ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION   WINTER SEMESTER, 2022-2023
DURATION: 3 HOURS   FULL MARKS: 150

CSE 4307: Database Management Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer all **6 (six)** questions. Figures in the right margin indicate full marks of questions whereas
corresponding CO and PO are written within parentheses.

1. a) Briefly explain the "Integrity Problem" in a traditional file processing system.

   5
   (CO1)
   (PO1)

   b) What is domain of attribute in relational database? How are they ensured in DDL statements? Explain with example.

   5
   (CO1)
   (PO1)

   c) Define Super Key, Candidate Key, and Primary Key. Use data from Table 1 to deduce super key, candidate key, and primary key. Show each step.

   10
   (CO1)
   (PO1)

   Table 1: Data for Question 1.c

Name	Address	Dept	CGPA
a	x	CSE	3.50
b	y	CSE	3.60
a	z	EEE	3.50
c	x	MPE	3.40

2. Followings are the requirements of 2 relational tables:

   - Table Name: **Divisions**

Attribute	Meaning and Requirement
DID	Primary key, exactly 6 digits with no decimal part.
DName	50 Characters irrespective of language setting, can not be empty.
DSize	Value in Square KM, can not be less than 100.

   - Table Name: **Persons**

Attribute	Meaning and Requirement
PID	Primary key, it is exactly a 6-digit number without any decimal part.
Name	20 characters long irrespective of language.
DOB	Date of Birth, must not be empty.
Division	Foreign key referencing Divisions and it can not be empty.
Blood Group	Must be any one from A+, A-, B+, B-, AB+, AB-.
Salary	Monthly salary, must be greater than 5000.

   a) Create the tables using standard SQL.

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   (CO1)
   (PO1)

b) Write the SQL for the following queries: 5 x 2
(CO1)
(PO1)

    i. List the division name and size in ascending order of their size.

    ii. List the person ID and name who live in divisions that start with 'D' and ends with 'A'.

    iii. List the person ID and name who live in division with the largest size.

    iv. List division name and its total inhabitants.

    v. List the division name and its total inhabitants where total inhabitants is at least 50000.

c) The main motivation for the concept of foreign key is to remove "redundancy" and "inconsistency" in relational database. Explain it using suitable example. 10
(CO1)
(PO1)

3. Consider the following scenario:

Citizen Information: It stores information for all citizens of the country including ID, Name, Date of Birth (DOB), Blood Group (BG), and Profession. Professions are organized as 2-layer hierarchy to include both generic and specific name of the profession. For instance, a "Civil Engineer" is a specific name for the category of the profession "Engineer".

Driving License and Accidents: Each citizen may have at most one driving license having the basic information such as Name, DOB, Type of Vehicle (i.e., Light or Heavy), Issue Date, Expiry Date. (Note that a certain level of redundancy is acceptable here.) Whenever any accident occurs, it is recorded with short description, date, and time, ID of the driver and the place of the accident.

    a) Draw the Entity Relationship Diagram (ER-D) using standard symbols. 15
(CO2)
(PO3)

    b) Implement the ER-D using standard DDL statements. 15
(CO1)
(PO1)

4.   a) Considering your design in Question 3, write a PL/SQL function using the following information: 10
(CO1)
(PO1)

Input	Driver ID (or similar)
Output	Status (i.e., Good, Average, Bad)
Algorithm	If the total number of accidents by this driver during the last 6 months exceeds 10, then his/her status is "Bad". If it is between 2 to 10 then it is "Average". Otherwise it is "Good".

    b) Present a suitable example to differentiate between row-level and statement-level trigger. 5
(CO1)
(PO1)

5.   a) "Trivial and Semi-Trivial functional dependencies are always true." Justify your position regarding the statement using suitable example data. 5
(CO1)
(PO1)

    b) Mention the primary rules of Armstrong's Axioms. Why are they called complete and sound? 5
(CO1)
(PO1)

    c) Consider the relation $R(A, B, C, D)$ and the following functional dependencies (FDs): 15
(CO1)
(PO1)

$$BC \longrightarrow AD \quad D \longrightarrow B \quad A \longrightarrow C$$

Show the steps to determine all possible candidate keys for the above relation. Also, show if the given relation is in BCNF.

6.
a) Define prime attribute. Consider the relation $R(A, B, C, D)$ and the following functional dependencies (FDs):

$AC \longrightarrow BDEF \quad CD \longrightarrow E$

Show the steps to determine if the given relation is in 3NF.

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(CO1)
(PO1)

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b) What is the basic motivation of multi-level indexing in database? Consider the sequences/-timings (i.e. $t_i < t_{i+1}$) of data insertion in a B Tree shown in Table 2. Use the concept of m-way binary tree where $m = 4$.

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(CO1)
(PO1)

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Table 2: Data for Question 6.b

Timing	Data points (Key values) for insertion
t_1	9,18,42,51
t_2	65,70,81
t_3	28,36
t_4	7,14

Construct the B Tree showing each step. Also, highlight the modification needed to convert it into a B+ Tree.

c) Briefly explain the major characteristics of Big Data. What is a "blind zone" in this context?

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10
(CO1)
(PO1)

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