file will be saved in the `games` folder
- Run `hex_visualizer.py` and select the save file you want to visualize

For using the visualizer,
Press < > to go forward/back, hold for fast forward/backing
Press C to toggle coordinate
Press Space to load another save

If Pygame does not work for your device(`NSInvalidArgumentException` something), you may also use the following method:

1. Go to https://replit.com/ and create an account
2. Click “Create Repl” and “Import from Github”
3. Click “From URL” and put in https://github.com/topazand/CMIMC2024-DCON5-Visualizer
4. Use `python3 main.py` as the run command
5. Upload and put your game files into the `games` folder on Repl.it
6. Run and input the name of the file you want to visualize(something.json)
7. Follow the `using the visualizer` instructions above.

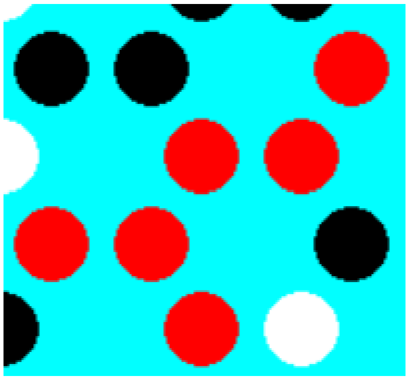
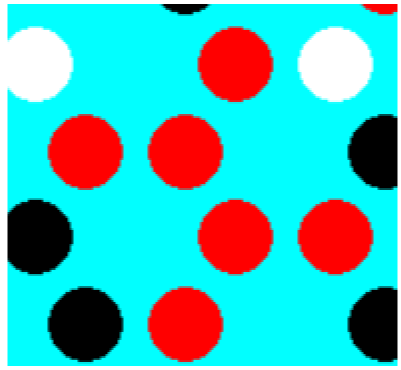
Time/Memory

- Memory limit: 256 MB
- Time limit: 30 seconds **for each game**(not each move)
- If there is a timeout, your bot will **not move** for the rest of the game.
- In case of an illegal output (occupied or out-of-bound), **no move** will be taken.

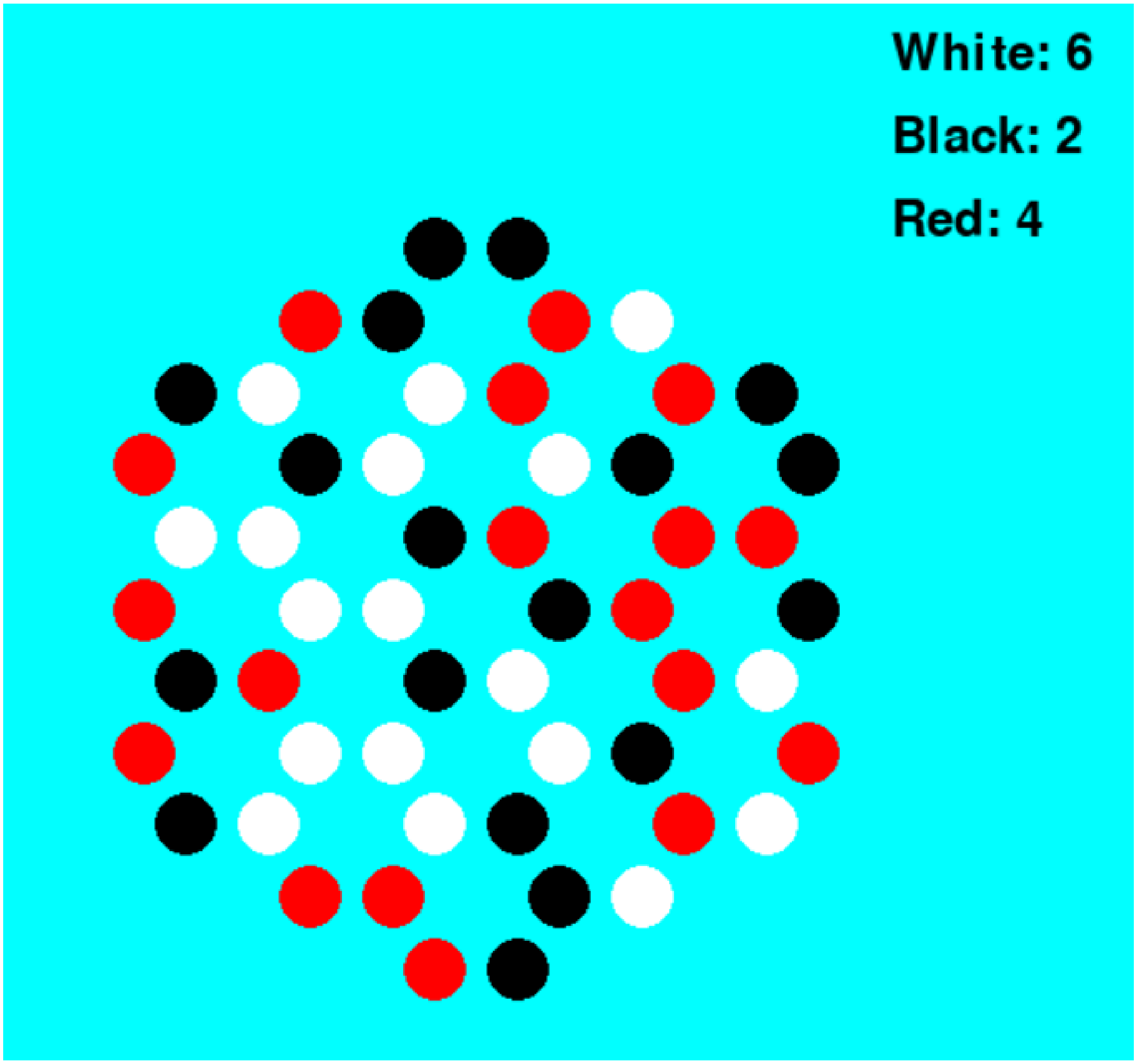
Grading: Your ranking in each game affect your ELO rating, with changes proportional to

Rank	Score	Rank	Score	Rank	Score	Rank	Score
1	1	1	.5	1	1	1	0
2	0	1	.5	2	-.5	1	0
3	-1	3	-1	2	-.5	1	0

Example of longest path calculation

	
This connected component gives red <u>0 point</u> because it has diameter 5.	This connected component gives red <u>3 points</u> because it has diameter 4.

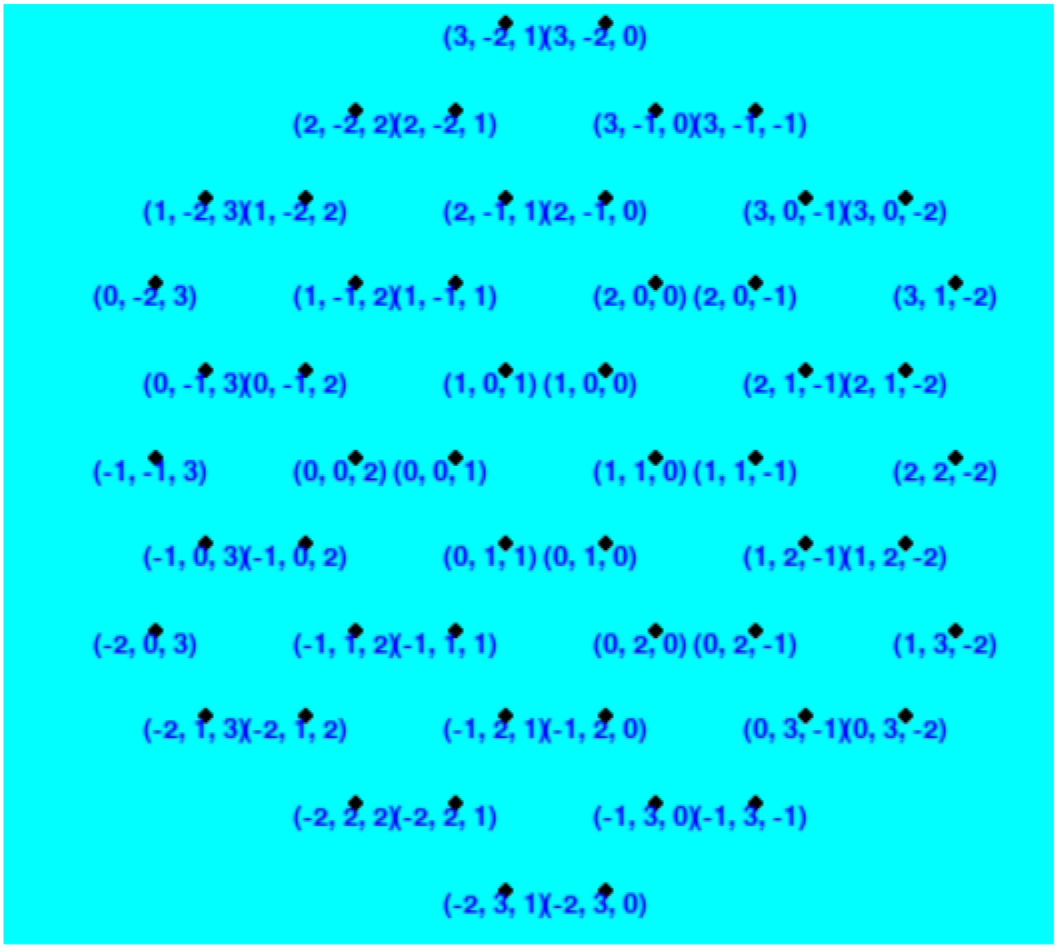
Example of score calculation



In the above game,

- White has 3 + 3 = 6 points since it has two connected components each of diameter 4.
- Black has 1 + 1 = 2 points since it has two connected components each of diameter 3.
- Red has 3 + 1 = 4 points since it has one connected component of diameter 4 and one of diameter 3.

Explanation of Hexagonal Coordinates



Each position is encoded by a coordinate (x, y, z). The 'center'(which is not a valid position) has coordinates (0, 0, 0). An increase in each entry of the coordinate corresponds to moving in a certain direction.

- x: 60 deg, top-right
- y: -60 deg, bottom-right
- z: 180 deg, left