NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
Theory Examination
Dec'2019

Programme:....B.Tech....................................   Semester:................3rd ....

Course no.:.....CSPC-25.................................   Maximum Marks:...50........................ ...

Course name:...Database Systems....................   Time allowed:........3 Hours............................

Number of Questions to be attempted:..5.......   Student Roll No.:...

Note: Unless stated otherwise, the Symbols have their usual meanings in context with Course. Assume suitably and state, additional data required, if any. The candidates, before starting to write the answer/solutions, should please check the question paper for any discrepancy, and also ensure that have been delivered the question paper of correct <u>course no./course title</u>. *Attempt all the questions*.

Q 1. Anwar the following (*briefly*):   (2*5)
    (i)   Why data is important?
    (ii)   How data independence plays the role in database architecture?
    (iii)   Why SQL does not allow to compare an attribute value to NULL using = and < > operators?
    (iv)   Between the properties of *dependency preservation* and *loss-lessness*, which one must definitely be satisfied? Why?
    (v)   How the ACID properties are useful to control concurrency among transactions?

Q 2. (a) What is the difference between logical data independence and physical data independence? Which   (4,6)
one is harder to achieve? Why?

(b) A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in that game, and the result of the game. Design an ER schema diagram and its mapping to equivalent logical schema for this application, stating any assumptions you make. Choose your favorite sport (e.g., soccer, baseball, football).

Q 3. (a) Nulls were originally proposed as a solution to the problem of missing information. Now it's true   (4,6)
that information is often missing in the real world. Therefore, if nulls are prohibited, how should we deal with missing information inside our database systems?

(b) Consider the relational **Company** database, where the primary keys are underlined.

     employee (<u>person-name</u>, street, city)
     company (<u>company-name</u>, city)
     works (<u>person-name</u>, company-name, salary)
     manages (<u>person-name</u>, manager-name)

     Give an expression in the *SQL* to express each of the following queries:

    (i)   Find the names of all employees in this database who do not work for *First Bank Corporation*.
    (ii)   Find the names of all employees who live in the same city and on the same street as do their managers.
    (iii)   Assume the companies may be located in several cities. Find all companies located in every city in which *Small Bank Corporation* is located.
    (iv)   Find those companies whose employees earn a higher salary, than the average salary at *First Bank Corporation*.
    (v)   For each company that has more than five employees, retrieve the company name and number of its employees who are making more than $50,000.
    (vi)   Find the company with the 2nd highest number of employees. (Without using *Limit* function).

Q 4. **(a)** What is a functional dependency? What are the possible sources of the information that defines the functional dependencies that hold among the attributes of a relation schema? **(4,6)**

(b) Consider the following relation:

TRIP (Trip_id, Start_date, Cities_visited, Cards_used)

This relation refers to business trips made by company salespeople. Suppose the TRIP has a single Start_date, but involves many Cities and salespeople may use multiple credit cards on the trip. **Insert few valid tuples in the table**, and answer the following:

(i) Discuss what FDs exist in this relation.

(ii) Identify the candidate keys for derived FD's set.

(iii) Show how you will go about normalizing it.

OR

Consider the relation REFRIG(Model#, Year, Price, Manuf_plant, Color), which is abbreviated as REFRIG(M, Y, P, MP, C), and the following set F of functional dependencies:

$F = \{M \rightarrow MP, \{M, Y\} \rightarrow P, MP \rightarrow C\}$;

(i) Evaluate each of the following as a candidate key for REFRIG, giving reasons why it can or cannot be a key: {M}, {M, Y}, {M, C}.

(ii) Based on the above key determination, state whether the relation REFRIG is in 3NF and in BCNF, giving proper reasons.

(iii) Consider the decomposition of REFRIG into R1(M, Y, P), R2(M, MP,C)}. Is this decomposition lossless? Show why.

Q 5. **(a)** For a user operation, how transaction will be processed? Draw a state diagram and discuss the typical states that a transaction goes through during execution, using an example. **(4,6)**

(b) What is the transaction commit points, and why are they important? What is the system log used for? What are the typical kinds of records in a system log for instructions (like read(x), write(x), commit etc.)?