LNMIIT
The LNM Institute of Information Technology

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Computer Science and Engineering

IDBMS

End Term Exam

Time : 150 mins **Date: 01/12/2018** **Max. Marks: 50**

Instructions:

- *There are two parts for the question paper.*
- *Part B has **seven** questions*
- *They should be answered in the booklet.*
- *In the booklet, start each answer on a new page.*

Part B

1. Below given is the log corresponding to a particular schedule at the point of a system crash for four transactions T1, T2, T3, and T4. **[4 marks]**

a. Assuming that the system follows immediate update strategy, specify which transactions are rolled back and which operations in the log are redone.

b. Assuming that the system follows deferred update strategy, specify which transactions are rolled back and which operations in the log are redone.

[start_transaction, T1]
[read_item, T1, A]
[read_item, T1, D]
[write_item, T1, D, 20, 25]
[commit, T1]
[checkpoint]
[start_transaction, T2]
[read_item, T2, B]
[write_item, T2, B, 12, 18]
[start_transaction, T4]
[read_item, T4, D]
[write_item, T4, D, 25, 15]
[start_transaction, T3]
[write_item, T3, C, 30, 40]
[read_item, T4, A]
[write_item, T4, A, 30, 20]
[commit, T4]
[read_item, T2, D]
[write_item, T2, D, 15, 25]
System crash

2. Consider the following transactions

T1
readLock(X)
read(X)
unlock(X)
writeLock(Z)
read(Z)
Z=X+Z
write(Z)
unlock(Z)

T2
readLock(Z)
read(Z)
unlock(Z)
writeLock(Y)
read(Y)
Y=Y+Z
write(Y)
unlock(Y)

T3
readLock(Y)
read(Y)
unlock(Y)
writeLock(X)
read(X)
X=X+Y
write(X)
unlock(X)

Assume the values in X, Y and Z are 1, 2 and 3 respectively. What will be the values in them at each step of the following schedules?
S1: serial schedule T1 T2 T3
S2: as given below **[4 marks]**

Time ↓

T1	T2	T3
readLock(X)	readLock(Z)	readLock(Y)
read(X)	read(Z)	read(Y)
unlock(X)	unlock(Z)	unlock(Y)
writeLock(Z)		
read(Z)		
Z=X+Z	writeLock(Y)	
write(Z)	read(Y)	
unlock(Z)	Y=Y+Z	
	write(Y)	writeLock(X)
	unlock(Y)	read(X)
		X=X+Y
		write(X)
		unlock(X)

3. Write the algorithms for locking and unlocking operations for two-mode (read-write or shared-exclusive) locks. **[6 marks]**

4. Consider the transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the serializability graphs for S1 and S2, and state whether each schedule is serializable or not. If a schedule is serializable, write down an equivalent serial schedule(s). **[6 marks]**

T1: r1 (X); r1 (Z); w1 (X);
T2: r2 (Z); r2 (Y); w2 (Z); w2 (Y);
T3: r3 (X); r3 (Y); w3 (Y);
S1: r1 (X); r2 (Z); r1 (Z); r3 (X); r3 (Y); w1 (X); w3 (Y); r2 (Y); w2 (Z); w2 (Y);
S2: r1 (X); r2 (Z); r3 (X); r1 (Z); r2 (Y); r3 (Y); w1 (X); w2 (Z); w3 (Y); w2 (Y);

5. Design an ER Diagram for the following requirements. **[10 marks]**

Design a database to assist physical plant personnel in managing assignment of keys to employees. The primary job of the database is to ensure proper accounting for all keys.

- An employee has a unique employee number, a name, a position, and an optional office number.
- A building has a unique building number, a name, and a location within the campus.
- A room has a room number, a size (physical dimensions), a capacity, a number of entrances, and a description of equipment in the room. Because each room is located in exactly one building, the identification of a room depends on the identification of a building.
- Key types (also known as master keys) are designed to open one or more rooms. A room may have one or more key types that open it. A key type has a unique key type number, a date designed, and the employee authorizing the key type. A key type must be authorized before it is created.
- A copy of a key type is known as a key. Keys are assigned to employees. Each key is assigned to exactly one employee, but an employee can hold multiple keys. The key type number plus a copy number uniquely identify a key. The date the copy was made should be recorded in the database.
- The physical plant needs to know not only the current holder of a key but the past holders of a key. For past key holders, the date range that a key was held should be recorded.
- The physical plant needs to know the current status of each key: in use by an employee, in storage, or reported lost. If lost, the date reported lost should be stored.

6. Suppose a *student* data file has the following contents : **[10 marks]**

Id	Name	Major
10101	Srinivasan	Comp. Sci.
12121	Wu	Finance
15151	Mozart	Music
22222	Einstein	Physics
32343	El Said	History
33456	Gold	Physics
45565	Katz	Comp. Sc.
58583	Califieri	History
76543	Singh	Finance
76766	Crick	Biology
83821	Brandt	Comp. Sc.
98345	Kim	Elec. Eng.

Assume that *id* is a primary key, blocking factor(*bfr*) of the data file is 2, and blocking factor of the index(bfr_i) is 4.

a) Draw figures to represent a single level index on *Major* for *student* file.
b) Now, assume that records (50000, Albert, Electronics) and (80000, Mary, Finance) are inserted into the file. Show modifications to the index as a result of these insertions. (Redraw the new index. Don't update the figure drawn previously).

7. Consider the relation **Courses**(C, T, H, R, S, G), whose attributes may be thought of informally as course, teacher, hour, room, student and grade. **[10 marks]**
   A) Find the set of FD's for **Courses** when,
      (a) A course has a unique teacher.
      (b) Only one course can be taught in a given room at a given hour.
      (c) A teacher can be in only one room at a given hour.
      (d) A student can be in only one room at a given hour.
      (e) Students get only one grade in a course.
   B) What are all the keys for **Courses**?
   C) Define BCNF.
   D) Decompose R into 3NF relations.
   E) Decompose R into BCNF relations.

R = Courses