National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	**Database Systems**	**Course Code:**	**CS219**
Degree Program:	**BS(Computer Science)**	**Semester:**	**Fall 2020**
Exam Duration:	**3 Hours**	**Total Marks:**	**50**
Paper Date:	**Wed 17-Feb-2020**	**Weight**	**50%**
Section:	**ALL**	**Page(s):**	**7**
Exam Type:	**Final Exam**	**Total Questions:**	**7**

Student : Name:_____ Roll No._____ Section:_____

Instruction/Notes: Scratch sheet can be used for rough work however, all the questions and steps are to be shown on question paper. ***No extra/rough sheets should be submitted with question paper***.
You will not get any credit if you do not show proper working, reasoning and steps as asked in question statements.

Q1. *(4 points)*

a. List the typical states that a transaction goes through during execution.

b. List the problems that occur when concurrent execution is uncontrolled.

Roll No. _____

Q2. *(5 points)* Consider a set of FDs *F = {D→E, ABC→BDE, B→F, A→C, ABC→F}*. Compute the minimal cover for F (i.e. F_c).

Roll No. _____

Q3. *(2+2+2+1= 7 points)* Consider a relation schema *R (A, B, C, D)*, with FDs *F = {B → D, D → A}*. Show all steps, working, and reasoning to answer the following questions.

a. Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF). Justify your answer.

b. Decompose the relation R into a 2NF schema, if it is not in 2NF. *(Remove 2NF violations only, in this part)*

c. Check whether your answer to part **(b)** is in 3NF. If not, decompose it into a 3NF schema.

d. Check whether your answer to part **(c)** is in BCNF. If not, decompose it into a BCNF schema.

Roll No. _____

Consider the following database for next two questions:

Worker

WId	Name	Title	Salary	Dept
1	Isbah	Manager	100,000	HR
2	Tahreem	Executive	80,000	Admin
3	Izaan	Lead	300,000	HR
4	Khadija	Manager	500,000	Admin
5	Mateen	Manager	500,000	Admin
6	Ayesha	Lead	200,000	Account
7	Moeez	Executive	75,000	Account
8	Minahal	Executive	90,000	Admin

Bonus

WorkerId	BonusDate	Amount
1	11-20-2020	5000
2	11-20-2020	3000
3	11-20-2020	4000
1	12-19-2020	4500
2	12-19-2020	3500

Q4. *(9 points)* Write the result of the following queries for the database state given above.

a. $\Pi_{\text{WId, name, Salary}}$ ($\sigma_{\text{WorkerID IS NULL and Dept='Admin'}}$ **(**Worker $\rtimes_{\text{WId=WorkerID}}$ Bonus))

b. R(**Title**, TotalBonus) ← **Title** $\Im_{\text{SUM(Amount)}}$ (Worker $\bowtie_{\text{WId=WorkerID}}$ Bonus)

c. SELECT * FROM Worker WHERE NOT EXISTS (SELECT * FROM Bonus WHERE WId=WorkerID);

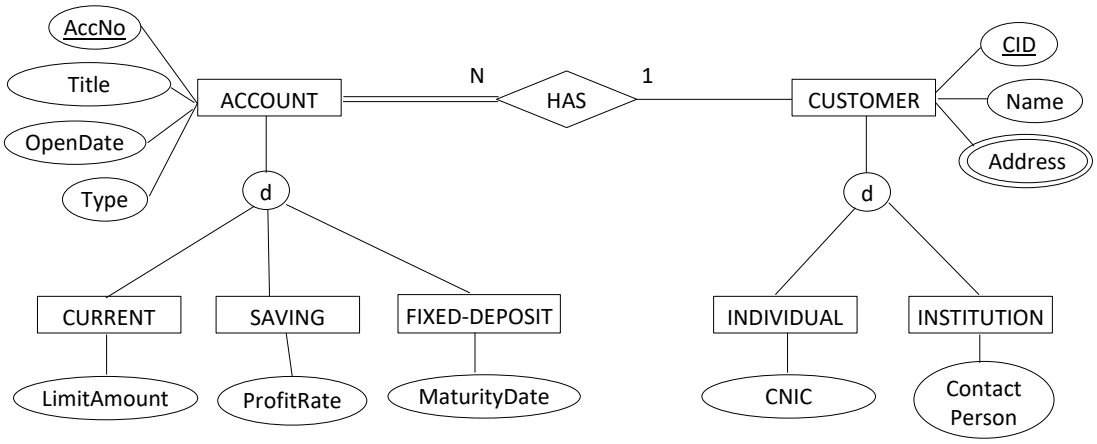
Q5. *(10 points)*

a. Write an SQL query to print Dept, Name, Title, and Salary of workers having the lowest salary in each department.

b. Write an SQL query to print WId, Name, Title, and Salary of workers who did not earn any bonus amount and have the salary less than 150,000.

Roll No. _____

Q6. *(5 points)* Map the following EER diagram into a relational model.



Q7. *(10 points)* Draw an ER/EER diagram for the following situation. Please do not forget to show the keys and cardinalities. If other constraints should be needed, it suffices to sketch them in natural language.

A Payroll department wishes to create a database to monitor employees' salary payments. To calculate an employee's salary, Payroll need to take into consideration holidays taken against holiday entitlement, number of days sick leave in the pay period, bonuses, and deductions. An employee must specify how his/her salary should be paid, although this may change over time. Most employees are paid by electronic bank transfer, but some types of employees may be paid by cash or check. If payment is electronic, then a routing number and account type are required. Payment can only be made by one method. There are various reasons for deductions being made; for example, federal tax, state tax, medical plan, retirement plan, or cash advance.