Noakhali Science and Technology University

Department of Computer Science and Telecommunication Engineering

3rd Year 1st Term B.Sc. (Engg.) Final Examination-2024

Course Code: CSTE 3105 **Course Title: Database Management System**

Time: 4 hours. **Total Marks: 70**

[Answer any seven of the following questions. Figures in the right-hand margin indicate full marks]

1. a) List four significant differences between a file-processing system and a DBMS. 4
   b) What are the primary responsibilities of a database administrator (DBA)? 2
   c) Discuss about DDL and DML. Write about different types of Data Models. 2+2

2. a) "Relations in a relational database must conform eight rules" – Write down the rules. 4
   b) Consider the relation employee (emp_id, emp_name, SSN,passport_num, licence_num, dept_id) and department(dept_id, dept_name). 4
   Define and identify Candidate Key, Super Key, Foreign Key, Alternate Key.
   c) Describe foreign key constraints. 2

3. a) Considering the relations from 2(b) write a sql query find the list of all departments along with the number of employees in each department using scalar subquery. 3
   b) Display all the employees of all departments where number of employees are less than 2. 2
   c) Suppose, you need to attach an instructor including the attributes ID, name, dept_name with a salary of $1800 for each student of 'Music' department who has earned 144 credit hours. (Hints: Insertion operation) 3
   d) List two reasons why null values might be introduced into the database. 2

4. a) Why is view used in DBMS? Classify and explain the views in database? 3
   b) Explain granting and revoking of privileges to the users with SQL example. 2
   c) Consider the following RDBMS schema: 5

   Employee {e_name, street, city}
   Works{e_name, company_name, salary, city}
   Company{company_name, city}
   Manages{e_name, manager_name}

   Solve the following query using SQL:
   i) Find the names of employees who are both managed by "Alice" and work for "Bangladesh Bank."
   ii) Find all employees in the database who earn more than each employee of Sonali bank.

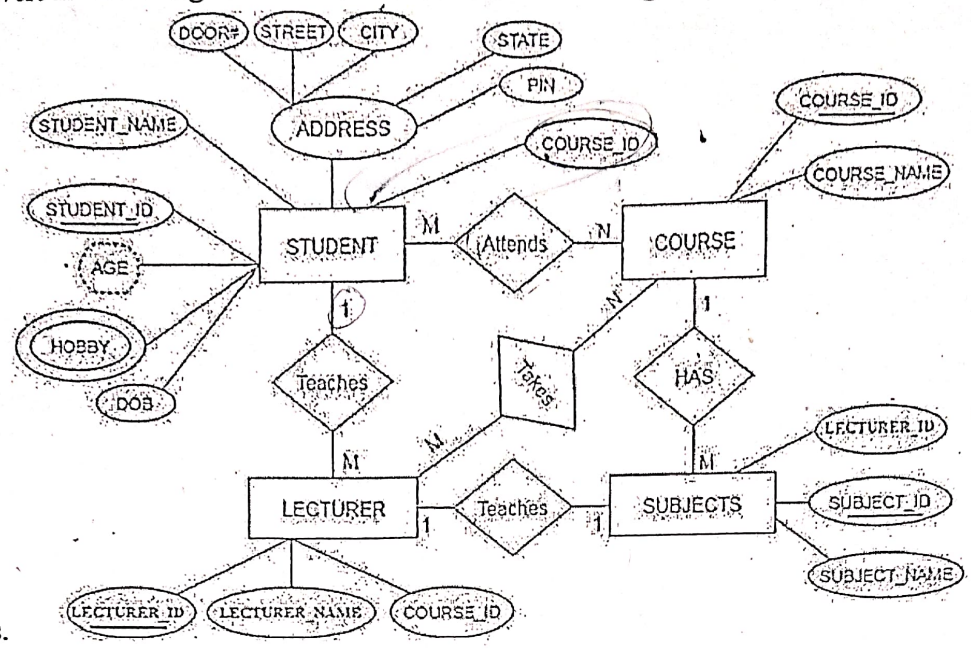
5. a) The Motor Vehicle Branch administers driving tests and issues driver's licenses. Any person who wants a driver's license must take a learner's exam at any Motor Vehicle Branch in the province. If he/she fails the exam, he can take the exam again any time after a week of the failed exam date, at any branch. If he passes the exam, he is issued a license (type = learner's) with a unique license number. A learner's license may contain a single restriction to use it. The person may take his driver's exam at any branch any time before the learner's license expiry date (which is usually set at six months after the license issue date). If he passes the exam, the branch issues him a driver's license. A driver's license must also record if the driver has completed driver's education, for insurance purposes. 7

   Create an E-R diagram following these steps.
   1. Find the entities in the specifications.
   2. Find out the relationships among the entities.
   3. Figure out attributes of the entities and (if any) of the relationships.

4. Figure out constraints between entities and relationships.

b) Describe strong entity and weak entity set with example and appropriate notion. 3

6. a) Convert the E-R diagram into relational schema indicating all primary keys and foreign keys. 7



b) Define Disjoint and Overlapping with example in Specialization. 3

7. a) What are multivalued dependencies, and how do they affect normalization? Explain how to deal with multivalued dependencies during the normalization process. 2+2

b) Discuss the significance of normalization in reducing redundancy and improving data integrity. Assume a retail store maintains a database of customer purchases without normalization. The following table is used: 2+4

Customer ID	Customer Name	Purchased Items	Purchase Date
001	Emily Davis	Laptop, Mouse, Keyboard	2024-01-15
002	David Smith	Smartphone, Laptop	2024-01-20
001	Emily Davis	Monitor	2024-01-25

Normalize this table through 1NF, 2NF, and 3NF, and explain any assumptions made.

8. a) What are the rules for maintaining balance in a B+ Tree during insertions and deletions? How do these rules ensure efficient search operations? 3+1

b) Consider inserting the values 15, 25, 35, 45, and 55 into a B+ Tree of order 4. Describe how the tree changes with each insertion, including any necessary splits. What does the final tree look like? 3+3

9. a) Consider the following two transactions: 4

T1: Read(A);
Read(B);
If A= 0 then B:= B+1;
Write(B);

T2: Read(B);
Read(A);
If B= 0 then A:= A+1;
Write(A);

Let the consistency requirement be A=0 B =0, with A=B=0 the initial values.

→ Show that every serial execution involving these two transactions preserves the consistency of database.

→ Show a concurrent execution of T1 and T2 that produces a nonserializable schedule.

b) Explain the ACID properties of a transaction 3

c) How do deadlocks occur in a transaction management system, and what strategies can be employed to detect and resolve them? 3