Project 2 - Lahmacun Entrepreneur
CmpE 250, Data Structures and Algorithms, Fall 2023

Instructor: Bahri Atay Özgövde
TAs: Kutay Altıntaş, Suzan Ece Ada
SAs: Süleyman Emir Taşan, Arda Yalçındağ

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1   Introduction

In 2071, as artificial intelligence took over all software-related tasks, you made the decision to leave computer engineering and open a lahmacun shop, just before robots entered the lahmacun-making business. Recognizing that a single lahmacun shop would not suffice, you realized the need to establish a chain and adopted a mindset and actions befitting a large company. Following the loss of your job to robots, you used the compensation received to found a company named "Has Urfam Lahmacun." Understanding the necessity for a swift employee bonus system, as well as efficient hiring and firing processes, you contemplated obtaining this system from robots promptly. However, your frustration at losing your job to robots fueled a determination to develop this system yourself. Thus, our entire journey in this project commences here: the initial sparks of the war between a lahmacun entrepreneur and robots.

2   More Details about Situation of the Company

Since our company is newly established, hiring and dismissals will occur frequently. While these processes are subject to an employee's own preferences, our company may also terminate its relationship with the employee (more detailed information will be given in the following sections). Since this is a fast food chain, it is desired to open branches in different cities and districts. We may have more than one branch in each city, but we will have at most one branch in a district. There won't be district without a branch. There might be districts with the same name in different cities, districts and branches should be considered along with the city they belonged to. There won't be two districts with the same name in the same city.

- There may be more than one city and may contain more than one district from the cities.

- There can be at most one branch in a district.

- There may be more than one employee with the same name in the company, but there cannot be more than one employee with the same name in a branch.

- There are four types of employees: Cashier, Cook, Courier and Branch Manager.

- Some employees have **monthly scores** that will be given on a monthly basis. **Not every employee get a monthly score each month**.

- **Promotion points** are calculated based on these monthly scores. Employees are given bonuses based on the remaining monthly scores after they are converted into promotion points. It is explained in more detail in the example part.

- Negative score means a penalty will be taken. It is explained in more detail in the example part.

2.1   Monthly Scores, Promotion Points, and Bonuses

Bonuses and promotion points are calculated according to monthly scores, which will be given in input files (for further details please look at the input&output section). The important point is that every month, monthly scores will be given for some of the employees. Here are the details of calculation of bonuses and promotion points.

- If the monthly score of an employee is positive, every 200 portion of the monthly score will be converted into 1 promotion point and the rest is the bonus that employee will get in that month.

- If the monthly score of an employee is negative, every -200 portion of the monthly score will be converted into -1 promotion point. An employee with negative monthly score will not get bonus that month.

  Examples:

  - 312 monthly score → 1 promotion point and 112$ bonus
  - 423 monthly score → 2 promotion point and 23$ bonus
  - -257 monthly score → -1 promotion point and 0$ bonus
  - -194 monthly score → 0 promotion point and 0$ bonus

2.2   Promotion System

- There is a hierarchy among employees. An employee can start working in any position. If they start as a courier, they will be outside of this hierarchy system. However if they become a cashier, they will start from the bottom layer of the 3-stage hierarchy (Actually they can enter this hierarchical system from anywhere).

- These 3 stages consist of cashier, cook, and manager, respectively (from bottom to top).

- In order to be promoted from the cashier to the cook, 3 promotion points must be collected and in case of promotion, the work must not be interrupted (If there is only 1 cashier, there cannot be a promotion).

- In order to be promoted from cook to manager, one must collect 10 promotion points and wait for the manager to either retire or be dismissed. If there is only 1 cook, there can be no promotion.

- If more than one person collects the required points before the manager leaves the job, first one who have collected 10 points will be promoted.

- There is no promotion for couriers and managers (but still they have promotion points).

- If an employee is promoted, the required amount of points (3 or 10) are subtracted from their promotion points and the rest is reserved. For example, if a cashier have 4 points when they are promoted to cook, they have 1 promotion point next month.

- If an employee wants to leave but they cannot because there won't be enough employee for the branch to operate (more details about this case will be elaborated in the next section), they should get 200$ as a bonus that month.

- However, if an employee has less than or equal to -5 promotion points but cannot be dismissed due to a shortage of employees, and they attempt to leave (they unable to do so), they shouldn't receive any bonus since they are to be dismissed.

2.3   Dismissal or Leaving Job

- Leaving job is arbitrary (will be given in inputs), but a dismissal is done by the company.

- The company makes dismissals based on promotion points.

- If an employee collects -5 promotion points, they will be dismissed. There are some dismissal rules:

  - If a manager's promotion point drops to -5, the cooks are checked.

- If there is only one cook, the manager cannot be dismissed.
- If there is at least one cook who reaches or exceeds 10 points and the total number of cooks is more than 1, the manager is dismissed and the cook who have reached 10 points first is promoted to manager.
- If there is no cook who have reached 10 points, the manager cannot be dismissed that month.
- If the manager gains some points and their points become larger than -5 in the next month, the manager continues to work.
- If the manager cannot get rid of -5 points, the same routine as the previous month should be applied.
  - If a cook is tried to be dismissed and there is only one cook, the cook cannot be dismissed.
  - If there is only one cashier, the cashier cannot be dismissed.
  - If there is only one courier, the courier cannot be dismissed.

- If there is only one courier or cook or cashier in the branch and this person wants to leave, the person is not allowed to leave the job. If the person who wants to leave is the manager, the process in the dismissal section is followed.

- Same rules for being dismissed is applied to leaving. The only difference is that leaving is the choice of the employee, therefore it will be given. However, employees are dismissed according to their promotion points, regardless of their preferences.

2.4 Recruitments

At the end of every **month**, some employees will be recruited to the company.

- For every new recruitment, all information such as which city or branch they will work will be given along with their names and positions.

- Other information such as monthly scores and promotion points should be zero for that month. However, starting from the next month, they can get monthly scores, therefore promotion points and bonuses.

3 Input & Output
3.1 Input
- There will be 2 input files.
- The first one will give information about the initial state of company.
- The second file keeps monthly changes and monthly scores.

- In the second file, there will be periods of more than one month or even longer than a year. Moving to a new month will be indicated by the month names in the file.

- At the end of each month, you may be asked for various types of printouts. These output types will be explained in the output section.

Input File 1	Explanation
Istanbul, Esenler, Alper Yılmaz, CASHIER	A cashier whose name is Alper Yılmaz works in Esenler, Istanbul.
Istanbul, Esenler, Eda Ece, COOK	A cook whose name is Eda Ece works in Esenler, Istanbul.
Ankara, Cankaya, Sema Hor, MANAGER	A manager whose name is Sema Hor works in Cankaya, Ankara
Istanbul, GOP, Osman Yol, COURIER	A courier whose name is Osman Yol works in GOP, Istanbul

Table 1: Initial State Input (Input File 1)

Input File 2	Explanation
January:	
PERFORMANCE_UPDATE: Istanbul, Esenler, Alper Yılmaz, 1572	Alper Yılmaz in Esenler, Istanbul took 1572 in the current month.
PERFORMANCE_UPDATE: Istanbul, Esenler, Eda Ece, -580	Eda Ece in Esenler, Istanbul took -580 in the current month.
ADD: Bursa, Karacabey, Ece Bayrak, COOK	New employee Ece Bayrak will start in Karacabey, Bursa as a cook.
LEAVE: Istanbul, Beyoglu, Canay Elmas	Canay Elmas in the branch Beyoglu, Istanbul wants to leave

Table 2: Monthly Operations (Input File 2)

3.2 Output

- You need to direct various printouts to the output file upon request at the end of each month.

- There are types of requests:

- *PERFORMANCE_UPDATE* : City, Branch, Name, Monthly Score **:** Process the monthly score of the given employee, there may be promotions and bonuses.
- *ADD* : City, Branch, Name, Position **:** Add new employee to the given branch at the given position.
- *LEAVE* : City, Branch, Name **:** Remove the given employee from the given branch if possible. If its not possible some bonus should be given.
- *PRINT_MONTHLY_BONUSES* : City, Branch **:** We ask you for the total bonus amount given at the specified branch that month.
- *PRINT_OVERALL_BONUSES* : City, Branch **:** Total amount of bonus that have given from the start of input file up to now in the specified branch.
- *PRINT_MANAGER* : City, Branch **:** Manager of specified branch.
- Besides these some of direct printouts, You should log actions like promotions, dismissals, and non-existing employee operations as well. Please check out sample input&outputs given to you carefully and write you code according to them.
- Here are some input&outputs:

INPUT FILE 1
Nevsehir, Hacibektas, Bakiye Ekinci, CASHIER
Nevsehir, Hacibektas, Canan Dede, COOK
Nevsehir, Hacibektas, Asli Alkan, COURIER
Nevsehir, Hacibektas, Canipek Elmas, MANAGER
Nevsehir, Hacibektas, Aylin Avci, COURIER
Nevsehir, Hacibektas, Aysun Bayrak, CASHIER
Nevsehir, Hacibektas, Baharnaz Arslan, CASHIER
Nevsehir, Hacibektas, Acarhatun Yilmaz, CASHIER
Bursa, Yildirim, Cankat Yilmazer, CASHIER
Bursa, Yildirim, Canipek Karahan, COOK
Bursa, Yildirim, Abadan Ozdemir, COURIER
Bursa, Yildirim, Benan Cetin, MANAGER
Bursa, Yildirim, Belgin Yigit, CASHIER
Bursa, Yildirim, Bahanur Gunay, CASHIER
Bursa, Yildirim, Belgi Ozdemir, COOK
Bursa, Yildirim, Aysel Dagdelen, CASHIER

INPUT FILE 2

January:
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Aylin Avci, 1630
ADD: Nevsehir, Hacibektas, Gewez Aksoy, COOK
ADD: Bursa, Yildirim, Hakgüzar Ucar, COURIER
LEAVE: Nevsehir, Hacibektas, Aylin Avci
PRINT_MANAGER: Bursa, Yildirim

February:
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Bakiye Ekinci, -774
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Canan Dede, 824
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Asli Alkan, -261
ADD: Bursa, Yildirim, Farik Yasar, COURIER
ADD: Nevsehir, Hacibektas, Burç Demirci, CASHIER
LEAVE: Bursa, Yildirim, Benan Cetin
LEAVE: Nevsehir, Hacibektas, Bakiye Ekinci

March:
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Canan Dede, 1724
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Asli Alkan, -302
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Bakiye Ekinci, 797
LEAVE: Nevsehir, Hacibektas, Canipek Elmas
LEAVE: Nevsehir, Hacibektas, Baharnaz Arslan
PRINT_MONTHLY_BONUSES: Nevsehir, Hacibektas

April:
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Bakiye Ekinci, 441
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Canan Dede, -899
PERFORMANCE_UPDATE: Nevsehir, Hacibektas, Asli Alkan, 1453
ADD: Bursa, Yildirim, Derince Tasdemir, COOK
ADD: Bursa, Yildirim, Bakanay Akbas, CASHIER
LEAVE: Nevsehir, Hacibektas, Bakiye Ekinci
LEAVE: Bursa, Yildirim, Cankat Yilmazer
PRINT_MONTHLY_BONUSES: Nevsehir, Hacibektas
PRINT_OVERALL_BONUSES: Bursa, Yildirim

OUTPUT FILE
Aylin Avci is leaving from branch: Hacibektas.
Manager of the Yildirim branch is Benan Cetin.
Bakiye Ekinci is leaving from branch: Hacibektas.
There is no such employee.
Canipek Elmas is leaving from branch: Hacibektas.
Canan Dede is promoted from Cook to Manager.
Baharnaz Arslan is leaving from branch: Hacibektas.
Total bonuses for the Hacibektas branch this month are: 124
There is no such employee.
There is no such employee.
Cankat Yilmazer is leaving from branch: Yildirim.
Total bonuses for the Hacibektas branch this month are: 53
Total bonuses for the Yildirim branch are: 200

4 Submission

Your code will be graded automatically. Therefore, it's important that you follow the submission instructions.

First, all of your source files should be collected under **Project2/src**. Then, you should zip the **Project2** folder and rename it to $<$**student**$_{id}>$**.zip**. This zip file will be submitted through moodle. Name of your main class **must** be **project2.java**.
Your program will be compiled with the command below:

```
javac *.java
```

The input and output files can be in any folder. Design your code to accept the full path for file arguments. Your program will be run with the command below:

```
java project2 <inputfile1> <inputfile2> <outputfile>
```

Make sure your final submission compiles and runs with these commands.

Figure 1: A Pure beauty

5 Grading

Grading of this project is based on the run and the success of your code in test cases. However, there is a crucial key in grading: **Time complexity. Even if your output is correct, you won't get any points if your code takes too long to run.** We don't expect you to write perfect code, but you have to write code within acceptable time frames.

6 Warnings

1. This is an **individual** project.

2. All source codes are checked automatically for similarity with other submissions and exercises from previous years. Do not copy codes from the internet or your friends. Any sign of cheating will be penalized **-100** points for the project, and there will be disciplinary action in case of recurrence.

3. Parallel Programming is not allowed. The direct use of any parallel programming structure such as Stream and Thread will result in getting a **0**.

4. You cannot include **any** external libraries to your project. Moreover, you cannot use every Java Standard libraries. You can use all libraries in **java.io**. You should implement your own classes for further needs. If you need a standard library, you should not use it without asking us. You are allowed to use as a start: java.util.ArrayList, java.util.Arrays, java.util.Queue, and java.util.LinkedList.

5. You are strongly encouraged to write and use appropriate data structures covered in lectures to achieve decent running times for large inputs. Don't forget that a significant portion of points will be given based on performance with large inputs. Therefore, using correct data structures is an integral part of this project.