Assignment 2 (Marks <20>): To be done in group of 3 students

Instructions:

- Posting Date: <17/Sept/2021>
- Due date of submission <30/Sept/2021>
- Late submission (latest by 5th Oct) will be evaluated out of 15 marks.
- Demo: TA will announce demo Schedule during Lab timings on <24th Sept 2021>
- Group information must be provided latest by 20th Sept. Surbhi will send you google form to collect group information.
- The program should be well documented.
- Zero tolerance for Plagiarism.
- Identify individual contribution in terms of % and marks will be suitable awarded. But questions can be asked from entire assignment irrespective of your contribution.

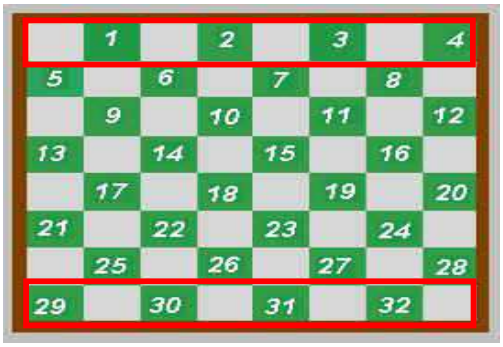
Develop and implement the following in C/C++/Java/Python:

1. GUI Display for the Checker Board. (4 marks)
2. Write a program for playing checkers games with a computer using the following game playing strategies discussed in class:
    a. Random (3 marks)
    b. Mini-Max (5 marks)
    c. Alpha-Beta Pruning (5 marks)
3. Prepare documentation to explain the strategies, compare the various strategies and comment on the algorithm used in the main program (3 marks).

Checker Game and its Rules
(Source reference: http://home.clara.net/davey/newpage5.htm)

The check board description:

- The checker board is 8 X 8 square, alternately light and dark (or black and white).
- The game is played only on the black (dark) squares, which for the purpose of reference are assigned numbers from 1 to 32 (see image below).
- There are 12 discs (**called men**) for each side.
- Starting status, one side occupies squares 1 to 12 and the other side occupies squares 21 to 32



Movement Rules:

A. The ordinary movement of a man:

1. A **man** moves diagonally forward left or right from one square to an immediately neighboring vacant square.
2. When a man reaches the farthest row forward (the king-row: top or bottom row for opponent player – marked with red in the diagram) it becomes a **king**.

B. The ordinary movement of a **king** (crowned man):

3. The king moves from one square diagonally forward or backward, left or right, to an immediately neighbor vacant square.

Capturing Movement Rules:

4. To capture the opponent's piece, a man moves from one square over a diagonally adjacent and forward square that is occupied by an opponent's piece and on to a vacant square immediately beyond it. On completion of the jump the captured piece is removed from the board.
5. The capturing movement of a king is similar to a man, but it can move both directions, forward and backward direction.
6. The capturing move of the piece (man or king) is continued until all the jumps are completed.

Exception: if a man reaches the king-row by means of a capturing move, it then becomes a king but may not make any further jumps in the same turn.

7. All capturing moves are compulsory, whether offered actively or passively. If there are two or more ways to jump, a player might select any one he wishes, not necessarily that which gains most pieces. Once started, a multiple jump must be carried through to completion.

Definition of a Win

8. The winner of the game is one who can make the last move; that is, no move is available to the opponent on his turn to play, either because all his pieces have been captured or his remaining pieces are all blocked.

Definition of a Draw

9. The **50-move rule**: The game shall be declared drawn if, at any stage of the game satisfy one of the followings:
    a. Neither player has advanced an uncrowned man towards the king-row during the previous 50 moves.
    b. No pieces have been removed from the board during the previous 50 moves.

Step Choosing Strategy:

- If there is a capture step, it has to choose that step (refer to rule 7).
- Choose step that minimizes the number of possibilities of steps (steps without being captured) of the opponent.

- Choose the step that has possibility to capture more than one piece.
- Choose step so that it can keep the lanes to the king's row blocked for the opponent.
- Choose step that can capture the pieces of the opponent, but the opponent can't do.
- Looking for step that can move between the own pieces and the opponent in order to move adjacent to an opposing checker without loss.
- Choose step in which if the opponent capture one piece, it can capture the opponent at least one piece.
- Choose the step that can reach the farthest row safely in order to become a king.

References:
1: Wikipedia : http://en.wikipedia.org/wiki/Checkers
2: Martin Fierz's web page: http://www.fierz.ch/checkers.htm
3: Anders Baumann: checkers documentation and design:
http://www.andersbaumann.dk/checkers/checkersDoc.html
4: https://www.openbookproject.net/py4fun/minimax/minimax.html
5: https://www.cs.huji.ac.il/~ai/projects/old/English-Draughts.pdf
6: https://cardgames.io/checkers/