Roll No. _____ Name _____ Section ____

National University of Computer and Emerging Sciences, Lahore Campus

Course:	Database Systems	Course Code:	CS2005
Program:	BS (CS, DS, SE)	Semester:	Spring 2023
Duration:	60 Minutes	Total Marks:	25
Paper Date:	Mon 10-Apr-2023	Weight	15%
Section:	ALL	Page(s):	1
Exam:	Midterm-II		

Instruction/Notes: **Solve the questions in the given order.**
You will not get any credit if you do not show proper working, reasoning, and steps as asked in the question statements.

SOLUTION

Q1. *(5 points)* Consider a relation R (A, B, C, D, E, F), with the set of FDs $F= \{A \rightarrow BC, B \rightarrow D, CF \rightarrow E, E \rightarrow F\}$. Find all possible keys of this relation? Prove it.

Ans: Keys are {AF}, {AE}.

Q2. *(5 points)* Consider two sets of FDs, F and G, $F = \{A \rightarrow BC, B \rightarrow CD, C \rightarrow DE\}$ and $G = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow E\}$. Are F and G equivalent? Prove it.

Ans: Not Eqauivalent. G covers F but F does not cover G.

Q3. *(5 points)* Find a minimal cover of $F = \{A \rightarrow BCD, BC \rightarrow DE, D \rightarrow E\}$. Show all steps.

Ans: $F_c = \{A \rightarrow BCD, BC \rightarrow DE, D \rightarrow E\}$ *or* $F_c = \{A \rightarrow BC, BC \rightarrow D, D \rightarrow E\}$.

Q4. *(5 points)* Consider the relation schema R (A, B, C, D), with FDs $F= \{AB \rightarrow C, BC \rightarrow D, AD \rightarrow B\}$. Keys of this relation R are {AB} and {AD}.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 and show your steps. Indicate which dependencies if any are not preserved by the BCNF decomposition.

Ans: HNF=3NF as FD2: BC → D violate BCNF; BCNF Schema is R1(A B C), R2(B C D); FD3: AD → B is lost.

Q5. *(5 points)* Consider the relation R (A, B, C, D, E), with FDs $F= \{A \rightarrow BC, B \rightarrow CD, C \rightarrow DE, D \rightarrow E\}$. Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF). Justify your answer. If R is not in 3NF, decompose it into a set of 3NF relations and show your steps.

Ans: HNF=2NF as FD2,3,4 violate 3NF; 3NF Schema is R1(A B), R2(B C), R3(C D), R4(D E); All FDs are preserved.