Roll No. _____ Name _____ Section ____

National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Database Systems**	**Course Code:**	**CS219**
Program:	**BS(Computer Science)**	**Semester:**	**Fall 2020**
Duration:	**90 Minutes**	**Total Marks:**	**23**
Paper Date:	**Mon 01-Feb-2021**	**Weight**	**15%**
Section:	**ALL**	**Page(s):**	**5**
Exam:	**Midterm-2**	**Total Questions:**	**5**

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. *(3 points)* Consider a relation schema *R (A, B, C, D, E)*, with FDs *F = {A→C, C→BD, D→A}*. Determine all possible candidate keys (i.e. keys). Prove it.

Roll No. _____ Name _____ Section ____

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

Roll No. _____ Name _____ Section ____

Q3. *(5 points)* Find out whether the following set of FDs are equivalent or not. Show all the steps.

F1 = {A→C, AB→C, C→DI, CD→I, EC→AB, EI→C}

F2 = {A→C, C→D, C→I, EC→A, EC→B, EI→C}

Roll No. _____ Name _____ Section ____

Q4. *(3 points)* Consider the relation *R (A, B. C, D, E)*, with FDs *F = {A→BC, C→D, E→D, BE→A}.*

a. Is the decomposition *R1(A, E), R2(A, B, C),* and *R3(D, E)* a lossless decomposition? Prove it.
b. Is the decomposition *R1(A, E), R2(A, B, C),* and *R3(C, D)* a lossless decomposition? Prove it.
c. Is the decomposition *R1(A, B, C), R2(C, D),* and *R3(D, E)* a lossless decomposition? Prove it.

Roll No. _____ Name _____ Section ____

Q5. *(1+1+2+2+1= 7 points)* Consider a relation schema *R (A, B, C, D, E, F, G)*, with FDs *F = {A→G, F→E, G→DB, D→C}*. Show all steps, working, and reasoning to answer the following questions.

a. Determine all possible keys. Prove it.
b. Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF). Justify your answer.
c. Decompose the relation R into a 2NF schema, if it is not in 2NF. *(Remove 2NF violations only, in this part)*
d. Check whether your answer to part **(c)** is in 3NF. If not, decompose it into a 3NF schema. List clearly complete set of 3NF schema relations with all keys and FDs.
e. Check whether your answer to part **(d)** is in BCNF. If not, decompose it into a BCNF schema. List clearly complete set of BCNF schema relations with all keys and FDs and also indicate which dependencies if any are not preserved.