111B Data Science and Python Programming

Homework Assignment #4

Due: 4/25 12:00:00

In this sunny and beautiful season, the annual NBA Playoffs are in full swing. In order to provide gamblers around the world (such as Peter) with a bright light in the void of gambling, you decided to write an NBA Playoffs simulator, to simulate which team is going to be the 2023 NBA champion.

KINDLY REMINDER
Please use Google, ChatGPT, or BingAI
if you don't know the rule of NBA Playoffs.

By the way, the TAs will be busy on watching games next week, so the TA class will be suspended once. This means you only have one chance to "hold their thighs" on 4/13.

Problem #1: Create the Simulator (60%)

The league standings of the NBA'22-23 season is stored in the "**data.csv**" file. You can find the record of each team in regular season and you can calculate the winning rate of each team. For simplicity, if team A and team B meet in the playoffs, the winning rate of these two teams in this round is defined as the following equation.

$$\text{The winning rate of team A} = \frac{w_A}{w_A + w_B}$$

where w_A and w_B represent the winning rate of each team in the regular season, respectively. Please create a simulator called "**simPlayOffs**" that aims to simulate the NBA Playoffs.

Here is the sample code,

```python
def simPlayOffs(csvDir, numTrials=100, toPrint=False):
    data = pd.read_csv(csvDir)
    result = {}

    for tournament in range(numTrials):
        sim = playoffs(csvDir)
        # Play-In Tournament
        sim.playin()
        # First Round
        sim.firstRound()
        # Second Round
        sim.secondRound()
        # Conference Final
        sim.conferenceFinal()
        # Final
        champion = sim.final()
        if toPrint:
            print("{} wins the 2023 NBA Finals !!!".format(champion))
        result[champion] += 1

    return result
```

If everything goes well, you might get something like this when you run the script:

```
(nycudopcs) O:\                                          \HW4>py main_hw4.py --num 10
MEM wins the 2023 NBA Finals !!!
PHX wins the 2023 NBA Finals !!!
BOS wins the 2023 NBA Finals !!!
LAC wins the 2023 NBA Finals !!!
BOS wins the 2023 NBA Finals !!!
PHX wins the 2023 NBA Finals !!!
PHI wins the 2023 NBA Finals !!!
BOS wins the 2023 NBA Finals !!!
PHI wins the 2023 NBA Finals !!!
PHI wins the 2023 NBA Finals !!!
```

Problem #2: Monte Carlo Simulations (40%)

Once you have created the simulator for NBA Playoffs, you can use that to analyze the probability of winning the NBA Champion for each team. Please count your simulation results and draw an analysis chart as follows.

```
(nycudopcs) O:\                                    \HW4>py main_hw4.py --num 100 --qn 2
```


Probability of Winning the 2023 NBA Championship (100 trials)
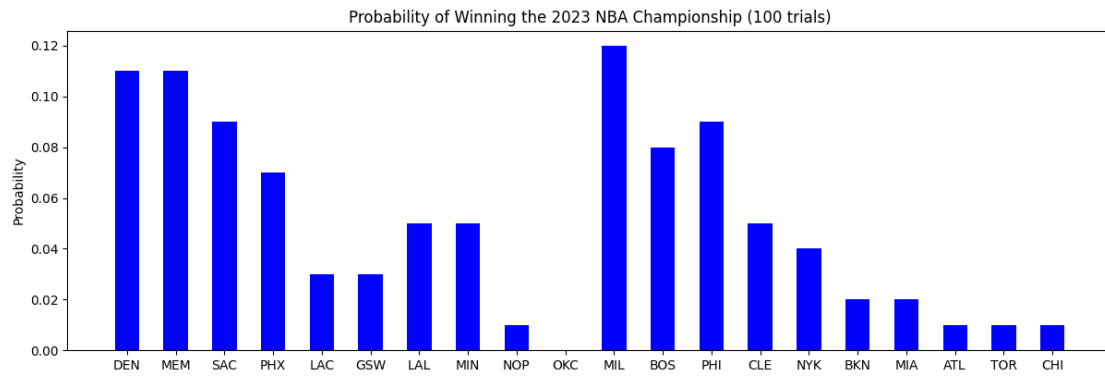
Please accomplish this homework with an organized code (e.g., with <u>main script</u> and <u>function script</u>). For example, you can package your scripts that related to the class object in a module "**obj.py**", some useful functions in other module, and remain the main content in the <u>main script</u> "**main_hw4.py**" clear. In addition, you should use "**argparse**" to set all related parameters of this homework. Here is a template for your code structure:

```
111B_hw4_0123456789
    ├── data.csv        # .csv data
    ├── obj.py          # Objects
    ├── utils.py        # Utility functions for hw4
    └── main_hw4.py     # Main script of hw4
```

You don't need to follow this structure, just keep your main script clean.

Hand in procedure:

As we had mentioned in the lecture, you should list all your collaborators in your programs. Here is the template:

```
"""
Created on Sun Aug 7 01:23:45 2022

@author: Xi Winnie, student ID

@collaborators: Jane Doe, her student ID
                John Doe, his student ID
"""
```

Please save your code as a "**.zip**", "**.7z**", or "**.rar**" file, where the file name should follow this format:

<div align="center">111B_hw4_<mark>ID</mark>.zip</div>

For example,

<div align="center">111B_hw4_0123456789.zip</div>

Please be aware. **We are not going to accept any homework file with wrong file name or without signature**. Please double check the content of your files.

Once you have accomplished your works, you can upload your homework to the "E3@NYCU" system. There will be a section for uploading your homework.