Data Structures (CSC212)
Second Trimester 2022/2023
Course Project
25 Marks
Due Date: Phase 1 (13 January 2023 11:59pm).
Due Date: Phase 2 (4 February 2023 11:59 pm).

In this project, you will be using java to develop a theme park management software that will improve the park's visitors' information system. The theme park has one entrance gate, one exit gate, and 4 kingdoms with their internal gates. Visitors are allowed to visit these kingdoms in any order they want by scanning their bracelets in each kingdom gate. However, for marketing purposes, to be able to exit the park, they have to revisit these kingdoms in reverse order in their way out. For example, a visitor who visit kingdoms: 1,2,3, then 4 should scan their bracelets in their way out using the exit gates of kingdoms 4,3,2, then 1. Also, visitors can visit all kingdoms or any number of kingdoms they want.
The program will read as an input the visitors' information from a text file (provided in .txt format), store it in the main memory, to facilitate the performance of several operations. Each visitor information includes the following:

- *First Name and Last Name,* as Strings,
- *Pass Type* as Boolean where 1 indicates a VIP pass holder and 0 indicates a regular pass holder,
- *Phone number* as a String of length 10,
- *Region* as integer indicating the region number a visitor comes from.
- The *order* of the kingdoms visited as integers.

Note: A *region* refers to an area that is part of the country. For example, in Saudi Arabia the regions would be Central, Eastern, Northern , ..etc., However, these regions will be dealt with as numbers (region (1), region (2), ..etc) instead of the names of the regions. Kingdoms on the other hand refer to the areas inside the theme park.

Therefore, the main task of this project is to design a suitable ADT (call it, ThemeParkADT) to store the visitors' information and enable the following operations to be performed **as fast as possible:**

1. An operation to find visitors based on their last name: this function will be used to pull out visitors' information using the last name
2. An operation to display the total number of regions visitors are coming from.
3. An operation to display the regions along with their number of visitors sorted by the total number of visitors from this region (sorted in descending order).
4. An operation to display the number of visitors holding VIP passes from a specific region.
5. An operation to display the current location of all visitors holding VIP passes.
6. An operation to check whether two VIP pass holder visitors from the same region, given their phone number, are currently in the same kingdom.
   Note: If the given visitors or one of them are not VIP pass holders, return false and display an informative message indicating that.
7. An operation to check whether two regular visitors from the same region, given their phone number, visited the kingdoms in the same order. The operation will return true if and only if the two visitors visited the same number of kingdoms in the same order.
   Note: If the given visitors or one of them are not regular pass holders, or do not come from the same region, return false and display an informative message indicating that.

Example:
Consider the following text file:
(Note the variables are separated by "," and each visitor's information is written in a separate line in the given format: FirstName, LastName, Region, PhoneNumber, order)

```
Ahmad,AlAli,1,1,0555555555,2,3,4,1
Sara,AlAli,1,1,0544444444,4,3,2,1
Saleh,AlSaleh,2,0,0533333333,4,3,2,1
Omar,AlOmar,3,0,0522222222,1,3,2,4
Amal,Omran,1,0,0511111111,4,3,1
Salem,Salem,1,0,0512211122,4
Hala,Ameer,2,1,0500000000,1,2
Hind,Ameen,4,1,0505000000,1,2,3,4
Sami,Akram, 1,1 0504000000,2
```

The output of each of the 7 operations are as follows:

Operation	Output
Operation (1) for the last name "AlAli",	Visitor 1: Name: Ahmad AlAli Region: 1 VIP Pass holder: Yes Phone number: 0555555555 Order of visiting the kingdoms: 2,3,4,1 Visitor 2: Name: Sara AlAli Region: 1 VIP Pass holder: Yes Phone number: 0544444444 Order of visiting the kingdoms: 4,3,2,1
Operation 2	The total number of regions are 4
Operation 3	Region 1: 5 Region 2: 2 Region 3: 1 Region 4: 1
Operation 4 for region 1	The total number of VIP pass holders coming from Region 1 is 3
Operation 5	Ahmad AlAli in kingdom 1 Sara AlAli in kingdom 1 Hala Ameer in kingdom 2 Hind Ameen in kingdom 4 Sami Akram in Kingdom 2
Operation (6) for "0555555555" and "0544444444" from Region 1	True
Operation (6) for "0555555555" and "0504000000" from Region 1	False
Operation (7) for "0511111111" and "0512211122" from Region 1	False

Phase 1: (10 marks)

In the first phase of the project, you are asked to describe your suggested design of the ADT for the problem described above and perform the following tasks:

a) Give a graphical representation of the ADT to show its structure. Make sure to label the diagram clearly.

b) Write at least one paragraph describing your diagram from part (a). Make sure to clearly explain each component in your design. Also, discuss and justify the choices and the assumptions you make.

c) Give a specification of the operations (1), (2), (3), (4), (5), (6), and (7) as well as any other supporting operations you may need to **read** the text from a text file and store the results in the ADT (e.g., insert).

d) Provide the time complexity (worst case analysis) for all the operations discussed above using Big O notation. Assume that the number of visitors is n, the number of VIP pass holders is v, and the number of regular pass holders is g, and the number of regions is r.

Phase 2: (15 Marks)

After submitting Phase 1, you will be provided with a graphical representation of the ADT that you are supposed to use in Phase 2. In the second phase of the project, you will implement the provided ADT and the operations specified in the first phase using Java programming language. Your program should contain a Main class that reads a specified text file and perform each of the seven operations that are described in this assignment. You will be asked to run a demo of your program and generate output using several test cases provided by the instructor. Failure to show for your demo will result in receiving ZERO for this phase.

Important notes:

- All data structures used in this assignment must be implemented by the students and any use of Java collections or any other libraries is strictly forbidden (you may only use the ADTs you have studied in the course).
- The program should implement the provided ADT. Implementing other representations will not be accepted.

Submission Guidelines

• You are expected to work in teams, each team must contain 5 students.
• For Phase 1, submit a written report (in PDF format) answering the given questions to your instructor through LMS. Your report should include the names and the IDs of your team's member.
• For Phase 2, submit your source code (compressed in ZIP format) through LMS. In addition, make sure to bring your LAPTOP, so you can present a demo of your work to your instructor.