JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS-2022

B.Tech-III Semester (CSE/IT)

COURSE CODE (CREDITS): 18B11CI313(3)   MAX. MARKS: 25

COURSE NAME: DATABASE MANAGEMENT SYSTEMS   MAX. TIME: 1 Hr. 30 Min.

COURSE INSTRUCTORS: Dr. P.K. Gupta, Dr. Hari Singh, Dr. Amit Kumar, Dr. Monika Bharti

Note: All questions are compulsory.

Marks are indicated against each question in square brackets.

Attempt all parts (IF ANY) of a given question at ONE PLACE ONLY.

Q1. Given two relations R_1 and R_2, where $R1$ contains N1 tuples, R_2 contains N2 tuples, and N2 > N1 > 0, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for R_1 and R_2 needed to make the expression meaningful.

    a) $R_1 \times R_2$ **[CO2] [1+1]**

    b) $\sigma_{a = 5}(R_1)$

Q2. Consider the relation schema R(A, B, C, D, E) and set of FDs: **[CO3] [1+2]**

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

    Compute the following:

    a) Closure F+.

    b) Canonical cover Fc.

Q3. Consider the following schema: **[CO2] [2+2]**

    Suppliers(*sid:* integer, *sname:* string, *address:* string)

    Parts(*pid:* integer, *pname:* string, *color:* string)

    Catalog(*sid:* integer, *pid:* integer, *cost:* real)

The key fields are underlined, and the domain of each field is listed after the field name. Therefore *sid* is the key for Suppliers, *pid* is the key for Parts, and *sid* and *pid* together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in tuple relational calculus, and domain relational calculus:

    a) Find the *sids* of suppliers who supply some red or green part.

    b) Find the *sids* of suppliers who supply some red part or are at 221 Packer Street.

Q4. Briefly answer the following: **[CO4] [2+2]**

    a) Consider the set of FDs $F = \{AB \rightarrow CD, B \rightarrow C\}$ for the relation schema R(A, B, C, D) with primary key AB under which R is in 1NF but not in 2NF.

b) Consider the relation schema R(A,B,C), which has the FD B → C. If A is a candidate key for R, is it possible for R to be in BCNF? If so, under what conditions? If not, explain why not?

Q5. Suppose you are given a relation R with four attributes ABCD. For the given set of functional dependencies F = {AB → C, AB → D, C→A, D → B}, assuming these are the only dependencies that hold for R, do the following: **[CO4] [2+1+2]**
   a) Identify the candidate key(s).
   b) Identify the best normal form that R satisfies.
   c) In case, if R is not in BCNF then decompose it into a set of BCNF relations that preserve the dependencies.

Q6. Answer the following with justification: **[CO4]**

   a) Give an example of a relation schema R and a set of dependencies such that R is in BCNF, but is not in 4NF. **[2]**
   b) Explain why 4NF is a normal form more desirable than BCNF. **[2]**
   c) Show that if A → B holds then A→→ B also holds. **[2]**
   d) How does removal of an attribute from either sides of a given functional dependency affect its strength? Explain. **[1]**