**CME 2204 Assignment-2**

**Dynamic Programming and Greedy Approach**

**17.05.2020 23:59 (Sharp deadline – No extension)**

**Rules** :

* The submissions will be checked for the code similarity. Plagiarism will be graded as zero.
* Other rules are explained at the end of this document.

**Scenario of the Assignment:**

**Part-1**

Assume that you are the owner of a car company. Your company has enough employees to produce **‘p’** cars for each month. However, the number of the demand for the cars differs from month to month. You should design a sales plan for the next ***‘x’*** months. Consider ***‘i’*** is the index of each month (*i=1,…,x****)*** and ***mi***is the demand for ***i th***month. If your company needs to produce more than ***‘p’*** cars for a month, you can hire some interns, paying ***‘d’*** TL per car for that month. Moreover, if your company keeps any unsold car at the end the month, you should pay a **‘garage cost’.** The garage cost will be calculated by the function *G(j)*, where,

*G(j) < G(j+1) , j > 0*

*G(j) > 0*

***To understand the problem:*** Your current employees can produce p=5 cars in a month, for the three month (x=3), m[ ] = { 7, 3, 6 } and G(1) = 5, G(2)= 7, G(3)=10, G(4)=12, G(5)=13, etc... and d=5 TL.

**For the first month**, your employees can produce 5 cars, however, the demand is 7. You can hire interns with the cost of *d\*(7-5)* TL.

**For the second month,** the demand is 3, will you produce 5 and keep 2 cars in the garage for the next months for not paying intern costs? Or will you just produce 3 cars?

**Part-2**

Besides, you must invest the payment that earned from your sales. Cost of each car is **‘B’** TL and you get half of the price at the beginning of the month and the rest will be taken at the end of the month. You have offers from **‘c’** different investment companies. Each investment company offers different rate for each month. At the end of each month, you can change your investment company by paying a taxes at a rate **‘t’** of your invested money or continue with the same investment company without paying any taxes.

***To understand the problem:*** Consider *B=100* TL, *c=3* -> C1 ={ 10, 8, 6 }, C2 ={ 8, 10, 6 }, C3 ={ 6, 8, 10 } and *t* is 2%.

**For the first month**, the demand was 7, so half of it is 7\*100/2 = 350 TL. Your company can invest 350 TL at the begining of 1st month. For only one month, C1 seems as the best option. 10% of 350 = 35 TL, at the end of the month, it will be 385 TL in total. Should you change C1 with C2 or C3 ?

**Hint:** Income at the end of 1st month = the second half of 1st month (350 TL) + the first half of 2nd month (3\*100/2=150 TL) = 350 + 150 = 400 TL.

If you change the investment company you must pay 2% of 385, then add 400 on your money for the second month. If you don’t change the company 385+400 will be invested in the same invesment company.

You are expected to design a dynamic programming approach that **minimizes** the production costs and **maximizes** the profit from invesments at the end of the ***‘x’*** months. In order to evaluate the dynamic programming method, you are also expected to develop a greedy approach for these plans.

Some variables are given in ***‘month\_demand.txt’ , ‘garage\_cost.txt’*** and ***‘invesment.txt’*** files.

The rest of variables(***‘x’, ‘p’, ‘d’, ‘B’, ‘c’*** and ***‘t’***)will be default at the beginning of the code as shown in table-1.

*You should print the difference between “total* ***profit*** *from**invesments” (Part-2) and “the* ***cost*** *comes from interns and garage costs” (Part-1) at the end of xth months.*

You are expected to write a ***Scientific Report*** that explains completed and uncompleted parts of your code. Your report should include comparison of run time complexity and space complexity for both dynamic programming approach and greedy approach that you coded.

**How to upload the documents (report and java file)?**

*As we cannot control the code face to face on these days, we expect your sensitivity in order and format.*

You must create only ***one*** java file named as “StudentID\_Name\_Surname.java” that includes the main, and some functions for dynamic programming approach and greedy approach as seen in Table-1. Also your report must be named as “StudentID\_Name\_Surname.pdf”. Then, put these two files in a folder and archive it as .rar or .zip etc. And upload the archived file such as “StudentID\_Name\_Surname.rar” or “StudentID\_Name\_Surname.zip” to the course page.

**Table-1:** “What must be in your code?“ and “Default start values of variables”

|  |
| --- |
| 2020510999\_Seymur\_Grace.java |
| **public class 2020510999\_Seymur\_Grace {**  **public int DP(...) {**  ...  **}**  **public int Greedy(...) {**  ...  **}**  //You can add different functions here...  **public static void main(String[] args){**  int x=3,p=5,d=5,B=100,c=3,t=2;  //read files...  ....... //Your code  System.out.println(“DP Results:” + ( Profit - Cost ) );  System.out.println(“Greedy Results:” + ( Profit - Cost ) );  // If you can’t find one of Profit or Cost, print it like below:  // System.out.println(“DP Results-Profit: ” + ( Profit) );  // System.out.println(“Greedy Results-Cost:” + ( Cost ) );  **}**  **}** |

**How will you be graded?**

|  |  |  |
| --- | --- | --- |
| **Item** | | **%** |
| Dynamic Programming Approach | Part-1 – ‘Cost’ | 30 |
| Part-2-‘Profit’ | 15 |
| Greedy Approach | Part-1 – ‘Cost’ | 20 |
| Part-2-‘Profit’ | 10 |
| Report | | 20 |
| Correct File Naming | | 5 |

**How will I check and grade?**

I will use the command line ‘cmd’ on my computer. After setting directories, I will run these ccommands for the given default values:

Javac 202051099\_Seymur\_Grace.java

Java 202051099\_Seymur\_Grace

DP Results: ...

Greedy Results:....

Then, I will open your code and change the variables and do test your code for 3-4 times. If all the results are correct, then you will get 75 points from your code and 5 points from correct naming. Then I will examine your report and give you final grade of your assignment.

If your results are not correct, I will first open your report and see missing parts of your code. Then I will examine your code and give you a final grade for your assignment.

**Note:** Different test scenarios will given to you in the following week. (Such as: What are the correct results when specific values are given to variables.)

***Good Luck!***

***Stay Home, Stay Healthy***