National University of Computer and Emerging Sciences

Lahore Campus

# Database Systems (CS2005) Sessional-II Exam

Date: April 5th 2024

**Course Instructor(s)**

**Total Time (Hrs.): 1**

**Total Marks: 25**

**Total Questions: 5**

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Roll No Section Student Signature

**Do not write below this line.**

**Attempt all the questions.**

***CLO # 3***

**Q. No 1:** Consider a relation R (A, B, C, D, E, F), with the set of FDs F= {AB→C, CD→E, EF→A, BC→ D, DE→F}. Find all possible keys (i.e. candidate keys) of this relation? Prove it. [5]

**Ans: Keys are Ans: AB, BC, BDE, BEF.**

***CLO # 3***

**Q. No 2:** Consider the relation schema R (A, B, C, D, E), with FDs F= {A→BC, BCD→E, BC→D, A→D}. Find a minimal cover of *F* (i.e. $F_c$). [5]

**Ans: $F_c$= {A→BC, BCD→E, BC→D, A→D} i.e. $F_c$= {A→BC, BC→DE}.**

***CLO # 3***

**Q. No 3:** Consider two sets of FDs, F and G, F = {A→BC, B→D, C→E, D→E} and G = {A→BC, B→D, C→E, BD→E, A→D}. Are F and G equivalent? Prove it. [5]

**Ans: Not equivalent. F covers G, but G does not cover F, as FD: D→E is not determined by G.**

***CLO # 3***

**Q. No 4:** Consider the relation R (A, B. C, D, E), with FDs {AC→B, D→E}. State which of the following decompositions of R relation are lossless decomposition. Prove/disprove it. [5]

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

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

**Ans: Key of R is {ACD}.**

**a. Lossless decomposition.** R1(A, C, D), R2(A, B, C), R3(D, E); R1∩R2→R2 & R1∩R3→R3.

**b. Lossy decomposition.** R1(A, B, D), R2(A, B, C), R3(D, E); Only one condition is true i.e. R1∩R3→R3.

***CLO # 3***

**Q. No 5:** Consider the relation schema R (A, B, C, D, E), with FDs F= {AB → C, BC → D, D → E, AE → B}. Keys of this relation are AB, AD, and AE. 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. [5]

**Ans: HNF=3NF as FD2/FD3 violate BCNF. BCNF Schema is R1(A B C), R2(B C D), R3(D E). FD4: AE→B is lost.**