Data Systems
Reversi/Othello - Group Assignment 2

NOTE: This assignment is built on top of the previous one, although you are allowed to make changes to the designs submitted in the previous one

SCENARIO: In this assignment you are given a Database which has a million games which have already been played. These games have been played until the very end. And now whenever a player plays a new game he/she will ask certain queries to strategise his/her game on the go and you have to answer those queries in a certain time limit. You can assume the time limit by yourselves but keep it decently fast as the player is playing in real time and he/she will expect your program to output results fast enough for him to actually use them.

QUERY DETAILS:

Firstly you are supposed to **define similarity** between 2 board orientations of the game. Then you have to suggest an algorithm **KNB**(K Nearest Boards) similar to **KNN** which returns the k most similar boards from the Database, given a board orientation (passed as an argument).

Then for the following queries it is assumed that these are made to run on the k nearest boards of the given board orientation. *You are expected to make an analysis on these k orientations.*

1. Query 1 [LONGEVITY]: You are given a position (i,j) and the move on which you are currently at. Then you need to answer the following
   a. Whether the color at position (i,j) will be flipped in the next move or not.
   b. For how many moves you can guarantee that this position will not be flipped.
   c. In the next move, all positions in the board that are going to become flippable.

2. Query 2 [DIFF IN FLIPS]: Suppose you are at the ith move and when player 1 plays (white) it turns "k" blacks to white and subsequently when player 2 plays (black) it turns "l" whites to black. Then we can define gain for player 1 as (k-l). Now, you need to answer the following
   a. Return all the i's such that player 1 is gaining at least "b"
   b. Return all the sequences of moves (i,i+1,i+2, ….. i+p) such that player 1 is continuously gaining at least b in all these moves and p is the highest such number.

3. Query 3 [MAX FLIPS]: Return all locations (i,j) which suffered maximum number of flips which happened throughout the games played.
4. Query 4: For the given board orientations, give me all the positions (i,j) which will not change forever (based on the KNB) . That is No matter what you or the other player plays the color at this position (i,j) will not change.
   a. ALTS for this query
      i. ALT1: Give me all the positions (i,j) which will not experience a color change in the next "m" moves.
      ii. ALT2: Give me the (i,j) such that if black plays and it flips k whites to black then when white plays it can only flip at most k blacks

NOTE: You are only expected to solve the original Query 4 not the ALT versions. Those are just for reference.

OPEN ENDED (Needs to be Answered)
What all other queries (at least 2) might be there in such a given scenario and how will you execute them?

KEY TAKEAWAY
Understanding the connection between Indexing, Page Design and Query Execution. (Comment on it)

NOTE:
In all the above queries, the board size is assumed to be 1000*1000. Also we expect you to give a gist of things like idea of how your solution works and what page designs and indices can help to make the execution of queries faster. We DO NOT expect detailed solutions.