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DTE 1st Semester (3)

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

SEMESTER FINAL EXAMINATION — WINTER SEMESTER, 2015-2016

DURATION: 3 Hours — FULL MARKS: 150

CSE 4173: Introduction to Database Management System

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

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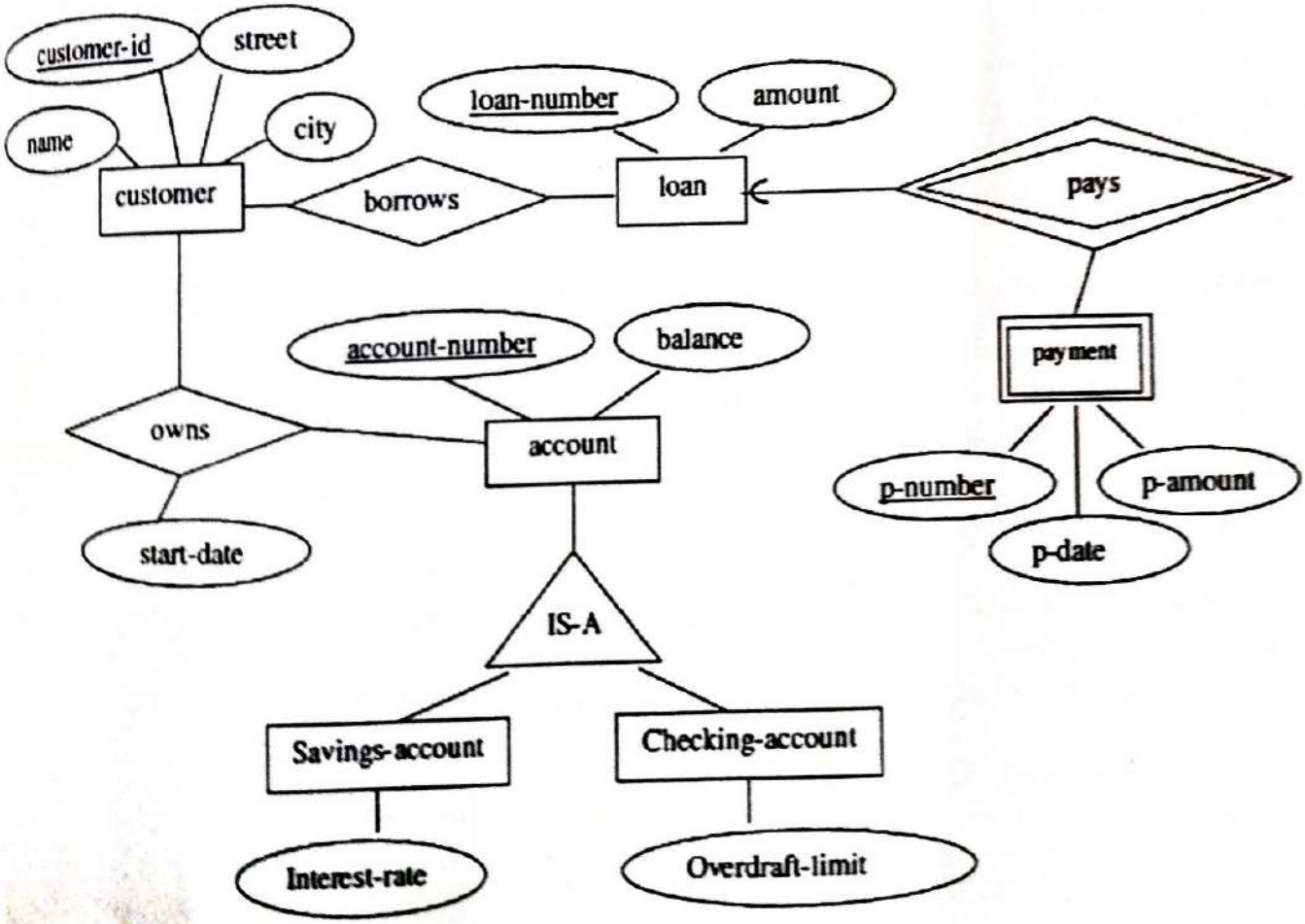
a) What are levels of abstraction in a database? Demonstrate with necessary figure. 8

b) Suppose IUT has a Student Management System that is implemented with several files. Now, the IUT authority is thinking about changing the system into a Database Management System. Give reasons why IUT authority is thinking about changing the system. 12

c) What is the difference between unique key and primary key in a database? 5

a) Translate the following ER diagram into relational schema: 15



b) What is weak entity set? Why does it need an identifying relationship with strong entity set? Explain with example. 5

c) What is DML (Data Manipulation Language)? What are the two types of DML? 5

3. a) What data types should be used to store large objects in your database? Explain them.
   b) Let R (A, B, C) and S (B, C, D) be the relations shown in Table 1 and Table 2.

Table 1: Relation R

A	B	C
a	c	c
a	e	c
a	c	d
b	d	d

Table 2: Relation S

B	C	D
c	c	a
d	c	a
e	d	b

Compute the results of the following operations based on the above tables:

i. $S \div \pi_b (R)$ ii. $\pi_{R.B, S.C} (\sigma_{A=D} (R \times S))$

c) Consider the following two tables:

Table 3: Customer

Customer_Name	City
Smith	Seattle
Roberts	Alabama
John	Dallas

Table 4: Account_Info

Account_Number	Customer_Name	Balance
111	John	500
115	William	1000
120	Roberts	300

Write down the results after performing the following operations:

i. Left Outer Join (Customer ⟕ Account_Info)
ii. Right Outer Join (Customer ⟖ Account_Info)
iii. Full Outer Join (Customer ⟗ Account_Info)
iv. Inner Join (Customer ⋈ Account_Info)
v. Natural Join (Customer × Account_Info)

4. a) What is the difference between user defined types and domains in database? Demonstrate with suitable examples.
   b) Consider the following relational schema where the primary keys are underlined:

Suppliers(sid, sname, street)
Parts(pid, pname, color)
Catalog(sid, pid, cost)

Write the following queries in *relational algebra*:

i. Find the names of the suppliers who supply parts colored "Green".
ii. Find sids of suppliers who supply "Red" colored parts and live in "Gazipur".
iii. Count the number of parts supplied by the supplier named "Bob".
iv. Find the sids of suppliers who supply all the parts.
v. Find the names of suppliers who supply the most expensive item.

a) Consider the following SQL data definition for part of the university database: 7

```
Create table section
(course_id varchar(8),
sec_id varchar(8),
semester varchar(6),
year numeric(4,0),
building varchar(10),
room_number numberic (3,0),
time_slot_id varchar(4));
```

Re-write the SQL data definition and apply the following integrity constraints:

i. Semester can only be Fall, Spring, Winter or Summer.
ii. Year must be greater than 1999.
iii. Room number must be between 101 and 150.
iv. (*course_id, sec_id, semester, year*) together is unique.
v. (*building, room_number)* cannot be null.
vi. *course_id* is a foreign key referencing *course* and *(building,room_number)* is a foreign key referencing *classroom.*
vii. Section id must start with 'IUT-'.

b) Consider the following relational schema: 5x3

Employee (FName, Initial, LName, ENo, Age, Address, Sex, Salary, DNumber)
Department (DName, DNumber, DLocation)
Project (PName, PNumber, PLocation, DNumber)
Works_on (ENo, PNumber, Hours)

Now answer the SQL queries for the given relational schema:

i. Find the average salary of all the male employees of 'sales' department.
ii. Find out the names of all the female employees who work in more than one projects.
iii. Find out the average salary of all the employees whose age is less than 35 yrs .
iv. Delete the records of all the projects involved with more than 3 employees.
v. Find out the name of the projects where all the employees work more than 5 hours.

c) What do you mean by materialized views? Explain briefly. 3

a) Consider a relation R (A, B, C, D, E, F, G, H, I, J, K) with a candidate key (A, E, F, G) and the following functional dependencies: 10

$$A \rightarrow B, C, D$$
$$H, I \rightarrow J$$
$$A, E, F, G \rightarrow H, I, K$$

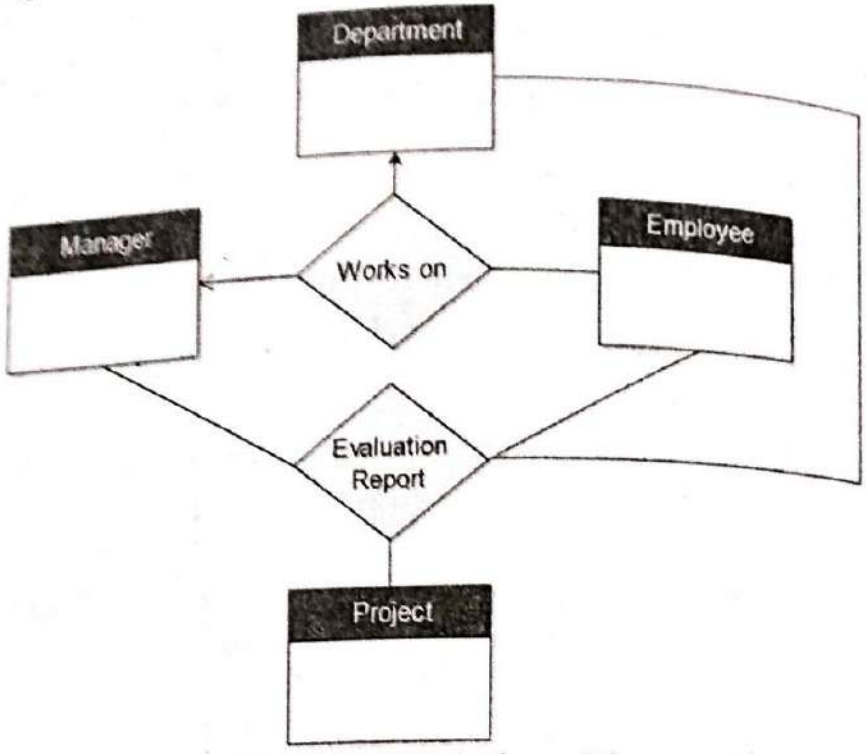
Compute the Boyce-Codd Normal Form (BCNF) decomposition of R. Indicate each step you make in your computation. Indicate clearly your end result: the relations, their attributes, and their keys.

b) Write short notes on the following topics: 9

i. Lossy Vs Lossless decomposition.
ii. Dependency preservation.
iii. Extraneous attribute

c) How super key can be defined using functional dependency? Show with an example. 6

7. a) Consider the following ER-Diagram:



Discuss the problems associated with this ER-design. Discuss few possible solutions to th problem.

b) What is the canonical cover of a set of functional dependencies? Given R = {A, B, C, D, E, F} and = {A → B, AB → C, BC → D, A → DE, E → A}. Find the canonical cover of F.

c) Write short notes on:
   i. Generalization and Specialization.
   ii. SQL Views.
   iii. Integrity Constraints

8. a) Draw the storage hierarchy with proper labeling
   b) Explain the Magnetic Hard Disk Mechanism with proper demonstration of necessary figures.
   c) Explain why the instructor_dept table given, in Table 5, is an example of bad database design. Als explain how can you convert this design into a good one.

Table 5: instructor_dept table

ID	*name*	*salary*	*dept_name*	*building*	*budget*
22222	Einstein	95000	Physics	Watson	70000
12121	Wu	90000	Finance	Painter	120000
32343	El Said	60000	History	Painter	50000
45565	Katz	75000	Comp. Sci.	Taylor	100000
98345	Kim	80000	Elec. Eng.	Taylor	85000
76766	Crick	72000	Biology	Watson	90000
10101	Srinivasan	65000	Comp. Sci.	Taylor	100000
58583	Califieri	62000	History	Painter	50000
83821	Brandt	92000	Comp. Sci.	Taylor	100000
15151	Mozart	40000	Music	Packard	80000
33456	Gold	87000	Physics	Watson	70000
76543	Singh	80000	Finance	Painter	120000