National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	**Database Systems**	**Course Code:**	**CS2005**
Degree Program:	**BS(Computer Science)**	**Semester:**	**Spring 2022**
Exam Duration:	**60 Minutes**	**Total Marks:**	**25**
Paper Date:	**Mon 09-May-2022**	**Weight**	**15%**
Section:	**ALL**	**Page(s):**	**5**
Exam Type:	**Midterm-2**	**Total Questions:**	**5**

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. *(5 points)* Consider a relation R (A, B, C, D, E, H, K, L), with the set of FDs F= {A → BL, B → CE, D → BK, K→ D}. What are the keys of this relation? Prove it.

Ans: Keys are {ADH} and {AHK}.

Roll No: _____

Q2. *(5 points)* Consider the relation schema R (A, B, C, D, E, H), with FDs F= {A → BC, B → CE, A → E, AC → H, D → B}. Find a minimal cover of *F* (i.e. F_c).

Ans:

F_c= {A → B~~C~~, B → CE, ~~A → E,~~ A~~C~~ → H, D → B} **OR**

F_c= {A → BH, B → CE, D → B}

Roll No: _____

Q3. *(5 points)* Consider a relation R (A, B, C, D), with the set of FDs F = {A → B, B → C, C → D, D → A}. Show the relation state that must hold all these FDs.

Ans:

A	B	C	D
a1	b1	c1	d1

Q4. *(5 points)* Consider the relation R (A, B. C, D, E), with FDs {AC→B, DE→B, C→E}. Key is {ACD}. State which of the following decompositions of R relation are lossless decomposition. Prove it.

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

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

Ans:

a. *Lossless*

b. *Not Lossless*

Roll No: _____

Q5. *(5 points)* Consider the relation schema R (A, B, C, D, E, H), with FDs F= {AB → C, CD → AE, E → H}. Keys are {ABD} and {BCD}. 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= 1NF; PFD2a: CD → E violate 2NF.
2NF relation schemas are:
R1(A B C D) with FD1, FD2a, Key1{ABD}, Key2{BCD}; R2(C D E H) with FD2b & FD3.
3NF relation schemas are:
R1(A B C D) with FD1, FD2a, Key1{ABD}, Key2{BCD}; R21(C D E) with FD2b; R21(E H) with FD3.
BCNF relation schemas are:
R11(A B D); R12(A B C) with FD1; R21(C D E) with FD2b; R21(E H) with FD3.
FD2a: CD → A is lost.
OR
R11(B C D); R12(A C D) with FD2a; R21(C D E) with FD2b; R21(E H) with FD3.
FD1: AB → C is lost.

Roll No: _____