

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

SEMESTER FINAL EXAMINATION
DURATION: 3 Hours

WINTER SEMESTER, 2017-2018
FULL MARKS: 150

CSE 4307: Database Management Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
 There are **8 (eight)** questions. Question No. 7 and 8 are compulsory to answer. Answer any **4 (four)** from the remaining questions. Figures in the right margin indicate marks.

1. a) "File processing system introduces difficulty in accessing data. It also incurs integrity problem. 10
 - Place suitable examples to justify these statements.
- b) Write down the main responsibilities of a Database Administrator (DBA). 5
- c) What is relational algebra? Briefly outline its major three operations. What is the basic 10
 difference between the relational algebra and query language?

- 2.* a) Consider the following database design: 3×4
- employee (person name, street, city)*
works (person name, company name, salary)
company (company name, city)

Give expressions both in the relational algebra and standard SQL to express each of the following queries:

- i. Find the names of all employees who live in city "Dhaka".
- ii. Find the names of all employees whose salary is greater than \$60000.
- iii. Find the names of all employees who live in "Dhaka" and whose salary is greater than \$60000.
- b) What is the basic difference between DDL and DML? Explain with example. 5
- c) What is the difference between inner join and outer join? Explain left outer join and right outer 8
 join with suitable example data.

- 3.* a) Answer the followings: 4+4
- i. Explain DDL and DML with suitable examples.
 - ii. Null values introduce a number of problems in arithmetic operations in SQL statements. Justify with suitable example.
 - b) Is it possible to add a "where" clause in an SQL statement involving aggregate functions? 5
 Justify your opinion with example.
 - c) Consider the following relations: 2×6

(Note: ID is the primary key of each entity. x(FK[r]) indicates x a foreign key referencing entity r)

persons(ID, Name, DOB, Address)

schools(ID, Name, Establish_Year)

companies(ID, Name, Location)

students(ID, Person_ID (FK[persons], gpa, school_ID (FK[schools]))

emp(ID, Person_ID (FK[persons]), Salary) company[Id]

Write the following SQLs:

- i. List the person Name, ID and Address according to their age (i.e. Oldest will appear first)
 - ii. List each student's information as following:
Student ID, Student Name, Name of School, gpa
 - iii. List the school's summary as : School Name, Total Students, average gpa
 - iv. List top 5 schools based on the average gpa (as obtained in iii)
 - v. List employees name, his/her company name, salary
 - vi. Update each employee salary by 20% for those who currently get less than the average salary of his/her company's employees salary
4. a) Define Super Key, Candidate key, Primary key with example data. 3
- b) What is jdbc? What are essential parameters for making a jdbc connection? Present a brief example code (only relevant part of the code is expected). 6
- c) What is a view? What is the basic difference between a table and a view? Can you insert data into a view? Justify it using suitable examples. 7
- d) i. What is cardinality? How do you ensure many-many cardinality? Use example to explain. 3×3
- ii. Differentiate between Cartesian product and natural join.
- iii. "Natural join removes meaningless records." - Justify with suitable example.
5. a) Name the four integrity constraints on single relation. Create one table involving these constraints (use standard SQL). 10
- b) i. What is a trigger? Mention one scenario where you are advised to use trigger and another scenario where it is not encouraged to use trigger. 10
- ii. Consider emp(ID, Name, DOB, address, Retired (yes or no)). You are the dba of the company. Whenever any employee finishes his/her job and gets into retirement his/her Retired flag is set to YES. And all personal information of that employee should be copied to another table for historical reference.
- Write SQL code to perform the above task.
- c) Define entity and attribute. Explain different types of attributes with appropriate examples. 5
6. a) Classify the constraints on generalization or specialization based on the followings: 3×4
- i. Attribute of higher-level entity determines lower-level entity membership
- ii. The number of branching in its lower-level entity
- iii. Completeness
- b) What is functional dependency? Explain with a suitable example. 5
- c) Explain the conditions of Boyce-Codd normal form (BCNF). State a general rule for decomposing schema that are not in BCNF. 8
7. [Compulsory] 25

Consider following Library Management System (LMS):

System description: The existing manual Library Management System (LMS) should be replaced by an automated system. Library stores books on various **major subjects** such as Physics, Computer Science and so on. Each major subject may have further details such as: Computer Science can be further detailed (e.g. Networking, Database, AI and so on). Library procures books from different **publishers**, it contains information such as publisher name, country and reputation (allowed values are: excellent, good, bad). The system should store **book's** basic information such as: title of book, publisher, year of publish, price. It can store **multiple copies** of the same book and uniquely identify each book efficiently.

Both **students** and **staffs** can borrow (normal borrow) books. Once a book is issued against a

ent or a staff the book is **no longer available** until he/she returns it. After borrowing book he/she must **return** book within 7 days. Apart from normal borrow the system also allows to issue one book against a number of students (e.g. 3 students can take one book) and the number of students is not fixed. This mode of borrowing is called **shared** borrow. In shared borrow multiple students take one book but one student is assigned as **major user** while others are **associate users**. The major user is responsible for any unusual cases such as: book lost or stolen (this module will not deal it).

Required Reports:

- A detail book report with the following information:
 - Book No, Book Title, Publisher Name, Country of Publisher, Date of Purchase
 - A summary book report with the following information:
 - Book No, Book Title, Publisher Name, Country of Publisher, Total Copy, Total Copy available
 - Given a student ID or staff ID list of books he/she borrowed but yet not returned.
 - Given a student ID or staff ID list of books he/she borrowed during the last 30 days.
- a) Make E-RD of the system. (You are free to make additional assumption for both entities and attributes)
 - b) Implement E-RD using proper DDL statements.
 - c) Write SQL statements for the mentioned reports.

8. a) [Compulsory]

Mr. X is database designer of very large company containing 20000 employees. As part of the total system design he has done the following in regard to employee's information:

- The total salary of each employee is calculated as follows:
 $\text{Total Salary} = \text{Basic} + 40\% \text{ of Basic (as house rent)}$
 Mr. X designed *emp* entity as follows:
emp(ID, Name, Date of Birth, Join Date, Age, Basic Salary, House Rent, Total Salary)
- In order to make employee ID more informative he designed the ID as follows:
 ID: X-NNN where X is either S or M or J, NNN is a 3-digit number.
 Here S, M and J stand for Senior, Medium and Junior. An employee has S status if he/she worked more than 10 years, M status if he/she worked more than 3 years and less than 10 years, others are with J status.

Since you have taken the database course in your undergrad, you think Mr. X has some design problems in this context. Your task is to explain the major design problem and at the same time propose an ideal solution to eliminate those problems.

- b) Referring the Q.8 a) the business rule for calculating total salary has been changed as follows:

$\text{Total Salary} = \text{Basic} + 40\% \text{ of Basic (as house rent)} + 50\$ \text{ for each child.}$

Your tasks are:

- i. Modify the DDLs to accommodate the new requirement.
- ii. Write a PL/SQL function that takes employee ID as IN parameter and computes and returns the total salary.
- c) Is it possible to declare one attribute as primary key and foreign key (referencing different entity)? Justify your position with a suitable real-life example.
- d) Is it possible to declare one attribute as primary key and foreign key (referencing the same entity)? Justify your position with a suitable real-life example.