EAST WEST UNIVERSITY
Department of Computer Science and Engineering
B.Sc. in Computer Science and Engineering Program
Theoretical Assignment I (Online), Spring 2021 Semester

Course:	**CSE 302 Database Systems**
Instructor:	**Mohammad Rezwanul Huq, Ph.D., Associate Professor, CSE Department**
Full Marks:	**100 (15 will be counted for final grading)**
Submission Deadline:	**Sunday, 28 March 2021, 11:59 PM**

Note: There are **7** (**SEVEN**) questions. Answer ALL of them. The Mark of each question is mentioned at the right margin.

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1. Assume that you are the owner of a trendy online grocery store. Every day, your store has thousands of transactions and, therefore, inserting a lot of data into your database. Finding some useful information out of this massive amount of data is a time-consuming task. [Mark: 08]

How can you improve the performance of your database so that the searching would be faster? Justify your answer briefly by using relevant terms.

2. Go to the website: https://surokkha.gov.bd/. This website is created for the registration of the COVID-19 vaccination. Visit the different pages on the website and try to understand how the registration system works. [Mark: 10]

Your job is to **draw a Schema Diagram** for this COVID-19 vaccination database as complete as possible. Mention your assumptions for this schema diagram, if any. Identify primary keys, foreign keys, and other necessary constraints along with the data type of different attributes.

3. Assume that there are two relations – r and s. [Mark: 15]
Relation r has p number of tuples, and relation s has q number of tuples.
Determine the maximum number of tuples that can be produced after performing the following operations.

a) $r \times s$ (Cartesian Product)

b) $r \bowtie s$ (Natural Join)

c) $r \cup s$ (Union)

d) $r \cap s$ (Intersection)

e) $r - s$ (Minus)

4. Consider the following database schema. [Mark: 40]

- Hotels (hotelId, hotelName, hotelCity, hotelRating)
- Rooms (roomId, hotelId, roomType, roomPrice)
- Bookings (hotelId, guestId, checkInDate, checkOutDate, roomId)
- Guests (guestId, guestName, guestAddress, guestGender, guestAge)

Hotels relation contains hotel details, and hotelId is the primary key. hotelRating indicates the star rating of the hotel like 2, 3, 4, or 5.
Rooms relation contains room details for each hotel and (roomId, hoteIId) forms the primary key. roomType could be 'single,' 'double,' 'triple,' 'suite', and so on.
Bookings relation contains details of bookings and (hoteIId, guestId, checkInDate) forms the primary key. checkOutDate will be NULL if a guest is still staying at the hotel.
Guests relation contains guest details, and guestId is the primary key. guestGender contains 'M' for male, 'F' for female and 'T' for transgender.

Write both **Relational Algebra Expressions** and **SQL Statements** for the following queries.

a) List full details of all hotels in Sydney.

b) Find the names and addresses of guests who live in Sydney and age is not greater than 25.

c) List the type and price of all rooms along with the hotel names of those in Sydney.

d) Using the cartesian product, Find the name, age, and gender of guests who previously stayed at 'Intercontinental' hotel.

e) Using the appropriate set operator, list the room id and the hotel id, which has never been booked.

f) Find the name of the hotel with the highest rating. (must use rename operator for relational algebra)

g) Find the average room price of hotels for each city.

h) How many 'single' rooms are there in London?

5. Using the same database schema as given in Question 4, **write SQL statements** for the following queries. [Mark: 12]

a) Display all rooms' information according to their room price in descending order.

b) Find hotel id and hotel name of those with 'Radisson' as a substring in their name.

c) Find the average age of guests for each hotel. Do not include the hotels which have less than five check-ins overall.

d) Produce a report that shows full details of a room including roomId, hotelName, hotelCity, roomType, roomPrice and roomPrice after giving 15% discount. Rename the column header of the result relation appropriately. Tuples must be sorted in the descending order of room price. If two rooms have the same price, they must be sorted in the ascending order of hotel city.

6. Consider the following relational instance of the relation Team. [Mark: 07]
The Team table shows the current points table of a football tournament.

teamId	teamName	Played	Won	Drawn	Lost	Points
1	team1	1	1	0	0	3
2	team2	2	0	1	1	1
3	team3	1	0	1	0	1

In the last match, team1 beats team3 by 2-0 goals. It is to be noted that, in a football match, the winning team gets 3 points, and the losing team gets none. If the game is drawn, both teams get 1 point each.

Write SQL statements to update the Team table accordingly.

7. Consider the following relations r and s. [Mark: 08]

Relation r

A	**B**	**C**	**D**
a1	b1	c1	d1
a2	b1	c2	d3
a3	b3	c2	d1
a4	b3	c3	d2

Relation s

D	**E**	**F**
d1	e1	f1
d2	e1	f2
d4	e2	f2

Find the output of the following expressions.

a) r ⟕ s (Left Outer Join)

b) s ⟗ r (Full Outer Join)