Homework Assignment

The homework assignment is the primary technical evaluation mechanism. It has several parts. Expect to take a couple of days to complete this assignment; let us know if you need more time.

Programming Exercise

Build an application that allows users to interactively explore a dataset. This CSV file represents the data in question, however, you should design your application under the assumption that the actual data to be explored would be larger than can fit in RAM. At minimum, the application should support displaying the total number of viewers, by genre, from a set of cities defined by the user.

Take into account the following considerations in your design:

- The actual dataset being explored is larger than can fit in memory
- The application should provide some sort of reasonable, if elementary, user interface for the exploration
- Requirements change over time: will it be reasonably easy to extend or change your application to support additional interactions? For instance, can you filter the data by other parameters? Can you group the data by other fields? Can you change the metric being explored from “total number of viewers” to something else (e.g., average number of viewers)? It is not necessary to actually handle all possible cases, but it should be clear how the design would support change and extension.
- What if the underlying data model changed over time? What if the data model were made more complex and had additional tables, such as metadata about the cities or metadata about the programs (a simple such change might be supporting multiple genres per program)? Again, your application does not need to anticipate all possible changes in the data, but it should be clear how the design could support such changes.
- Suppose that your application is so wildly successful that other teams would like to integrate the same analytics your application produces into their own applications; consider how that sort of integration might be accomplished in your design.

The choice of programming language and any frameworks, libraries, or other tools (e.g., databases, etc.) is up to you, but please make every effort to make it clear how to install any dependencies and how to build your application so we can run it. (If this is complex, consider using Docker.)

Also, please anticipate how other developers would extend, modify, and use your code in the future.

Perform a Code Review

Code review is an important part of our development process. Every piece of code we write undergoes code review by other members of the team before it is merged. Here is a small piece of code written in Python 3.8; what comments would you provide during code review? Write your comments the way you would if this was an actual pull request in GitHub/GitLab/etc.

```
import random


class TicTacToe:

    def __init__(self):
        self.board = [None]*9

    def make_move(self, row: int, col: int, player):
        position = col*3 + row
        self.board[position] = player
        return

    def make_random_move(self, player):
        available_squares = []
        for i in range(9):
            if self.board[i] is None:
                available_squares.append(i)
        position = random.choice(available_squares)
        self.board[position] = player
        return

    def _get_position(self, row, col):
        return col*3 + row

    def _get_board_state(self, row, col):
        position = self._get_position(row, col)
        return self.board[position]

    def _check_diagonal_win(self):
        center_square = self._get_board_state(1, 1)
        if not center_square:
            return None

        if ((center_square == self._get_board_state(0, 0)) and
                (center_square == self._get_board_state(2, 2))):
            return center_square
        elif ((center_square == self._get_board_state(0, 2)) and
              (center_square == self._get_board_state(2, 0))):
            return center_square

        return None

    def _check_row_win(self):
        for row in (0, 1, 2):
            if (self._get_board_state(row, 0) ==
                self._get_board_state(row, 1) ==
                    self._get_board_state(row, 2)):
                return self._get_board_state(row, 0)

        return None
```

```
    def _check_col_win(self):
        for col in (0, 1, 2):
            if (self._get_board_state(0, col) ==
                self._get_board_state(1, col) ==
                    self._get_board_state(2, col)):
                return self._get_board_state(0, col)

        return None

    def check_win(self):
        for check_winner in (self._check_diagonal_win,
                             self._check_row_win,
                             self._check_col_win):
            winner = check_winner()
            if winner:
                return winner

        return None

    def display_board(self):
        board = [square or ' ' for square in self.board]

        template = f"""
          {board[0]} | {board[1]} | {board[2]}
         --- --- ---
          {board[3]} | {board[4]} | {board[5]}
         --- --- ---
          {board[6]} | {board[7]} | {board[8]}
        """

        print(template)

        return


def main():
    ttt = TicTacToe()

    while True:
        ttt.display_board()
        print("Player X, choose your next move!")
        row, col = [int(square) for square in input().split(',')]
        ttt.make_move(row, col, 'X')
        winner = ttt.check_win()
        if winner:
            print(f"Player {winner} has won!")
            break

        ttt.make_random_move('O')
        winner = ttt.check_win()
        if winner:
            print(f"Player {winner} has won!")
            break

    return


if __name__ == '__main__':
    main()
```

Recommend a Technology

Imagine you intend to run the application you wrote for your programming exercise in production as a web-delivered service, and it will be accessible to the general public, so may need to support a fair amount of user load. (You don't need to assume that the users will have accounts or that you need to save any user state.)

What technologies or platforms would you recommend and why? What changes might you have to make? What additional considerations would you need to think about to operate and maintain the system?

Recommend a Process

Imagine you are working on a Scrum team doing two week sprints. The team finds that, quite often, planned stories aren't being completed within the sprint and are "rolling over" into the next sprint.

- Is this really a problem? If so, why, and what consequences might it have?
- What processes or strategies might the team adopt to improve?