Semester: 4th
Subject Name:- DBMS & Code:- CS2000/ IT20006/ CC20006/ CM20006/ CS 2004
Branch (s): - CSE, IT, CSSE, CSCE

SPRING MID SEMESTER EXAMINATION-2024

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Database Management System
CS20006/ IT20006/ CC20006/ CM20006/ CS 2004

Time: 1 1/2 Hours **Full Mark: 20**

Answer Any four questions including question No.1 which is compulsory.
The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. Answer all the questions. [1 Mark X 5]

   a) We can convert weak entity sets into strong entity sets by simply adding the appropriate attributes. Then, why are weak entity sets needed?

   b) If a user creates relation r1, and includes a foreign key referencing another relation r2, what authorization privilege is required for the user regarding r2? Additionally, why is it not advisable to permit this without the need for such authorization?

   c) Relationships can have attributes. What are they called and give one example where this is required.

   d) What is the difference between compound key and composite key?

   e) Consider a relation R with attributes $\{a_1, a_2, a_3, \ldots, a_n\}$. determine the total number of super keys for relation R.

2. The division operator in relational algebra, denoted by ÷ is defined as follows. Let r(R) and s(S) be the relations with attribute sets R and S respectively. Let S ⊆ R (that is, every attribute in s is also present in r). Then r ÷ s is a relation on R-S (that is, that result consists of attributes in R - S). A tuple t∈ r÷s iff:

   - t∈ $\Pi_{R-S}(r)$
   - For every tuple $t_s \in s$, there is a tuple $t_r \in r$ satisfying: i) $t_r[S] = t_s[S]$ (that is the tuples match on the attribute set S), and, ii) $t_r[R - S] = t$

   A. Write a relational algebra expression using the division operator to find the IDs of all students who have taken all Comp. Sci. courses using the university schema(given in question number 5). [1 Marks]
   B. Without using division, show how to write the above query in relational algebra. [2 Marks]
   C. Write the pseudocode to efficiently evaluate the division operator. [2 Marks]

3. Assume we have the following application that models soccer teams, the games they play, and the players in each team. In the design, we want to capture the following:

   - We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.

- Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
- Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
- For each match we need to keep track of the following:
    - The date on which the game is played
    - The final result of the match
    - The players participated in the match which will be stored in match_players. For each player, how many goals he scored, whether or not he took a yellow card, and whether or not he took a red card.
    - During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
- Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.

A. Design an ER diagram to capture the above requirements. Make sure cardinalities and primary keys are clear. [3 Marks]

B. Convert the above ER diagram into relational schemas with specifying primary keys. [2 Marks]

4. Explain the significance of each level and data independence at each level in the 3-Level Abstraction of a Database, and support your explanation with a diagram. [5 Marks]

5. Write the following queries either in relational algebra or SQL (choose only one), using the following university schema.

classroom(*building*, *room_number*, *capacity*)
department(*dept_name*, *building*, *budget*)
course(*course_id*, *title*, *dept_name*, *credits*)
instructor(*ID*, *name*, *dept_name*, *salary*)
section(*course_id*, *sec_id*, *semester*, *year*, *building*, *room_number*, *time_slot_id*)
teaches(*ID*, *course_id*, *sec_id*, *semester*, *year*)
student(*ID*, *name*, *dept_name*, *tot_cred*)
takes(*ID*, *course_id*, *sec_id*, *semester*, *year*, *grade*)
advisor(*s_ID*, *i_ID*)
time_slot(*time_slot_id*, *day*, *start_time*, *end_time*)
prereq(*course_id*, *prereq_id*)

I. Find the ID and name of each instructor in the Physics department.
II. Find the set of all courses taught in the autumn semester 2023, the spring semester 2021, or both.
III. Find the ID and name of each student who has taken at least one course in the "Comp. Sci." department.
IV. Find the names of all instructors in the computer science department together with the course id of all courses they taught.
V. Find the ID and name of each student who has not taken any course section in the year 2023. [5 Marks]

*** Best of Luck ***