The National Higher School of Artificial Intelligence
Data Structures and Algorithms 2

Programming Mini Project: Restaurant Chain Management System

Submission deadline: Saturday 16/12/2023, not later than 11:59pm

Company *Koul Hani* is a food service retail chain operator. The company operates and franchises thousands of *Koul Hani*'s restaurants throughout the country, which serve locally relevant menus. This company wants to develop a system to manage the restaurants it owns as well as the ones it franchised. As such it needs to keep data about each such restaurant (whether owned or franchised). This data includes the name of the restaurant and its ID and the number of employees that work in it. Any day, the restaurant will have sales that amount to some given amount of money. But it will also have a total cost for that day that will include rent (brought to a daily amount from the monthly rent), employees' payments, electricity, gas, vegetables, meats, other ingredients, publicity spending, etc.

The company wants to encourage the restaurants be as performant as possible in terms of the return on investment on publicity. To this end, the platform computes the ratio of the monthly sales to the amount of money spent during any given month on publicity. But it also wants to keep track of the main cuisines of meals sold, so as to do a better data mining which would help get insights that could boost the sales. These cuisines are: Algerian, Syrian, Chinese, Indian, and European.

Also, the company has introduced a website which allows customers to rate any restaurant on a value x of 0 to 5 for the particular menu this customer has consumed, 0 being very bad and 5 being excellent. And, to encourage the restaurants to be as attractive as possible, a national prize is given monthly to the restaurant with the best performance. This prize is computed by sorting all the restaurants on the basis of their   *sales in a given month+ x/100* (where x is now the average monthly rating of the restaurant for a given cuisine). This amount is cumulative month after month. This means that a restaurant that gets the prize one month would be a little advantaged the following month, though another restaurant could become the new national prize winner. Also note that there is one prize for each cuisine. So in a given month a restaurant could get the prize for more than one cuisine.

The Restaurant Chain Management System (RCMS) we want to build needs to keep all the needed data about the following:
- the information about each restaurant as explained above;
- the total daily sales as well as the distribution of this total over the 5 food cuisines;
- the daily costs of any given restaurant;
- the daily average amount spent on publicity;
- The ratings a restaurant gets for its different cuisines. (These can be considered for a month.)

This data will be kept, and accumulated as appropriate, over the years.

The RCMS should organise all this data in such a way that all operations of access to the data and of processing it to return the below results should be done as quickly as possible.

The RCMS is supposed to be web-based or mobile-based, but this is really optional; you can only implement the strictly necessary functionalities. But nicer systems will be positively appreciated.

Based on EXACTLY[1] THE AFOREMENTIONED DATA, the results expected from the RCMS are the following, in addition to any other results you may wish to include and explain in your report why they are good additions.
- A report on the sales of any restaurant on any month.

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[1] Not less, and not more types of data!

- A listing summarising all the sales of all the restaurants of any specified district or city or Wilaya or even the whole country.
- The prize winners for the 5 cuisines on any month.
- A listing summarising the ratio of the monthly sales to the amount of money spent during any given month on publicity for any specified restaurant or city or Wilaya or even the whole country.
- One may wish to display any of the previous results for a given month, year, or even period (from a start date to an end date).
- Appropriate relevant figures (curves, bar charts, etc.) could be displayed for the previous results.

Part A of the Project:
We have decided to store the data in a Binary Search Tree (plus any other ADTs as you see appropriate)
1. Give the graphical representation of the most suitable ADT for the RCMS. This global ADT could be a combination of ADTs, each of which would be useful for any purposes you will need to explain.
2. Give a complete specification of this ADT.
3. Implement all the operations, making use as much as possible of any ADTs and operations we have studied in class.
4. Write a program which computes the average time for displaying the various results mentioned above.

Part B of the Project:
We have decided to store the data in an AVL Tree.
5. Implement all the operations, making use as much as possible of any ADTs and operations we have studied in class.
6. Write a program which computes the average time for displaying the various results mentioned above.
7. Compare the results obtained in questions 4 and 6, and give your conclusion.

Enjoy!