Course: DBMS	Course Code: CSE 506	Max marks: 90
Semester: 5th (CSE)	Time Allotted: 3 hours	Dated: 06/03/2020

Course Outcomes (CO)

CO1	Understand the concept of a database transaction and related database facilities, including concurrency control, journaling, backup and recovery, and data object locking and protocols.
CO2	Construct simple and moderately advanced database queries using Structured Query Language (SQL).
CO3	Understand and successfully apply logical database design principles, including E-R diagrams and database normalization
CO4	Understand basic database concepts, including the structure and operation of the relational data model.

This Question Paper Consists of 6 Questions. (Attempt only five)

Q1. a) Find out whether given two schedules are conflict serializable, view serializable, recoverable, cascadeless and strict? [CO1][12]

T1	T2
R(x)	
	W(x)
W(x)	
	Abort
Commit	

T1	T2	T3
R(X)		
R(Y)		
W(X)		
	R(Y)	
		W(Y)
		Commit
W(X)		
	R(Y)	
	Commit	

b) Consider the schedule given below. Check whether the given schedule is possible under time stamp ordering protocol. Justify your answer.
$W1(X)\ W2(X)\ W3(X)\ R2(X)\ W4(X)$. [CO1][4]

c) There are 2 transactions, T1 with 2 instructions and T2 with 5 instructions. Find the number of serial and concurrent schedules respectively. [CO1][2]

Q2 a) Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values. $F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$ is a set of functional dependencies (FDs) so that F + is exactly the set of FDs that hold for R. How many candidate keys does the relation R have? Find whether the given Relation is in 2NF? If not than decompose it into 2 NF. [CO3][6]

b) Suppose you are given a relation R with four attributes ABCD. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following:
(a) Identify the candidate key(s) for R. (b) Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF). (c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.
   1.) $C \rightarrow D, C \rightarrow A, B \rightarrow C$ 2.) $B \rightarrow C, D \rightarrow A$ 3.) $ABC \rightarrow D, D \rightarrow A$ [CO3][6]

c) The relational schema student(name, courseno, rollno, grade) has following functional dependencies: Name,Course no→grade; Roll no, course no→grade; Name→Roll no; Roll no→Name.
Find out the highest normal form of this relation? [CO3][6]

Q3. a) Notown Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The company has wisely chosen to hire you as a database designer (at your usual consulting fee of $2500/day).

- Each musician that records at Notown has an SSN, a name, an address, and a phone number. Poorly paid musicians often share the same address, and address has more than one phone.
- Each instrument used in songs recorded at Notown has a unique identification number, a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat).
- Each album recorded on the Notown label has a unique identification number, a title, a copyright date, a format (e.g., CD or MC), and an album identifier.
- Each song recorded at Notown has a title and an author.
- Each musician may play several instruments, and a given instrument may be played by several musicians.
- Each album has a number of songs on it, but no song may appear on more than one album.
- Each song is performed by one or more musicians, and a musician may perform a number of songs.
- Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

Design a conceptual schema for Notown and draw an ER diagram for your schema. The preceding information describes the situation that the Notown database must model. Be sure to indicate all key and cardinality constraints and any assumptions you make. Identify any constraints you are unable to capture in the ER diagram and briefly explain why you could not express them. [CO3][10]

b) Let E1 and E2 be two entities in an ER diagram with simple single-valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one-to-many and R2 is many-to-many. R1 and R2 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model? [CO3][4]

c) Consider the entities 'hotel room', and 'person' with a many to many relationship 'lodging' as shown below:

If we wish to store information about the rent payment to be made by person(s) occupying different hotel rooms, then this information should appear as an attribute with the entities or the given relationship. Justify your answer. [CO3][4]

Q4 a) Consider the following schema:

Suppliers(*sid:* integer, *sname:* string, *address:* string)
Parts(*pid:* integer, *pname:* string, *color:* string)
Catalog(*sid:* integer, *pid:* integer, *cost:* real)
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 SQL queries for the following:
1. Find the *names* of suppliers who supply some red part.
2. Find the sids of suppliers who supply some red or green part.
3. Find the sids of suppliers who supply some red part or are at 221 Packer Street.
4. Find the sids of suppliers who supply some red part and some green part.
5. Find the sids of suppliers who supply every part. [CO2][10]

b) Consider the relations r1(P, Q, R) and r2(R, S, T) with primary keys P and R respectively. The relation r1 contains 2000 tuples and r2 contains 2500 tuples. What will be the maximum size of the join r1 $\bowtie$ r2 ? [CO2][2]

c) Give the following queries in the relational algebra using the relational schema student (id, name), enrolledIn (id, code), subject (code, lecturer)

   c.1) Which subjects is Hector taking?

   c.2) What are the names of all the students in cs1500?

   c.3) What are the names of students taking a subject taught by Roger. **[CO2][6]**

Q5 a) Consider the case of immediate database modification and assume that after a crash, the log contains following records: **[CO1][9]**

   <T1 start>

   <T1, A, 400,500> op1

   <T1,B,300,400> op2

   <T1 commits>

   <T2 starts>

   <T2,C,100,200> op3

   <T3 starts>

   <T3, D,700,800> op4

   <T3 commits>

   <T4 starts>

   <T4, E,800,900> op5

   a.1) Which transactions (T1 -T4) will be redone during recovery?

   a.2) For each operation (Op1-Op5) state whether that operation will be redone, undone or neither during recovery.

   a.3) What Will be the value of data item 'A' and 'E' after recovery algorithm has finished?

  b) Explain the following with example:

   b.1) Acid properties. b.2) Query optimization. b.3) Referential integrity. **[C04][9]**

Q6 a) Discuss at least four problems with the help of examples that may occur with concurrent execution in transactions. **[CO1][7]**

  b) Describe the three-schema architecture with the help of a diagram. Why do we need mappings among schema levels? **[CO4][7]**

  c) There are 2 relations: UGC2019 (exam_date, exam_center, branch_id) and candidate (rollno, name, bid, refno, choice_of_date). In a candidate relation, bid is the foreign key which refers to the key of UGC2019. Suppose an insertion into candidate relation and deletion from UGC2019 relation is done, which of these two operations will lead database into an inconsistent state and why? Also give solutions to prevent such violations. **[CO4][4]**

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