NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA

Theory Examination

B Tech. (3rd Sem), Nov-Dec'2020

Programme: **B.Tech** | Maximum Marks: **50**

Course No.: **CSPC-25** | Time Allowed: **02 hours**

Course Name: **Database Systems** | Number of Questions to be attempted: **05**

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, should please check the question paper for any discrepancy, and also ensure that have been delivered the question paper of correct course no./course name. **Attempt all the questions**.

Q 1.	Anwar the following (***briefly***): (i) Why database system is important? (ii) How data independence plays important role in database architecture? (iii) Between the properties of *dependency preservation* and *loss-lessness*, which one must definitely be satisfied? Why? (iv) How does the data normalization affect the database transaction processing, particularly to the concurrency control? (v) How the ACID properties are useful to control concurrency among transactions?	**(2*5)**
Q 2.	**(a)** What the role of mappings is between schemas in the three schema database architecture? As database designer, how do you create these mapping? **(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. baseball, football).	**(4,6)**
Q 3.	**(a)** Nulls values were originally proposed as a solution to the problem of missing information. Now it's true 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 schema of **Company** DB, where the primary keys are underlined. employee (person-name, Gender, city) company (company-name, city) works (person-name, company-name, salary) manages (person-name, manager-name) Give the SQL expression for each of the following queries: (i) Find pair of the names of all employees with managers, who live in the same city and of the same gender as do their managers. (ii) Find the names of all employees in this database who do not work for '*ABC*' Bank. (iii) Retrieve the name of manager, who receives minimum salary among managers. (iv) Find the company names whose employees earn a higher salary, than the average salary at *ABC* bank. (v) For each company that has more than 2020 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).	**(4,6)**

Course Coordinator: Dr Vikram Singh (viks@nitkkr.ac.in, 88160 86589)

Date of Exam: 15 Dec 2020

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? **(2,4,4)**

(b) Consider the following relation R= {A, B, C, D, E} and set of FD's.

FD Set : { AB-> DE, C->E, D->C , E->A }

FD Set : { AB->D, AC->E, BC->D, D->A, E->B }

For each FD set, identify the following:

(i) Identify the candidate keys and current normal form of the relation?

(ii) Apply normalization until you cannot decompose relations further. State the reasons behind each decomposition?

(c) 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 & identify the candidate keys.

(ii) Describe the steps involves in the normalization and validation of each decomposition.

OR

Consider the following relation,

R (Doctor#, Patient#, Date, Diagnosis, Treatment_code, Charge)

In the above relation, a tuple describes a visit of a patient to a doctor along with a treatment code and daily charge. Assume that diagnosis is determined (uniquely) for each patient by a doctor. Assume that each treatment code has a fixed charge (regardless of patient).

Is this relation in 2NF? Justify your answer and decompose if necessary. Then argue whether further normalization to 3NF is necessary, and if so, perform it.

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. **(2, 4, 4)**

(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?

(c) Consider the below mention Schedule & items (X=20, Y=30 as initial values),

Answer the following,

(i). Derive the possible values of data items X and Y, for both **T1 -> T2** and **T2 -> T1**.

(ii). Verify, whether above mention schedule follows 2-phase locking protocol? If yes explain the order and data item values for the sequence, otherwise justify your answer.

T1	T2
read_lock(Y);	read_lock(X);
read_item(Y);	read_item(X);
unlock(Y);	unlock(X);
write_lock(X);	write_lock(Y);
read_item(X);	read_item(Y);
X := X + Y;	Y := X + Y;
write_item(X);	write_item(Y);
unlock(X);	unlock(Y);