ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID-SEMESTER EXAMINATION — WINTER SEMESTER, 2021-2022

DURATION: 1 HOUR 30 MINUTES — FULL MARKS: 75

CSE 4307: Database Management Systems

Answer **all 3 (three)** questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

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1. a) *"In a traditional file processing system it is hard to provide user access to some, but not all, data."* Explain using suitable example. **10** (CO1) (PO1)

   b) Is there any difference between schema and instance in relational database area? Explain. Consider the following records: **4 + 6** (CO1) (PO1)

Table 1: Employees data for Question No. 1.(b)

Name	Address	DOB
m	a	1-1-87
n	b	2-4-82
q	a	1-12-80
r	f	3-4-79

Now, deduce its super keys, candidate keys, and primary key for the given records. Present suitable arguments for finalizing the primary key.

c) What is domain of attribute? How can you ensure it in implementation phase? Explain with example. **5** (CO1) (PO1)

2. a) Consider the following SQL statement to list all employees name, address and their total salary where total salary is calculated as the sum of his/her basic and bonus amount (if any): **5** (CO1) (PO1)

```
select Name, address, (salary+bonus) Total
from emp;
```

It was observed that the values for total salary for a number of employees were displayed as 0 but each of employees monthly salary has been found correct.

Your task is to identify and explain the most probable cause of the above result. At the same time, provide a suitable solution to get rid of such error.

b) Consider the following entities (note: here pk means primary key, fk[x] means foreign key referencing entity x): **2 × 5** (CO1) (PO1)

- `Depts(Name(pk),Location,Budget)`
- `Students(SID(pk),Name,CGPA,Dept(fk[Depts]))`
- `Teachers(TID(pk),Name,Designation, Dept(fk[Depts]) )`
- `Supervisors(TID(fk[Teachers]),SID(fk[Students]),ProjectName)`

Write SQL statements for the following queries:

i) List of departments name, location, and total number teachers for each department.

ii) List of the students with ID, name, their dept name, and dept location only for those departments that are located at "Academic Building 2".

iii) List of teachers with their name, designation, and the total number of students they are supervising.

iv) List of teachers with their name and designation who are supervising at least 5 students.

v) List of top 3 department name, location and the total number of students (ranking is based on total number of students)

c) What is the basic purpose of a materialized view? Consider the following 2 view definitions: **5** (CO2) (PO2)

```
create or replace view empV
as select id,name, salary/12 as monthlySalary
from emp;

create or replace view studentV
as select id,name,dob,cgpa
from students;
```

Is it allowed to insert data through these views? Justify your choice. (assume the tables emp and `student` exist with the mentioned attributes in the view definitions)

3. Read the following user requirement in the context of automation of Bangladesh NID, driving license and treatment history:

National ID (NID) is an integrated collection of citizens' information such as Name, Date of Birth, Occupation, Blood Group. Each citizen has his/her own NID. In order to investigate the population density, the country has been divided into divisions. Each division has its name, size (in square kilometer) and a brief description. Again each division has a number of districts with similar attributes. Citizen information must be connected to its corresponding division and district.

Each citizen may have exactly one driving license where information such as type of license, issue date, and expiration date are maintained. Whenever any accident occurs, it is logged in the central system. The system stores relevant information such as date and time of accident, location of accident, and the number of deaths (if any).

There are a number of hospitals in the country having names and contact information. Each hospital may have more than one contact number. Citizens may avail treatment in any hospitals they prefer. Whenever any patient (i.e. citizen) is admitted, the system keeps the record of his/her date of admission, a brief description, and release date.

a) Draw the Entity Relationship Diagram (ER-D) using conventional method. **10** (CO3) (PO3)

b) Write appropriate DDL statements to implement above ER-D. **10** (CO1) (PO1)

c) Write standard SQL for the followings: **5 × 2** (CO1) (PO1)

i Find the list of Districts along with its total population.

ii Find the list of Districts having at least 20000 people living there.

iii Find the number of accidents occurred (if any) by a citizen whose NID is 210.

iv Find the list of top 5 hospitals based on the number of patients admitted so far.

v Find the list of Divisions along with its total number of Districts for each Division.

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION — WINTER SEMESTER, 2021-2022

DURATION: 3 HOURS — FULL MARKS: 150

CSE 4307: Introduction to Database Management System

Programmable calculators are not allowed. Do not write anything on the question paper. Answer all 6 (six) questions. Marks of each question and corresponding CO and PO are written in the right margin with brackets.

1. a) Differentiate between relation and relation instance. "A relation may not have any superkey" - briefly mention when this situation may occur and state the associated problem. **5** (CO1) (PO1)

   b) Suppose you are going to automate a typical private company's human resource management system. How will you select the format of employees ID? Explain briefly. **5** (CO2) (PO3)

   c) Suppose R and S are two relations. In order to concatenate them (i.e. UNION operation) two conditions must be met. Briefly mention them. "Even these two conditions are satisfied the result of concatenation could be erroneous" - justify this fact with example. **10** (CO1) (PO1)

2. a) Consider the following SQL with the assumption that mentioned table exists: **5** (CO1) (PO1)

```
select id,name,dept
from students
where dept='CSE';
```

   Your task is to write two equivalent queries of the above SQL statement using relational algebra.

   b) Consider the following entities (pk denotes primary key while $fk[x]$ implies foreign key referencing entity x): **5 × 3** (CO1) (PO1)

```
Depts(NAME(pk),LOCATION,SIZE)
Students(ID(pk), NAME,CGPA,DEPT(fk[Depts]))
Employees(ID(pk), NAME,DEPT(fk[Depts]),JOININGDATE)
```

   Note: Some employees may not be assigned to any department yet.

   Write the standard SQL queries for the followings (query must be case in-sensitive where applicable):

   i. List of the department name and location whose name begins with letter 'C' and ends with 'E'.
   ii. List of the employees name and designation along with their corresponding department size.
   iii. List of all employees name and designation along with their corresponding department size if it is available otherwise it will show null (i.e. blank).
   iv. List of department and its location whose total number students is at least 400.
   v. List of employees name and designation who are working for more than 5 years.

3. a) There is a danger of using *natural join* construct in SQL. Briefly explain it using example. **5** (CO1) (PO1)

   b) Differentiate between anonymous and named blocks in PL/SQL. "A function in PL/SQL can return more than one value." Justify it using suitable example. **5 + 5** (CO1) (PO1)

c) Explain the concept of total and partial participation in E-R diagram. Consider a one-to-many mapping cardinality between entities E_1 and E_2. In implementation phase, is it possible to ensure total participation for both E_1 and E_2 using any table-level constraint? Justify your position. **10** (CO2) (PO3)

4. a) Consider the following system description: **5 + 10** (CO3) (PO2)

In IUT students are enrolled against a particular department. The Student Information System (SIS) maintains students basic information such as ID, Name and CGPA. Department name, its location are the the relevant information for each department. Courses are offered in each semester. Each course has its code, title and credit hour. Multiple courses are taken by each student. Again one course can be taken by a group of students. The university runs a central board of different societies such as debate, photography and so on. For each society, SIS maintains the name and detailed description of the society. Each student must be attached to exactly one society.

Design the system using standard the E-R Diagram and write the DDL statements to implement it.

b) Consider the following records of STUDENTS Table: **10** (CO1) (PO1)

Table 1: STUDENTS (Data for Question No. 4 b)

ID	Name	CGPA	Dept
1	a	3.5	CSE
2	b	3.7	EEE
3	a	3.5	CSE

Your task is to split the table into two for both (i) lossless and (ii) lossy decomposition.

5. a) Define functional dependency. What is the basic motivation of using functional dependency in database design? Present example of each type of the following functional dependencies: **2 + 8** (CO1) (PO1)

i. trivial ii. non-trivial iii. semi-trivial iv. transitive

b) Briefly mention primary rules of Armstrong's Axioms. Why are they called complete and sound? **5 + 5** (CO1) (PO1)

c) Is 2NF stricter than 3NF? Briefly explain. Consider the following records of CITIZENS table: **2 + 8** (CO1) (PO1)
(Note: the last 3 attributes are namely districts name,size and population)

Table 2: CITIZENS (Data for Question No. 5. c)

ID	Name	DistName	DistSize	DistPolulation(in million)
101	a	Dhaka	Large	20.5
102	b	Rajshahi	Medium	10.2
103	c	Dhaka	Large	20.5
104	a	Khulna	Medium	8.9
105	f	Rajshahi	Medium	10.2

Your task is to verify if the relation is in 3NF. You need to deduce functional dependencies from the given data set. If this is not in 3NF then suggest a loss-less decomposition. (*Hint:* You do not need to check 2NF condition, just check if it exhibits transitivity dependency for non prime attributes)

6. a) Briefly explain why the closure of attributes and concept of superkey are closely linked. Consider the following relation R and functional dependencies (FDs): 10 (CO1) (PO1)

$R(A, B, C, D)$ given FDs: $AD \longrightarrow BC \quad B \longrightarrow D \quad C \longrightarrow A$

Show all steps to determine all possible candidate keys for the above relation.

b) Consider the following relation R and functional dependencies (FDs): 10 (CO3) (PO2)

$R(A, B, C, D, E)$ given FDs: $A \longrightarrow C \quad C \longrightarrow E \quad B \longrightarrow D \quad E \longrightarrow A$

Show each step to verify if the given relation is in BCNF.

c) Briefly present a comparative analysis of sparse and dense indexing. Consider the following citizen relation: 5 + 5 (CO2) (PO2)

`CITIZEN(ID, Name,BloodGroup,YearlyIncome)`

Here `YearlyIncome` indicates the exact yearly income of a citizen. Is it wise to apply bit-map indexing on `YearlyIncome` directly? Justify your position.

Islamic University of Technology

Organisation of Islamic Cooperation (OIC)

Department of Computer Science and Engineering (CSE)

ONLINE EXAMINATION **WINTER SEMESTER, 2019-2020**

Duration: 45 Minutes **Full Marks: 30**

CSE 4307: Database Management Systems

This is an open book exam. You are allowed to surf the net but not allowed to talk or communicate with any human person. 10 Minutes time is allocated for processing and uploading your file. After the exam is over, scan and convert to a single pdf to upload in the classroom. Figures in the right margin indicate marks.

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1. Consider the following entities for a typical result processing system (Note: pk and fk stand for primary key and foreign key respectively:

Students
SID (pk)
Name
Address
Dept
Prog

Courses
CID (pk)
Name
Credit

Grades
SID (fk)
CID (fk)
LetterGrade

Here only allowable values for Dept attribute are CSE, EEE, MPE, CEE. Valid values for Prog attribute are Undergrad and Graduate. Notice Grades entity has no primary key (think on it in the next DDL question).

(a) Create the DDL for the above description. *[5]*

(b) Write a function in PL/SQL as follows: *[10]*

Input: Student ID

Output: *CGPA* (numeric value)

Algorithm: $CGPA = \frac{\sum Ci \times \sum Ni}{\sum Ci}$

where N_i can be obtained from the following mapping:

LetterGrade	Value (Ni)
A+	4
A	3.5
B	3
C	2
D	1.5
F	0

(Note: You can use decode() to extract value from the letter grade)

(c) Write a java program to show the results of CSE Department of undergrad program in the following format: [08]

ID	Name	Result
103	a	3.6
107	d	3.7

Note:Write only the relevant part in java, assume the database connection is already made.

(d) Write a **single SQL** to show a combined list of top 3 students Name and CGPA and bottom 2 students Name and CGPA (in terms of CGPA). [07]

(Note: You can use Rank() in this regard)

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STER FINAL EXAMINATION — WINTER SEMESTER, 2016-2017

ATION: 3 Hours — FULL MARKS: 150

CSE 4307: Database Management Systems

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re 8(eight) questions. Question No. 1 and 3 are mandatory. Answer any 4 (Four) from the remaining questions. Figures in the right margin indicate marks.

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le processing system introduces data redundancy and inconsistency. It also incurs ntegrity problem." Place suitable examples to justify these statements. 5

t do you mean by 1-1 mapping (or cardinality)? Present a real-life scenario where mapping should be used to design an efficient system. 5

15

pose there are two relations:

- `employees(ID, Name, DOB, DeptName, Dept. Budget, Dept. Location).`
- `Students (ID, Name, DOB, DeptName, Dept Building Area Size (in squire meter))`

ese tasks are as follows:

i) Criticize the design with its major pros and cons.

ii) Propose an alternative design to eliminate the *problems you have just mentioned.*

iii) Finally place proper examples to prove that your modified design is able to answer following queries:

- Find the students' name and date of birth who study in the departments that are located at the "Second Academic Building".
- Find the employees name and date of birth who work in the departments that are bigger than 4500 squire meter in size.

fine the following terms with examples: 6

Projection ii) Selection iii) Cartesian Product

fine super key, candidate key, primary key and foreign key. 3+10

Now consider the following system description of a typical library automation:

There are books on different subjects such as Computer Science, Mechanical, Education etc. Each book have information such as Book Title, Author Name, Publisher Name, Publishing Year. There are a number of copies of a single book (e.g Java-How to Program, 60 copies).

There are a number of departments in the University. Each department runs a number of programs. The students information system stores basic information of each students such as name, date of birth, address, father name, department name (i.e. CSE, EEE), program

name (i.e. B.Sc. or HD).

Students can borrow book and return book in time without fine.

Your tasks are:

i) Design the E-R diagram and its equivalent DDL statements.

ii) In each case determine the primary key and foreign key.

c) What is the difference between inner join and outer join? Explain left outer join and right outer join with suitable example data. *"Natural join removes meaningless records."* Justify with suitable example.

3. a) Explain DDL and DML with suitable examples.
   b) Consider the following description:

Table: Department		
Attribute	Description and/or Data Type	Requirement / Other information
ID	Numeric with no decimal part.	Primary key
Short Name	3 characters	Exactly 3 characters, can not be null
Full Name	100 characters	Can be null
Date of Establishment	Date	Can be null
Location	35 characters	Value should be either i) First Academic Building or ii) Second Academic Building
Head of Dept	Present head of department	Foreign key referencing the table **Teachers**
Table: Teachers		
Attribute	Description and/or Data Type	Requirement / Other
ID	Numeric with no decimal part.	Primary key
Name	50 characters	It may be used by other than English language such as Chinese.
DOB	Date	No date before January 1, 1950 is allowed.
Designation	25 characters	Any values from the List: {Lecture, Assistant Professor, Associate Professor, Professor}
Salary	Monthly Basic Salary	May be null only for unemployed.
BloodGroup	Character	Any value from List{A+ve, A-ve,

		B+ve, B-ve, AB+ve, AB-ve}
Immediate Boss		Foreign Key referencing **Teachers** table itself (self-reference).

Table: Students		
Attribute	Description and/or Data Type	Requirement / Other information
ID	Numeric	Primary key, E.g. 164409
Name	60 characters	
DOB	Date	It must be greater than 31-DEC-1985
Dept	Student's dept.	Foreign key referencing the table **Department**

Table: Courses		
Attribute	Description and/or Data Type	Requirement / Other information
ID	8 characters	Primary key, E.g. CSE 4401
Title in Full	60 characters	
Credit Hour	Numeric	It must be between **0.5 to 4.0**
Offering Dept	Which dept is offering the course	Foreign key referencing the table **Department**

Your tasks are as follows:

i) Create tables as described.

ii) Note that the table **Department** has the Head of Dept field that stores only the present head of the department. It has no way to store the history of heads of each department. How can you include this feature? Explain.

iii) Students should be able to take a number of courses in each semester. First comment on the cardinality between students and courses. Finally present the DDL in this regard.

Consider the table definitions of Question No. 3 and answer the followings using standard SQL query: 5x2

i) List of the teachers name, date of birth and his/her immediate boss's name (if any) according to Salary in decreasing order.

ii) Find the students name and his/her department name whose names start with 'A' and end with 'A'.

iii) List the department name and total number of students admitted of the corresponding department.

iv) List the department name and total number of students admitted of the corresponding department for the departments whose budgets are more than 90000.

v) List the department name and total number of students admitted of the corresponding department for those departments that have at least 100 students admitted.

b) What is a view? What is the basic difference between a table and a view? "Most SQL implementations allow updates only on simple views" Justify it using suitable example.

c) Describe the single-level index entry deletion process using a suitable example.

5. a) Describe the ACID properties of transaction.
   b) Consider the following 2 transactions:

   T1: Transfer $50 from A to B
   T_2 : Transfer 10% of the balance from A to B

   Present three schedules S1, S2 and S3 such that S1 is serial and S2 and S3 are not serial. Moreover, S1 and S2 logically equivalent and preserve the correctness while S3 does not preserve the correctness.

   c) Define entity and attribute. Explain different types of attributes with appropriate examples.

6. a) What is a weak entity set? Define discriminator. *"The primary key of a weak entity set is formed by the primary key of the strong entity set on which the weak entity set is existence dependent, plus the weak entity set's discriminator."* Explain with suitable example.

   b) Classify the constraints on generalization or specialization based on the followings:

   i) Attribute of higher-level entity determines lower-level entity membership
   ii) The number of branching in its lower-level entity
   iii) Completeness

   c) "Each occurrence of an entity set plays a *role* in the relationship" Explain with example.

7. a) "Two schema can be merged into one larger schema". Explain *this concept with a suitable* example and discuss its relative pros and cons.
   b) What is functional dependency? Explain with a suitable example.
   c) "Bad decomposition may result in invalid records". Establish this fact with a *suitable* example data set.

8. a) Define superkey using functional dependency. "Trivial dependency is always valid" Explain with an example.
   b) Explain the conditions of Boyce–Codd normal form (BCNF). State a general rule for decomposing schema that are not in BCNF.
   c) What is the basic purpose of indexing in database? What is the basic difference between primary index and secondary index.

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

SEMESTER FINAL EXAMINATION — WINTER SEMESTER, 2017-2018

DURATION: 3 Hours — 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.

File processing system introduces difficulty in accessing data. It also incurs integrity problem. 10
- Place suitable examples to justify these statements.

Write down the main responsibilities of a Database Administrator (DBA). 5

What is relational algebra? Briefly outline its major three operations. What is the basic difference between the relational algebra and query language? 10

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.

What is the basic difference between DDL and DML? Explain with example. 5

What is the difference between inner join and outer join? Explain left outer join and right outer join with suitable example data. 8

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.

Is it possible to add a "where" clause in an SQL statement involving aggregate functions? Justify your opinion with example. 5

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)

Write the following SQLs:

i. List the person Name, ID and Address according to their age (i.e. Oldest ... 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 ... salary of his/her company's employees salary

4. a) Define Super Key, Candidate key, Primary key with example data.
b) What is jdbc? What are essential parameters for making a jdbc connection? Present ... example code (only relevant part of the code is expected).
c) What is a view? What is the basic difference between a table and a view? Can you insert ... into a view? Justify it using suitable examples.
d) i. What is cardinality? How do you ensure many-many cardinality? Use example explain.
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 ... constraints (use standard SQL).
b) i. What is a trigger? Mention one scenario where you are advised to use trigger; another scenario where it is not encouraged to use trigger.
ii. Consider emp(ID, Name, DOB, address, Retired (yes or no)). You are the dba of company. Whenever any employee finishes his/her job and gets into retirement, ... Retired flag is set to YES. And all personal information of that employee should ... copies 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 example*.

6. a) Classify the constraints on generalization or specialization based on the followings:
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.
c) Explain the conditions of Boyce–Codd normal form (BCNF). State a general rule ... decomposing schema that are not in BCNF.

7. **[Compulsory]**

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

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

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

... Reports:

... book report with the following information:
Book No, Book Title, Publisher Name, Country of Publisher, Date of Purchase
... summary book report with the following information:
Book No, Book Title, Publisher Name, Country of Publisher, Total Copy, Total Copy available
... a student ID or staff ID list of books he/she borrowed but yet not returned.
... a student ID or staff ID list of books he/she borrowed during the last 30 days.

... E-RD of the system. (You are free to make additional assumption for both entities and ...)
... ment E-RD using proper DDL statements.
... SQL statements for the mentioned reports.

... pulsory] 10

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

- The total salary of each employee is calculated as follows:
  Total Salary = Basic + 40% 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.

... you have taken the database course in your undergrad, you think Mr. X has some design ... in this context. Your task is to explain the major design problem and at the same time ... an ideal solution to eliminate those problems.
... the Q.8 a) the business rule for calculating total salary has been changed as follows: 5

Total Salary= Basic + 40% of Basic (as house rent) + 50$ 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.

... it possible to declare one attribute as primary key and foreign key (referencing *different* ...)? Justify your position with a suitable real-life example. 5
... it possible to declare one attribute as primary key and foreign key (referencing *the same* ...)? Justify your position with a suitable real-life example. 5

...sity of Technology
Organisation of Islamic Cooperation (OIC)
Department of Computer Science and Engineering (CSE)

...S FINAL EXAMINATION — WINTER SEMESTER, 2018-2019
... Hours — Full Marks: 150

CSE 4307: Database Management Systems

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

...e of the major drawbacks of traditional file processing system is the *difficulty to access data*. ...plain it with a suitable example. Mention some widely used applications of modern database ...stems. [10]

...A major purpose of a database system is to provide users with an abstract view of the data. ...Explain the concept of different types of *data abstraction* in modern database systems. [10]

...What are projection and selection? Does the order of these operations matter in the final ...result? Explain with example. [05]

...Define and differentiate between Data-Definition Language (DDL) and Data-Manipulation Lan...guage (DML). [05]

...Define super key, candidate key, primary key and foreign key. Consider the following system ...description of a typical library automation: [5+10]

There are books on different subjects such as Computer Science, Mechanical Engineering, Edu...cation etc. Each book have information such as Book Title, Author Name, Publisher Name, Publishing Year. There are a number of copies of a single book (e.g Database System Concepts, 20 copies). There are a number of departments in the University. Each department runs a number of programs. The students information system stores basic information of each students such as name, date of birth, address, father name, department name (i.e. CSE, EEE), program name (i.e. B.Sc. or M.Sc.). Students can borrow book and return book.

...Your tasks are:

i. Design the E-R diagram and its equivalent DDL statements.

ii. In each case determine the primary key and foreign key.

...What is the difference between inner join and outer join? Explain left outer join and right ...outer join with suitable examples. [05]

...Following are the requirements of some tables. Each field is separated by comma (,) and ...additional requirements are stated in brackets [ ]. [10]

- Departments(ID primary key, Name of dept [Can not be empty], Establishment Year)
- Employees(ID primary key [it is exactly a 9-digit number without any decimal part], Name ...20 characters long but it can be in any language other than English],Date of birth [must ...not be empty and it can be less than 01-01-1960], Dept [foreign key of departments entity ...and it can not be empty], Blood Group [must be any one from A+,A-, B+,B-,AB+,AB-]
- Salary(EmpID [foreign key of Employees entity], Date of Payment, Amount)

...Your tasks are:

i. Create the tables using standard SQL.

ii. Now you forgot to include Salary (per month) and Join Date of the Employees. How can ...you solve this problem?

(b) Write the SQL for the following queries:

i. Find out the name and date of birth of all Employees who joined in the last 3 months (i.e. 90 days).

ii. Find out the name, date of birth and name of the department of all Employees who joined in the last 3 months (i.e. 90 days).

iii. Generate a list containing department name and its total employees.

iv. Generate a list containing department name and its total employees but include only those department with at least 20 employees.

v. Generate a list containing department name and its total employees but include only those department with at least 20 employees and whose departmental average salary is greater than 20000.

(c) What is cardinality? Briefly explain different types of cardinality.

4. (a) Null value introduces a number of problems in arithmetic operations in SQL statements. Explain with suitable example.

(b) What is jdbc? Consider the entity Emp(ID,Name,Address,Dept). Write a java program which will print the name, address and dept of those employees who work in 'Accounts' department. Assume that jdbc driver is already loaded. Write only the relevant part of the code.

(c) There are four integrity constraints on single relation. Name them with suitable examples.

5. (a) What is the domain of attribute? Explain different types of attributes used in E-R model.

(b) Consider the following description:

XYZ is a large company comprising about 5000 employees. To automate the Human Resource programmers are hired. Mr. Simple, one of the programmers, designs the ID of employee using simple numbers such as 000001, 000002 and so on. Mr. Complex, another programmer, designs the ID for the format: DEPTCODE-DESIGNATIONCODE-JOINDATE-SEQUENCENUMBER (i.e. ACCOUNTS-MANAGER-01JAN2017-001).

Your tasks are:

i. Criticize the above designs mentioning the strength and weakness of each option.

ii. Propose your solution minimizing the weaknesses you have just mentioned.

(c) Classify the constraints on generalization or specialization based on the followings:

i. Attribute of higher-level entity determines lower-level entity membership

ii. The number of branching in its lower-level entity

iii. Completeness

6. (a) What is the purpose of Normal Forms in database design? Explain the concept of 1st Normal Form with example.

(b) Mention the conditions of Boycee Code Normal Form (BCNF). Cite two examples both valid and invalid BCNF schema. Also mention how you will decompose an invalid BCNF into some valid BCNF schema.

(c) Consider the following schema and records (as presented in table 1) for a student information management system:
students(ID,Name, Date of Birth,Country Name, Capital Name, Total Population)
Your tasks are:

i. Verify if the given schema is in BCNF.

ii. If it is not in BCNF then decompose it as directed by the BCNF algorithm.

Table 1: Records for Question No. 6.(c)

ID	Name	DOB	Country Name	Capital	Population (in m)
1	a	1-1-87	Bangladesh	Dhaka	160
2	b	1-2-85	Afghanistan	Kabul	32
3	c	1-3-81	Bangladesh	Dhaka	160
4	d	1-3-81	Cameroon	Yaounde	17
5	e	1-4-77	Afghanistan	Kabul	32

theory)

the following scenario:

a large bank with few hundreds of branches located at different parts of the country. Customer provide their profile information such as Name, Date of Birth, Address before opening account. Once a customer's profile is available he/she can open multiple accounts reusing the information. After opening account regular transactions are made. There are two types of transactions such as withdraw and deposit.

for loans. Only existing customers who have valid accounts are primarily eligible for getting loans. There are 3 types of loan schemes such as Platinum, Gold and Silver . Each loan has its properties as described in table 2.

Table 2: Properties of loan schemes for Question No. 7

Scheme	No. of Instalment	Interest Rate (per year)	Eligibility
Platinum	100	5	Total Transaction (i.e. add both types of transactions) in the last 12 months must be $\geq$ 2000000
Gold	75	8	Total Transaction in the last 12 months must be between 2000000 and 1500000
Silver	50	12	Total Transaction in the last 12 months must be between 1500000 and 1000000

ions are:

sign the table definitions and issue the required DDLs. Additional assumptions are welcome in design phase. [08]

te a function to assign a customer to a specific category of loans as mentioned. (assume each customer makes regular transactions such as deposit and withdraw). [08]

ut: *Account No. Output:Rejected or Accepted, if Accepted it should also show which type of can be granted based on the* Eligibility *parameter as described in table.*

ce a customer is assigned to a specific loan scheme, write a procedure to schedule the loan. [09]
ure each loan must be paid after 6 months interval.

ut: *Account No, Loan Scheme, Total Amount, Starting Date. Output: It will schedule x number of equal instalments based on Total Amount and No. of Instalment of that particular loan scheme. The schedule information should include: account no, loan scheme, Instalment Numbers from 1 to x),Instalment amount (i.e. total amount will be equally distributed), Payment Date (i.e. after every 6 months from the Starting Date), Payment Status. All fields except Payment Status should be initialised by the procedure. Payment Status should be set to null.*

8. **(Compulsory)**

(a) Suppose you have issued an UPDATE statement to a table *citizens* as mentioned in No. 8.(c) with some WHERE CLAUSE (as you like).

Write an anonymous block that will execute the above UPDATE statement. If no records are affected by the statement then it will print *NO RECORDS ARE UPDATED* otherwise it will count the total number of updated records (i.e. X) and will print *X RECORDS ARE UPDATED.*

(b) What is the basic difference between row-level trigger and statement-level trigger? Explain with example.

(c) Consider the table *citizens(id, name, dob, salary).* The Government of Bangladesh (GOB) created one fund of total BDT *total_aid_amount.*

GOB wants to ensure (but can not guarantee) each citizen receives an amount *gob_allownace* such that after receiving it his/her total earning *(i.e. salary + gob_allownace)* is equal to average income of the country (average is computed before any *gob_allownace* is given). The citizens having more than the average salary of the country are not eligible for this scheme.

For this purpose GOB invites applications from needy and interested people. The applications are stored in *applied(citizen_id),date of application)* table (assume only the valid persons apply).The citizens who have not applied will not be considered even his/her salary is very low.

The citizen (who applied) with the lowest salary will get the highest priority to receive gob_allownace and *gob_allownace* amount is determined by the difference of his/her salary and average salary of the citizen. GOB can not ensure sufficient fund for all needy citizens. So the process terminates whenever the fund is exhausted (i.e. *total_aid_amount=0* or *total_aid_amount is less than the difference of the average salary and the salary of the particular citizen).*

When a citizen receives gob_allownace an appropriate update of *citizens* table should be done.

- Your task is to write a procedure *distribute_allowance* satisfying the above requirements. The procedure will take only one IN parameter i.e. total_aid_amount.[Hint: use explicit cursor to select the candidates as per the description]

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

MID SEMESTER EXAMINATION WINTER SEMESTER, 2022-2023
DURATION: 1 HOUR 30 MINUTES FULL MARKS: 75

CSE 4307: Database Management Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) "Cartesian Product is a superset of Natural Join." - Justify with suitable example. 5 (CO1) (PO1)

   b) What is the basic purpose of providing "data abstraction" in Database Management System? There are broadly 3 levels of abstraction. Briefly describe them. 5 (CO1) (PO1)

   c) Differentiate between "table" and "view". Mention two important purposes of creating a view. 5 (CO1) (PO1)

2. Considering the requirements of the 3 relational tables as shown in Table 1, 2 and 3,

Table 1: Information about `Department` table for Question 2.

Attribute	Meaning and Requirement
DID	Primary key
Dept Name	can not be empty
Establishment Year	Exactly 4 digits with no decimal part

Table 2: Information about `Employees` table for Question 2.

Attribute	Meaning and Requirement
EID	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
Dept	Foreign Key referencing Department 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
ManagerID	ID of his immediate reporting boss in the office,and he must be one of the existing employees

Table 3: Information about `Salary` table for Question 2.

Attribute	Meaning and Requirement
EmpID	Foreign key referencing Employees
PDate	Payment Date
Amount	Amount paid

a) Create the tables representing the information shown in Tables 1, 2, 3 using standard SQL. 10 (CO1) (PO1)

b) Write the SQL to answer the following queries: 5 × 2 (CO1) (PO1)

i. Find out the name, date of birth and name of the department of all employees who joined in the last 2 months (i.e. 60 days).

ii. Generate list containing department name and its total employees but include the department with at least 20 employees.

iii. List the employees name,yearly salary and name of their employer.

iv. A list containing department name and its total employees but include the department with at least 20 employees and whose departmental average salary is greater than 20000.

v. List 2 departments with the highest and the lowest number of employees.

c) Consider there exists two relations $R1$ and $R2$. Mention the two conditions must be met in order to execute `UNION` operation. Is it possible to get inconsistent records even if these two conditions are satisfied? Justify your position using example data. 10 (CO1) (PO1)

3. Consider the following high-level description of a sales company:

ABC is a large company that sells different electronic items, such as: Laptop, Smart Phone, Smart Watch, etc. Each item has its name, a short description, and unit price. The country has a number of divisions. Each division has a number of districts. The company has branches at different districts of the country. Employees have basic information, such as name, DOB (date of birth), contact number, and current branch location (i.e. division and district). The company has a number of departments, such as sales, accounts, admin. Each employee must be attached to a specific department. Only customers who are pre-registered with basic information such as name, contact numbers, and address can buy items. The company also provides rental service for items, such as laptop/smart phone for its employees for a specific time duration. After the duration, items must be returned.

Based on the scenario, answer the following questions:

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

b) Implement the ER-D from Question 3.a) using standard SQL. 15 (CO2) (PO3)

1. **(Compulsory)** Government of Bangladesh plans to digitalize its different sectors. Each of the following questions are based on a description of the desired system of a particular component and a number of tasks are identified. The components are logically connected. *You may add additional attribute only if it is needed.*

   (a) A national database should be maintained to store the basic information of each citizen such as `Name`, `Date of Birth (DOB)`, `Blood Group`, `Address`, `Profession`. There are two positions of conflicts of entity Vs. attribute choice for `Blood Group` and `Profession` as given bellow: [6]

   Position A: Both Blood Group and Profession should be attributes.
   Position B: Both Blood Group and Profession should be entities.

   Tasks: Justify your position. Make Entity Relationship Diagram (ERD) specifying the cardinality explicitly. Finally make the DDL statements corresponding the ERD.

   (b) We want to store and maintain citizens' driving license information such as `Name of Citizen`,`Address`, `Date of Birth`,`License No`, `License Issue Date`, `License Expire Date`. Each Citizen may have at most one driving license. [6]

   Tasks: Design the ERD without any data redundancy, mention the cardinality.Comment on if the participations are *total* or *partial*. Make the equivalent DDL statements.

   (c) Now medical sector should be connected to this system. To achieve this the information of each hospital should be maintained including `Name of Hospital`, `Location`, `Year of Establishment`, `Total Capacity` Citizens may be admitted to any of these hospitals but his time and reason for admission must be stored. [6]

   Tasks: Draw the ERD explaining the cardinality involved here. Write the DDL statements to reflect the ERD.

   (d) Based on the above design write the SQL statements for the followings: [2+2+3=7]

   i. Find out the list of citizens ID, name, date of birth, age in years (not given as entity attribute), whose names begin with 'a' and end with 'n' (in both cases letters are not case-sensitive).

   ii. Find the citizen ID, Name and Name of the profession.

   iii. Find a list of top 10 professions along with its total number of people (based on total number of people involved in the profession). A profession must have at least 1000 people involved to be considered primarily.

3. Read the following user requirement in the context of automation of Bangladesh NID, driving license and treatment history:

   National ID (NID) is an integrated collection of citizens' information such as Name, Date of Birth, Occupation, Blood Group. Each citizen has his/her own NID. In order to investigate the population density, the country has been divided into divisions. Each division has its name, size (in square kilometer) and a brief description. Again each division has a number of districts with similar attributes. Citizen information must be connected to its corresponding division and district.

   Each citizen may have exactly one driving license where information such as type of license, issue date, and expiration date are maintained. Whenever any accident occurs, it is logged in the central system. The system stores relevant information such as date and time of accident, location of accident, and the number of deaths (if any).

   There are a number of hospitals in the country having names and contact information. Each hospital may have more than one contact number. Citizens may avail treatment in any hospitals they prefer. Whenever any patient (i.e. citizen) is admitted, the system keeps the record of his/her date of admission, a brief description, and release date.

   a) Draw the Entity Relationship Diagram (ER-D) using conventional method. **10** (CO3) (PO3)

   b) Write appropriate DDL statements to implement above ER-D. **10** (CO1) (PO1)

   c) Write standard SQL for the followings: **5 × 2** (CO1) (PO1)

   i Find the list of Districts along with its total population.

   ii Find the list of Districts having at least 20000 people living there.

   iii Find the number of accidents occurred (if any) by a citizen whose NID is 210.

   iv Find the list of top 5 hospitals based on the number of patients admitted so far.

   v Find the list of Divisions along with its total number of Districts for each Division.