Ananya Singh
Assignment #1

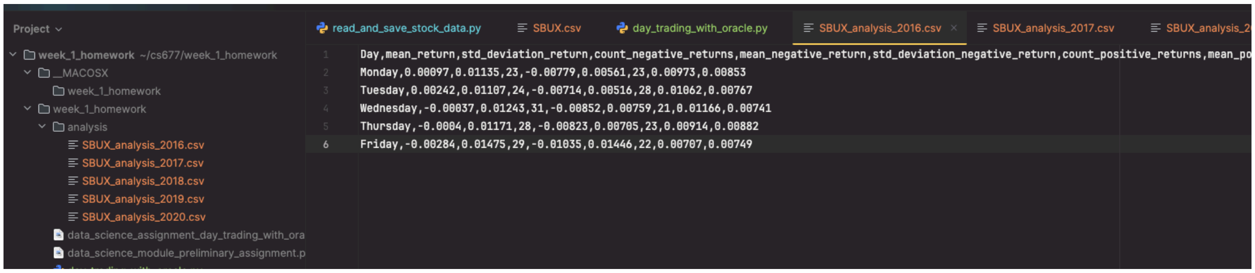
Ticker: Starbucks ($SBUX)
Main file: day_trading_with_oracle.py

Notes: For the assignment, I outputted much of the analysis in CSV files under analysis directory, making it easier to review large datasets and meet the assignment's requirements efficiently and hopefully easier for you to grade,

Problem 1:

- Part 1 and 2

    For all the tables, please look under the analysis folder. I have generated csv for the tables for each year. You should see this:

    ```
    Day,mean_return,std_deviation_return,count_negative_returns,mean_negative_return,std_deviation_negative_return,count_positive_returns,mean_po
    Monday,0.00097,0.01135,23,-0.00779,0.00561,23,0.00973,0.00853
    Tuesday,0.00242,0.01107,24,-0.00714,0.00516,28,0.01062,0.00767
    Wednesday,-0.00037,0.01243,31,-0.00852,0.00759,21,0.01166,0.00741
    Thursday,-0.0004,0.01171,28,-0.00823,0.00705,23,0.00914,0.00882
    Friday,-0.00284,0.01475,29,-0.01035,0.01446,22,0.00707,0.00749
    ```

    You can open it in excel for better formatting. Please refer to analyze_stock_data() method to see how I structure the data.

    I have also created a method compare_daily_returns_across_years() where it gives me multiple types of analysis on the data for each year and using save_comparison_results(), I aggregate the data into one table in csv format so it's easier for me to analyze (and for you to look at as well). This table includes how much gained/lost metrics, average magnitude of loses/gains, and frequency of gains/losses. *This will help me answer all the following questions!*

- Part 3
    - 2016: 135 negative vs 117 positive (more negative)
      2017: 125 negative vs 126 positive (slightly more positive)
      2018: 110 negative vs 141 positive (significantly more positive)
      2019: 103 negative vs 149 positive (significantly more positive)
      2020: 123 negative vs 129 positive (slightly more positive)
      Overall: 596 negative vs 662 positive days
    - There are more positive returns days than negative days.
- Part 4
    - 2016: Losses were smaller than gains on all days except Friday
      2017: Losses were smaller than gains on all days except Friday

    2018: Losses were larger than gains on all days except Friday
    2019: Mixed pattern, with larger losses on Mondays and Thursdays
    2020: Mixed patterns
  - It seems when losses occur, they tend to be larger in magnitude (especially around 2019 and 2020)
- Part 5
  - Monday: volatile, 2020 had larger swings
  - Tuesday: stable, consistent gains than losses
  - Wednesday: balanced
  - Thursdays: larger losses than gains (especially in 2020)
  - Friday: most volatility and largest differences between gains and losses
  - It seems like the day of week patterns are not consistent over time so inconclusive.

Problem 2

- Part 1
  - Other than 2020, Monday through Thursday was stable
    - Tuesday to Thursdays had more consistent patterns such as balanced gains and losses and low volatility
  - Friday had it its extreme
    - Highest losses in 2016-2017
    - Highest gains in 2018-2019
- Part 2
  - Monday: became more volatile overtime
  - Tuesday: most consistent day (maintained balanced returns)
  - Wednesday: increased volatility over time
  - Thursday: gradually increasing losses over years
  - Friday: most inconsistent day year-over-year
  -
- Part 3 (gain/loss potential shows risk/reward trade-off)
  - 2016:
    - Best: Tuesday (+0.01062%, -0.00714%)
    - Worst: Friday (+0.00707%, -0.01035%)

    2017:

    - Best: Wednesday (+0.007%, -0.00652%)
    - Worst: Friday (+0.00863%,- 0.01146%)

    2018:

    - Best: Friday (+0.01411%, -0.01117%)
    - Worst: Wednesday (+0.01058%, -0.01202%)

    2019:

    - Best: Friday (+0.01139%, -0.008%)
    - Worst: Monday (+0.00447%, -0.00887%)

  2020:

    - Best: Tuesday (+0.01875%, -0.01328%)
    - Worst: Monday (+0.02092%, -0.02548%)

- Part 4
  - Yes, the best and worst days for SBUX stock change significantly year to year (calculations below is based off of mean_return col). Mean_return shows overall average performance:
    - Best days shift:
      - 2016: Tuesday (+0.242%)
      - 2017: Wednesday (0.154%)
      - 2018: Friday (0.241%)
      - 2019: Friday (0.341%)
      - 2020: Tuesday (0.397%)
    - Worst days shift:
      - 2016: Friday (-0.284%)
      - 2017: Friday (-0.161%)
      - 2018: Wednesday (-0.072%)
      - 2019: Monday (-0.303%)
      - 2020: Wednesday (0.005%)

Problem 3

Please refer to analyze_aggregate_table() and save_aggregate_analysis() methods.

- Part 1/Part 2
  - According to the the analysis, SBUX is very similar to SPY and follows the S&P Market trends very closely. For both SBUX and SPY the best days were Tuesday where the mean return was 0.002% and the worst day was Monday where the mean return was -0.00017%.

Problem 4

Note for grader: Honestly I was very confused by the oracle but I solved it the way I understood it: Investment returns are calculated by multiplying your current value by (1 + return rate) for ONLY the positive returns.

So running our method simulate_perfect_oracle_trading(), these are the results:

Perfect Oracle Trading Results: SBUX: $130.90 SPY: $111.37

Problem 5

Using the same understanding as above, please refer to buy_and_hold_oracle() method.

My results were: SBUX: $100.51 SPY: $99.57

The Oracle (obviously) in this scenario outperformed the buy and hold strategy:

SBUX: Oracle beat buy and hold by $30.39

SPY: Oracle beat buy and hold by $11.80.

Problem 6

Please refer to wrong_oracle_trading() method. When you run the main, you will see the results below.

Part A - Missing Best 10 Days:

SBUX: $112.18

SPY: $104.28

Part B - Realizing Worst 10 Days:

SBUX: $97.82

SPY: $97.13

Part C - Missing Best 5 and Realizing Worst 5 Days:

SBUX: $118.88

SPY: $103.05

Section 2: You gain more by missing the best days rather than realizing the worst days.

Part A (Missing Best Days): Portfolio ends up at $112.18 (SBUX) and $104.28 (SPY)

Part B (Realizing/Investing in Worst Days): Portfolio ends up at $97.82 (SBUX) and $97.13 (SPY)

Section 3: Yes, they are evidently different. This makes sense because in question 4 we had a perfect oracle which only invested in positive returns whereas the oracle gave wrong advice for 10 days (missing 5 best days and investing in 5 worst days) which had a worse performance.

Perfect Oracle: SBUX: $130.90 SPY: $111.37
Part C: SBUX: $118.88 SPY: $103.05

SBUX is $12.02 lower ($130.90 - $118.88, SPY is $8.32 lower ($111.37 - $103.05)