

FILE ORGANIZATION AND DATABASE SYSTEMS: Class Test I

Instructions: 1. **Total Marks: 20** **Duration 1 Hour (6.30 PM – 7.30 PM)**
2. Date: **25-02-2021**
3. **Write your Roll Number, Name and upload pdf file in Microsoft Team**

1. Consider the following set of requirements for a university database that is used to keep track of student's information.
 - The university keeps track of each student's name, student number, current address and phone, permanent address and phone, DOB, sex, class (first year, second year,...) and degree program (B.Tech., M.Sc., ...). Student number has unique value for every student.
 - Each department is described by a name, department code, office number, office phone. Both name and code have unique values for every student.
 - Each course has a course number, description, number of semester hours, level and offering department. The value of course number is unique for each course.
 - Each section has an instructor, semester, year, course and section number. The section number distinguishes sections of the same course that are taught during the same semester.
 - A grade report contains a student name, student number, section and letter grade.
 - i. Identify the entity sets and the corresponding attributes. Specify the key attributes of each entity set and the relationship among these entity sets.
 - ii. Draw an ER diagram that captures the above information.
 - iii. Write the relational model and draw the network model corresponding to the above ER diagram with proper justification.

(1+3+2)
2.
 - a) Prove that if a relation R has only one key, it is in BCNF if and only if it is in 3NF.
 - b) Consider a relational scheme R(W, X, Y, Z). Prove or disprove the following rules :
 - i) $X \rightarrow Y, W \rightarrow Z$ and $Y \subseteq W$ **imply** $X \rightarrow Z$.
 - ii) $XZ \rightarrow Y, X \rightarrow W$ and $Z \subseteq W$ **imply** $X \rightarrow Y$.
 - c) Given the relational scheme R (A, B, C, D, E,X,Y) with FDs
 $\{D \rightarrow A, XD \rightarrow C, DA \rightarrow B, A \rightarrow X, XE \rightarrow B, E \rightarrow A, B \rightarrow D, EB \rightarrow C, AB \rightarrow C, Y \rightarrow B, C \rightarrow B\}$
Reduce the relation R into 3NF loss-less join decomposition preserving dependencies.

(1+2+3)
3.
 - a) Suppose we have two relations R(A,B,C) and S(A,B,D). Show how the natural join of R and S can be computed using fundamental operations of relational algebra. Write the corresponding expression in tuple relational calculus.
 - b) Consider the following library database :
SUPPLIER(s_id, s_name, s_address) ; BOOK(acc_no, year_of_pub, title) ; USER(card_no, u_name, u_address) ; SUPPLY(acc_no, s_id, price, date_of_supply) and BORROW(acc_no,

card_no, date_of_issue) . Express the following queries in **relational algebra**:

- i) List the name of those users who have not issued any book.
- ii) Find the name of those suppliers, who have supplied all the books issued to card number "A11".
- iii) List the title and price of the most expensive book.

(2+4)

4. a) Consider a relational scheme $R(A, B, C, D, E)$ with FDs

$$\{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$$

Let R can be decomposed into $R_1\{A, B, C\}$ and $R_2\{A, D, E\}$. Show that

- i) This decomposition is a lossless join decomposition.
- ii) This decomposition is not a dependency preserving decomposition

(2)

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