

Department of Mathematics
I.I.T., Kharagpur

Mid Spring Semester Examination 2016-2017

Subject :File Organization & Database Systems(MA40004/MA61018/MA60050)
4th Yr. B.Tech., 4th Yr. M.Sc., 1st Yr. M.Tech(CSDP)
No. of Students (115 + 29)

Time : 02 Hours

Marks : 30

Answer all **FIVE** Questions
(This question paper consists of **TWO** Pages)

1. A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialist in a particular area, take sole responsibility for editing one or more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with one editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject.

- 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. Draw the relational model, hierarchical model and network model corresponding to the above ER diagram with proper justification.

(1+2+3)

2.

- a) Explain the important features which distinguish a database system from a collection of conventional data files.
- b) Define lossless join decomposition and preservation of dependency. Explain their importance in the decomposition process of a relational scheme with appropriate examples.
- c) Define extraneous attribute and redundant FD. Give an efficient algorithm to compute the closure of a set of attributes under a set of functional dependencies.

(2+2+2)

3.

- a) Write an algorithm for decomposing a relational scheme into 3rd Normal Form. Illustrate your algorithm for a relational scheme $R(A,B,C,D,E,X,Y)$ with FDs $\{ D \rightarrow A, XD \rightarrow C, DA \rightarrow B, A \rightarrow X, XE \rightarrow B, E \rightarrow A, B \rightarrow D, EB \rightarrow C, AB \rightarrow C, Y \rightarrow B, C \rightarrow B \}$.
- b) Define multivalued dependency with one example. If a relational scheme is not in 4NF, then discuss its decomposition process.
- c) Define elementary FD and elementary prime attribute. Give an example of a relational scheme R and a set of dependencies D such that R is in 3NF but not in 4NF. Justify your answer.

(3+2+2)

Contd...

4.

a) 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.

b) What is the difference between Cartesian product and Natural Join? 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 operators of relational algebra.

(4+2)

5.

a) Define BCNF. Prove that if a relation R has only one key, it is in BCNF if and only if it is in 3NF.

b) State the decomposition axioms for functional dependency.

Given a relational scheme R(W,X,Y,Z). Prove or disprove the following rule:

$XZ \rightarrow Y$, $X \rightarrow W$ and $Z \subseteq W$ imply $X \rightarrow Y$.

(2 +3)

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