

# Database Systems (CS2005)

## Sessional-II Exam

Date: Fri, 05 April 2024

Course Instructor(s)

Total Time (Hrs.):

Total Marks:

Total Questions:

1

25

5

Roll No

Section

Student Signature

Do not write below this line.

Note: Please ensure that you attempt all questions and their respective parts in the given order.

### CLO # 3

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

### CLO # 3

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

### CLO # 3

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

### CLO # 3

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

a.  $R_1(A, C, D)$ ,  $R_2(A, B, C)$ , and  $R_3(D, E)$ .

b.  $R_1(A, B, D)$ ,  $R_2(A, B, C)$ , and  $R_3(D, E)$ .

### CLO # 3

Q. No 5: Consider the relation schema R (A, B, C, D, E), with FDs  $F = \{AB \rightarrow C, BC \rightarrow D, D \rightarrow E, AE \rightarrow B\}$ . 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]

3NF

$R_1(ABC), R_2(BCD), R_3(DE)$

$R(ABCD E)$

$R_1(BCDE)$   
 $\{BC \rightarrow D, D \rightarrow E\}$

$R_2(ABC)$   
 $\{AB \rightarrow C\}$

$R_1(BCDE)$

$R_1(BCD)$   
 $\{BC \rightarrow D\}$   
BCNF

$R_2(DE)$   
 $\{D \rightarrow E\}$   
BCNF

$$A \rightarrow BC, BCD \rightarrow E, BC \rightarrow D, A \rightarrow D$$

Step 1:  $A \rightarrow B, A \rightarrow C, BCD \rightarrow E, BC \rightarrow D, A \rightarrow D$

Step 2:  $A \rightarrow B, A \rightarrow C, BCD \rightarrow E, BC \rightarrow D, A \rightarrow D$

$$A^+ = \{A\} \times$$

$$A^+ = \{ABD\} \times$$

$$B^+ = \{BCD\} \times$$

$$BC^+ = \{BCE\} \times$$

$$A^+ = \{ABCD\} \checkmark$$

$$A \rightarrow B, A \rightarrow C, BC \rightarrow E, BC \rightarrow D \checkmark$$

$$A \rightarrow BC, BC \rightarrow DE \checkmark$$