CSL213: **Data Structure and Program Design – I**

Lab Assignment (Announcement: 31st October, 2022)

Due Date : 7th November, 2022 (By 12:00 noon)

For batch - R1

Notes

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Cricket Tournament:

There were N (N is even) teams participated in a cricket tournament. All teams were divided into two groups having equal number of teams. Each team in a group played in Round Robin fashion (each team played with other teams in the same group). Winning team will get 2 points and no result/tie gives 1 point to each team. Two top teams from each group lead to semi-finals, which always be the case to be assumed. Finals will be between the winners of the two semi-finals.

Define three structures named as ***player***, ***team*** and ***match_played***.

A. ***player*** attributes- player_id, match_id, previous_total_score, previous_avg, previous_total_wickets, previous_wicket_avg, total_runs_in_last_five_matches, total_wickets_in_last_five_matches, century, present_match_score, present_match_wicket, player_role, out/not out. The attribute player_role identify the player as batsman, bowler or all-rounder.
B. ***team*** (set of players) - Each team has 15 players.
C. ***match_played*** attributed - match_id, teams_played, higest_run, man_of_the_match, wicket_taken_by_pacer, match_result (winning team/no result/tie) .

After all the matches played in the tournament, find out-

i. The possible combination of playing 11 to form a team following rules are to be maintained:
   - Minimum number of batsman= 5
   - Minimum number of bowler= 4
   - Minimum two best batsmen (on the basis of maximum runs and highest avg)
     [**hint**: sort the players based on the key < previous_total_score , previous_avg >]
   - Minimum two best bowlers (on the basis of maximum wickets and highest avg). If there are multiple such combinations, list them all.

ii. Highest total individual run getter before knock out matches. If there are multiple such players, sort them based on the runs scored. If there are multiple players scoring same number of runs, then sort on the basis of their names.

(P.T.O.)

iii. The player who was declared as man_of_the_match for maximum number of times. If there are multiple such players, sort the output based on their names.

iv. Check whether results of ii) and iii) are same or not.

v. Calculate highest average by an individual

vi. Difference in total wickets taken between all pacers and spinners of the teams

vii. Find out the players who are declared as man_of _match at-least k times (k is input) and also having maximum number of centuries among such players. If there are multiple such players, sort the output based on their names.

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Hostel Management System:

In an Engineering Institute campus, the hostels are filled once in an academic year at the beginning of the session. Each hostel is four storied. Ground floor is occupied by 1st year students only. Rest of the floors may be occupied by 2nd, 3rd or 4th year students with no bindings. All the rooms are two-seaters. Ground floor contains two guest rooms. Consider a single hostel of N rooms for (2N-4) students' occupancy. The seats can be allotted for (i) newly admitted students, (ii) existing students eager to room change in the same hostel or from different hostel, (iii) existing students staying outside campus. Students other than 1st year can give their preference of choosing floor, room partner. If no room is available according to either of the preferences of the student then the student will not be allotted. Number of vacant rooms should be less than number of applicants. Define appropriate structures to formulate the hostel allotment process for a particular hostel.

The order of preference given to the applicants during allotment is-

Preference-1 : The applicant is the boarder of the same hostel (=1 highest priority)
Preference-2 :The applicant is the newly admitted student (=2)
` Preference-3 :The applicant is staying outside campus (=3)
Preference-4 :The applicant is the boarder of a different hostel (=4 lowest priority)

A. *Determine*

- *Number of seats filled in each floor for n number of available seats and k number of applicants (k>n)*
- *Number of students who got rooms as per their 1st preference*
- *Number of students who got rooms as per their 2nd preference*
- *Number of vacant seats in each floor after allotment (if any)*

(P.T.O.)

B. *What are the possible stable combination of room allotment if the order of preferences of a student for choosing roommate is as below:*

1-> same department and same year

2-> different department and same year

3-> junior of any department

4-> senior but same department

5-> other department's senior

[**hint**: A stable combination is one which consists of k/2 number of pair among k elements such that no two unmatched pair prefer each other to their partners under the matching. Example-

Student	Preference List
1	2 5 4 6 7 8 3
2	3 6 1 7 8 5 4
3	4 7 2 8 5 6 1
4	1 8 3 5 6 7 2
5	6 1 8 2 3 4 7
6	7 2 5 3 4 1 8
7	8 3 6 4 1 2 5
8	5 4 7 1 2 3 6

Three stable matching set are- {1/2, 3/4, 5/8, 6/7}, {1/4, 2/3, 5/6, 7/8}, {1/5, 2/6, 3/7, 4/8}]

C. *Based on all preference criteria mentioned in question B (preference of floor and preference of roommate), list as many possible seat allotments for a particular student.*

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E-Shopping :

An online shopping site sells 'N' number of total products for 'M' different categories (N >> M). Each product is identified by following characteristics

1. Brand Name
2. Product Identification no
3. Product Name
4. Price
5. Colour
6. Stock (available quantity for the product)
7. Dealer
8. Offer / Offer details

It also maintains the Purchasers details as

1. ID / password
2. Name / Address
3. List of products purchased (history can be maintained along with date, review, ratings given by purchaser(can be number from 5 to 1 i.e. 5 is highest rating and 1 is lowest)

Write a program to solve following queries

1. Allow purchaser to search for a particular product by-
   - Category
   - Product name
   - Colour

- Brand name (P.T.O.)

Function should list all the products that satisfy best seller criteria. The best seller criteria can be implemented by applying following two conditions.

- First, consider the price for identifying best seller/dealer.
- For the same price, consider the volume (total no of products sold) for a dealer for identifying best seller

2. If customer purchases any product, your function should recommend other products. Implement following recommendation criteria
    - You can recommend other products by comparing the products in purchaser details.
    - You can recommend other products from the same brand.
3. Write a function to display category wise list and dealer wise product list for products whose quantity is less than the reorder quantity. You can assume same or different reorder quantities for different products. Your list should be sorted as per the available stock figures.
4. Provide user registration facility.
5. Display all the products with available offers.

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Temperature Analysis System:

A city is divided into 'n' no. of different climate stations. Each station has some urban parameters and weather parameters. Urban parameters include

1. Sky view factor (range from 0.1 to 0.9)
2. Vegetation density ratio (%age value)
3. Population density (Number of people per Sq. km)
4. Pervious surface fraction (range from 0 to 15)
5. Impervious surface fraction (range from 0 to 15)
6. Station status (urban/rural)
7. Distance of station to other stations (in km)

Weather parameters are air temperature, relative humidity recorded for each station every day for one month.

Write program to provide solution to the following queries

1. List the stations with highest heat degree days.

   Heat degree days = days on which temperature is higher than average city temperature. Average city temperature is average temperature of all stations on all days.

2. For any searched station find the thermally comfortable days.

   Thermally comfortable days = days for a station on which temperature difference between current station and its nearby rural station (only one i.e. any station can have only one nearest rural station) is minimum. You should calculate thermally comfortable days for urban stations only. Use distance array to find out nearby rural station.

(P.T.O.)

3. List dates for all stations with decreasing vegetation density ratio and for which the temperature was more than average city temperature.
4. List the (top ‘k’, k-input) stations with minimum population density with highest maximum temperature. If two stations have same population density, then list those in the order of highest maximum temperature.
5. Write a function to find the heat island intensity for all urban stations.

   Heat island intensity = urban station temp – rural station temp

   Heat island intensity calculation: Identify all the nearby rural station for any urban station and take the average temperature difference for two stations (urban avg. temp-rural avg. temp.).

Note. If two rural stations have same distance metric, then you should consider other metric like pervious surface fraction (higher value to be preferred), to identify the nearby rural station.

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Analysis of the Indian Stock market

Define a structure having 5 members' wiz Open, High, Low and Close price of stock and volume.

Note : You can visit "https://www1.nseindia.com/live_market/dynaContent/live_watch/equities_stock_watch.htm" Data is available and downloadable in csv file from above URL. You can also take some dummy data if you desire.

For each stock you can store data from *FIRST_DATE* and *LAST_DATE*. Take data of 10 stocks listed below for days in between start_date and end_date.

- SBIN
- TATAMOTORS
- PNB
- YESBANK
- TECHM
- INFY
- TCS
- TITAN
- ONGC
- IOC

Write functions for

i To find % change in the price of a stock from start to end date specified by the user.

ii To sort given stock <volume-wise, close prices> wise on a particular day, which means data is sorted first on volume and for equal volume based in close prices

iii Take a date on which a stock is bought and a date on which it is sold. Find profit/loss of two or more stocks, for these two dates.

iv To find the highest performing stock for a specified duration, which means for a given duration (starting date and ending date), find out the stock which has highest profit / gain in terms of %age. For e.g is "s" is starting day price and "e" is ending day price, gain is (e-s)/s * 100

v To find lowest performing stock for the specified duration, which means for a given duration (starting date and ending date), find out the stock which has lowest profit / gain in terms of %age. For e.g is "s" is starting day price and "e" is ending day price, gain is (e-s)/s multiplied by 100

vi List all stock as per increasing the overall performance, for the specified duration (starting-date and ending-date). Overall performance for a stock is calculated as summation of (%age change compared to previous day multiplied by volume of the stock traded on that day.

vii To find the average value of all stock at any instant of time. Average value is calculated as weighted average of stick price and volume of the stock. Find average of average values of all stocks from start to end dates given by the user.