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| **National University of Computer and Emerging Sciences, Lahore Campus** | | | | |
| C:\Users\saif\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Word\final design.jpg | **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 → BC, B → D, CF → E, E → 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 → BC, B → CD, C → DE }* and *G = {A → B, B → C, C → D, D → 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 → BCD, BC → DE, D → E}*. Show all steps.

**Ans: *Fc = {A → BC~~D~~, BC → D~~E~~, D → E}*** *or* ***Fc = {A → BC, BC → D, D → E}.***

**Q4.** *(5 points)* Consider the relation schema R (A, B, C, D), with FDs *F= {AB → C, BC → D, AD → 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 → BC, B → CD, C → DE, D → 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.**