Roll No. _____Name _____ Section ___

National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Database Systems**	**Course Code:**	**CS203**
Program:	**BS(Computer Science)**	**Semester:**	**Spring 2018**
Duration:	**3 Hours**	**Total Marks:**	**65**
Paper Date:	**Mon 21-May-2018**	**Weight**	**50%**
Section:	**ALL**	**Page(s):**	**11**
Exam:	**Final Exam**		

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. *(5 points)* Consider the following two sets of FDs. Check whether or not they are equivalent. Provide proper reason.

F1 = {A→B, B→C, C→A} and *F2 = {A→C, C→B, B→A}.*

Roll No. _____Name _____ Section ___

Q2. *(5 points)* Consider the relation schema *R(A, B, C, D, E, F)*, with FDs *F = {AB→CD, B→C, BC→D, CD→EF, E→F}*. Compute the minimal cover for *F* (i.e. F_c). Show your work!

Roll No. _____Name _____ Section ___

Q3. *(5 points)* Consider the relation *R(A, B. C, D, E)*, with FDs *{AB →C, DE →C, B →D}*. Possible key of this relation is *{ABE}*. State which of the following decompositions of R relation are lossless decomposition. Justify your answer.

a. *R1(A, B, C), R2(C, D, E)*, and *R3(B, D)*.

b. *R1(A, B, C), R2(A, B, E)*, and *R3(B, D)*.

Roll No. _____Name _____ Section ___

Q4. *(5 points)* Consider the relation schema *R(A, B, C, D)*, with FDs *{AB → C, BC → D, CD → A}*. Identify the best normal form that *R* satisfies (*1NF, 2NF, 3NF, or BCNF*). Justify your answer. If *R* is not in *BCNF*, decompose it into a set of BCNF relations. Indicate which dependencies if any are not preserved by the decomposition.

Roll No. _____Name _____ Section ___

Q5. *(5 points)* Consider the following classes of schedules: conflict-serializable, view-serializable, strict, cascadeless, recoverable and non-recoverable. For a schedule *S: r2(X); w3(X); w1(Y); r2(Y); r2(Z); r2(Y); c3; c2; r1(Z); c1*, state which of the preceding classes it belongs to. Give proper reason. The actions are listed in the order they are scheduled. Also draw the serializability (precedence) graph for this schedule. If the schedule is conflict-serializable or view-serializable, write down the equivalent serial schedule(s) otherwise explain why it is not.

Roll No. _____Name _____ Section ___

Q6. *(10 points)* Consider the following database of the "BLOGs" website. The website keeps tracks of the different users and blog written by them on different topics. Each user is identified by a unique username. The website also keeps track of the various comments given by Users on the Blogs.

The field Bwriter in Blog table is a foreign Key from user table and it gives the unique username of the Blog-writer and similarly the field Cwriter in Comment Table is a foreign key and gives the username of the user who have given a comment on the Blog.

USER

Uname	Age	Gender
Sara	25	F
Zara	42	F
Ali	15	M
Ahmad	19	M
Aliya	27	F
Tania	29	F
Hamza	34	M

TOPIC

TId	Name	Subject
1	Deep Learning	Computer Science
2	Big Data	Computer Science
3	Databases	Computer Science
4	Algorithms	Computer Science
5	Human Interactions	Philosophy

BLOG

BId	Bname	Bwriter	TopicId
10	BigData Frameworks	Ahmad	2
20	Generation Gap	Sara	5
100	Map Reduce	Hamza	2
30	The world of CNN	Ali	1
50	Cassandra	Ali	3
70	Neural Nets	Tania	1
60	MongoDB	Tania	3
120	Emerging trends	Sara	2
80	Hbase	Ali	3

COMMENT

CId	BlogId	Cwriter
1	20	Hamza
2	100	Hamza
3	20	Zara
20	80	Hamza
7	30	Zara
9	50	Zara
5	80	Ali
12	50	Ahmad
15	50	Tania

Write both **SQL and Relation Algebra Queries** for the following tasks

a. Find the name and age of the users who have never written any blog and have never given any comment.

b. Find the name of the users who have given comment on all the blogs written in Computer Science area.

Roll No. _____Name _____ Section ____

Find the name of the users who have given comment on all the blogs written in Computer Science area.

Roll No. _____Name _____ Section ___

Q7. *(5 points)* For the above database, create a view that find and list the pair of users who have never written a blog on the same Topic. If this query is run on the above database, the result should be:

Blog Writer 1	Blog Writer 2
Ahmad	Tania
Hamza	Ali
Hamza	Tania

Roll No. _____Name _____ Section ___

Q8. *(10 points)* Write the result of the following queries for the Database State given above. Also show the intermediate tables. Explain in one sentence what these queries are doing.

a. STopics $\leftarrow \Pi_{Subjects}(TOPIC)$
BSubjects $\leftarrow \Pi_{Bwriter,\ Subjects}(TOPIC \bowtie_{TId=TopicId} BLOG)$
$T \leftarrow \Pi_{Bwriter}(BSubjects) - (\Pi_{Bwriter}((\Pi_{Bwriter}(BSubjects) \times STopics) - BSubjects))$

b.
```
SELECT   BId
FROM   blog B  JOIN  user U  ON  Bwriter=Uname
WHERE   U.age < 30
AND   B.BId  IN  ( SELECT BlogId   FROM comment    GROUP BY BlogId   HAVING  COUNT (*) >= 2 )
AND   NOT EXISTS (SELECT *    FROM comment    WHERE B.Bwriter = Cwriter AND B.Bid = BlogId )
```

Q9. *(10 points)* Draw an ER/EER diagram for the following case study. Specify key attributes of each entity type and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete but clearly state your assumptions along the diagram.

A taxi company (like Uber) needs to model their activities. There are two types of employees in the company: drivers and operators. For drivers it is interesting to know the date of issue and type of the driving license, and the date of issue of the taxi driver's certificate. For all employees it is interesting to know their personal number, address and the available phone numbers. The company owns a number of cars. For each car there is a need to know its type, year of manufacturing, maximum number of passengers in the car and date of the last service. The company wants to have a record of car trips. A taxi may be picked on a street or ordered through an operator who assigns the order to a certain driver and a car. Departure and destination addresses together with times should also be recorded.

Roll No. _____Name _____ Section ___

Q10. *(5 points)* Map following ER diagram into a relational model.