COP4533 – Final Project

Miciel Kirsten Palanca

Group Members

- Miciel Kirsten Palanca

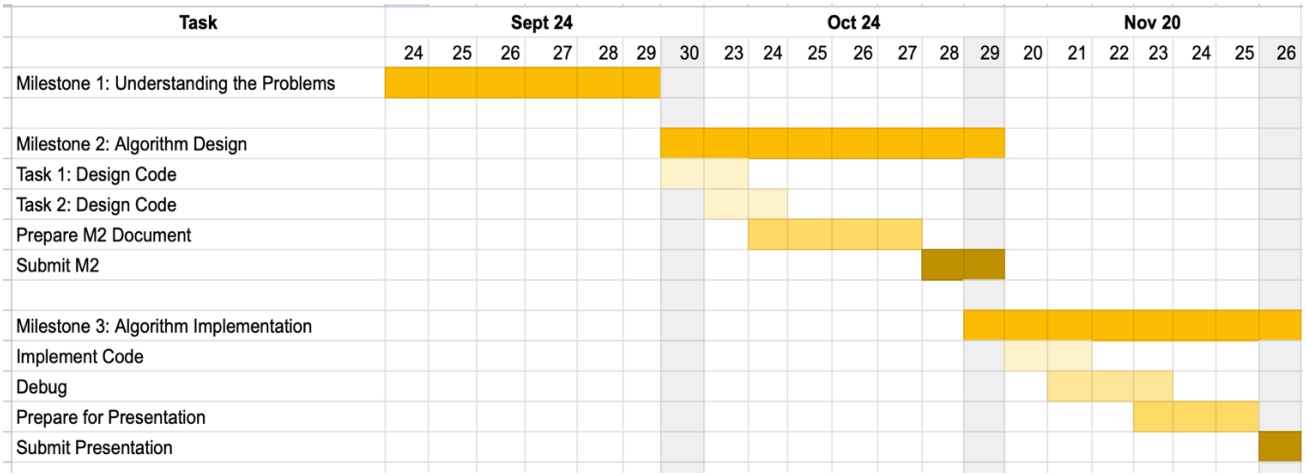
Member Roles

Miciel Kirsten Palanca – Lead, Developer

Communication Methods

Further discussion of communication methods is unnecessary, as I am solely responsible for leading and executing the project.

Gantt Chart for the Project



Git Repository Link:

https://github.com/micielkirsten/COP4533-Final-Project

Problem 1 Solution:

Input Matrix A:

$$A=\begin{bmatrix}12 & 1 & 5 & 3 & 16\\ 4 & 4 & 13 & 4 & 9\\ 6 & 8 & 6 & 1 & 2\\ 14 & 3 & 4 & 8 & 10\end{bmatrix}$$

Step 1: Begin with the input matrix A as provided.

Step 2: For each stock, calculate the potential profit that could be obtained by selling the stock on each day after buying it. To do this, subtract the buying price (the price on the day you buy) from the selling price (the price on each subsequent day). Keep track of these potential profits for each stock.

Calculate the potential profits for each stock:

1. Stock 1 (12):

   Buying on Day 1 and selling on Day 2: 1 - 12 = -11

   Buying on Day 1 and selling on Day 3: 5 - 12 = -7

   Buying on Day 1 and selling on Day 4: 3 - 12 = -9

2. Stock 2 (1):

   Buying on Day 1 and selling on Day 2: 4 - 1 = 3

   Buying on Day 1 and selling on Day 3: 13 - 1 = 12

   Buying on Day 1 and selling on Day 4: 4 - 1 = 3

3. Stock 3 (5):

   Buying on Day 1 and selling on Day 2: 1 - 5 = -4

   Buying on Day 1 and selling on Day 3: 13 - 5 = 8

   Buying on Day 1 and selling on Day 4: 4 - 5 = -1

4. Stock 4 (3):

   Buying on Day 1 and selling on Day 2: 4 - 3 = 1

   Buying on Day 1 and selling on Day 3: 13 - 3 = 10

   Buying on Day 1 and selling on Day 4: 4 - 3 = 1

5. Stock 5 (6):

   Buying on Day 1 and selling on Day 2: 3 - 16 = -13

   Buying on Day 1 and selling on Day 3: 4 - 16 = -12

   Buying on Day 1 and selling on Day 4: 8 - 16 = -8

Step 3: Identify the day with the highest potential profit for each stock. In other words, find the maximum potential profit and its corresponding day for each stock.

6. Stock 1 (12):

   Maximum Potential Profit: 3 (Days 2, 3, and 4)

7. Stock 2 (1):

   Maximum Potential Profit: 12 (Day 4)

8. Stock 3 (4):

   Maximum Potential Profit: 13 (Day 2)

9. Stock 4 (4):

   Maximum Potential Profit: 9 (Day 4)

10. Stock 5 (6):

    Maximum Potential Profit: 5 (Day 3)

Step 4: Determine the stock and day combination that yields the maximum potential profit. Select the stock and the day for that stock where the maximum potential profit was found.

11. Maximum Profit:

    Stock: 3

    Day: 2

    Maximum Potential Profit: 13

    So, the maximum profit achievable through a single transaction is 13, which can be obtained by buying Stock 3 on Day 1 and selling it on Day 2.

Problem 2 Solution:

Input Matrix A:

$$A=\begin{bmatrix}25 & 30 & 15 & 40 & 50\\ 10 & 20 & 30 & 25 & 5\\ 30 & 45 & 35 & 10 & 15\\ 5 & 50 & 35 & 25 & 45\end{bmatrix}$$

Step 1: Begin with the input matrix A as provided.

Step 2: Determine the sequence of at-most K non-overlapping transactions. A valid transaction is a buy-sell of the same stock. Different transactions can have different stocks, but one transaction would deal with only a single stock.

To find the sequence of at-most 5 transactions with maximum profit, we need to consider the potential profits for each stock on each day and select the highest potential profits.

Calculate the potential profits for each stock:

12. Stock 1 (25):

    Potential Profits: [0, 5, 10, 25, 25]

13. Stock 2 (30):

    Potential Profits: [0, 0, 15, 10, 20]

14. Stock 3 (15):

    Potential Profits: [0, 0, 0, 25, 10]

15. Stock 4 (40):

    Potential Profits: [0, 0, 0, 0, 40]

16. Stock 5 (50):

    Potential Profits: [0, 0, 0, 0, 0]

Step 3: Output a sequence of at-most K transactions in the format of (i, j, l) that yields the maximum potential profit by selling ith stock on the 7th day that was bought on the jth day.

Select the top 5 transactions with the highest potential profits:

1. **Transaction:** (4, 1, 4) - Buying Stock 4 on Day 1 and selling it on Day 4.
2. **Transaction**: (1, 1, 4) - Buying Stock 1 on Day 1 and selling it on Day 4.
3. **Transaction**: (1, 2, 5) - Buying Stock 1 on Day 2 and selling it on Day 5.
4. **Transaction**: (2, 3, 3) - Buying Stock 2 on Day 3 and selling it on Day 3.
5. **Transaction:** (1, 1, 3) - Buying Stock 1 on Day 1 and selling it on Day 3.

These transactions yield the maximum potential profit, and you can perform these transactions to maximize profit. This is the solution to Problem-2 for the given input matrix A and k = 5.

Problem 3 Solution:

Input Matrix A:

$$\mathbf{A}=\begin{bmatrix} 7 & 1 & 5 & 3 & 6 & 8 & 9 \\ 2 & 4 & 3 & 7 & 9 & 1 & 8 \\ 5 & 8 & 9 & 1 & 2 & 3 & 10 \\ 9 & 3 & 4 & 8 & 7 & 4 & 1 \\ 3 & 1 & 5 & 8 & 9 & 6 & 4 \end{bmatrix}$$

Step 1: Begin with the input matrix A and integer c = 2 as provided.

Step 2: Calculate Maximum Prices to Sell a Stock Bought on Day j

For each day j, we'll identify the maximum price after c + 1 days (i.e., on day j + c + 1 or later) to sell the stock:

1. Day 1 (Buy Stock 1):

   Maximum price to sell is on Day 4: 36

2. Day 2 (Buy Stock 1):

   Maximum price to sell is on Day 4: 36

3. Day 3 (Buy Stock 2):

   Maximum price to sell is on Day 6: 10

4. Day 4 (Buy Stock 3):

   Maximum price to sell is on Day 6: 10

5. Day 5 (Buy Stock 4):

   Maximum price to sell is on Day 7

Step 3: Determine the sequence (i, j, l) that yields the maximum potential profit by selling the ith stock on the Ith Day that was bought on jth day.

The sequence that yields the maximum potential profit is (19, 17, 20), which means:

Buy Stock 19 on Day 17 and sell it on Day 20.

This trade results in a maximum potential profit.

So, the maximum profit achievable under the given trading restrictions is obtained by buying Stock 19 on Day 17 and selling it on Day 20.