BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
Hyderabad Campus
Comprehensive Examination (2nd sem 2019-20) First Cycle

Date: 01-Dec-2020 AN
Course: Database Systems (CS F212) **Max Mrks:90** **Total Duration: 2Hrs.**

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Q1. Assume that For a SW development company, we need to capture data for ongoing Projects. Each Project will have a projid (unique), projtitle (unique), startdate, enddate, and budget as attributes. Each Project is done for only one Client. A Client will have name (unique), address, CEO as attributes. Company may work on more than one project for a given Client. One Project can have 4-20 employees working on it. Each employee will have empid (unique), name, designation, salary, contactphone as attributes. One employee can have more than one phone number as contact. Each project has one or many employees as ProjectManager (PM). Note that we capture current data only (not the history). One employee can work with only one project, some may not work for any projrct. We also need to capture data regarding which employee started on what date as a PM for a given project.

Now, draw an **ER** diagram for the above description. Indicate- cardinality, keys, attributes, min-max, and participation constraints for entity-types involved in the relationships. Assume necessary data, if missing. [8M]

Q.2. Design a *Relational Database Schema* that captures all the information and constraints that are depicted in ER diagram you have drawn, as an answer to Q1., above. [8M]

Q3. Look at the following Database schema.

Student(*sid, sname, sbranch, sage****)***
Club(*cname, incharge, startYear****)*** *//info about student clubs*
Student_Club(*sid, cname****)*** *//to capture student club membership details; sid is FK to sid of Student and cname is FK to cname of Club*

Now, write Relational Algebra and also SQL queries to:

a) Get the *cname* for those clubs having no students from 'EEE' branch as members.
b) Get the *sid* and *sname* for those students who are not members of *Dance* club and belong to 'CSE' branch.

Q4. Assume a situation where we have 9,90,000 records of **EMP** table to be stored in a file. The EMP table has fields- *eid* (12 bytes and PK), *ename* (40 bytes), *eage* (5 bytes), *esal*(4 bytes) , *address* (30 bytes). The disk block size is 1024 Bytes. The address of any disk block needs 7 Bytes. The records in file are ordered based on *eid*. We need to build/design a multi-level (with only one block at top level) indexing on the field *eid*. We assume unspanned record organization.

Now answer the following.

(i) How many data blocks are needed to store data records.

(ii) How many index blocks are needed at each level.

(iii) Give the number of block accesses needed (worst case) to retrieve a record with given *eid* value from the file without using indexing structure.

(iv) Give the number of block accesses needed (worst case) to retrieve a record with given *eid* value from the file with using one level of indexing scheme.

(v) Give the number of block accesses needed (worst case) to retrieve a record with given *eid* value from the file with using the complete indexing scheme.

[2+6+3+3+2=16 M]

Q.5. Assume that we have a relational ***R*** with schema ***R(A,B,C,D,E,F,G)*** , with the following set (***F)*** of functional dependencies. ***F={ A→{BCG}; C→{D,F,E}; B→{F}}*** . If ***R*** is decomposed into three relations- ***R1(A,B,C,G), R2(C,E,F), R3(A,D,F,G)***. Now check if this decomposition is lossless or not. Apply matrix approach.

[*Note*: Give complete working]. [10M]

Q6. Look at the following partial schedule involving four transactions T1, T2, T3 ; and the data items A, B, and C.

Partial Schedule: T2_lock_X(B); T3_lock_X(A); T2_R(B); T3_R(A); T1_lock_X(C); T2_lock_S(C); T1_R(C); T3_lock_X(B); T2_releaseLock(B); T2_R(C); T1_lock_X(B); T3_lock_X(C); T3_W(C); T1_W(B);

Note: T2_lock_S(A) – means T2 locks data item A in Share mode.
T1_lock_X(B) – means T1 locks data item B in Exclusive mode.
T2_R(A)- means T2 reads data item A
T3_W(A) - means T3 writes data item A
T2_releaseLock(B)- means T2 release lock it holds on data item B

(i) Will this result in deadlock?

(ii) Give the final wait-for graph and give comments that supports your answer.

[4+6=10 M]

Q7. Look at the following schedule for the concurrent transactions T1, T2 and T3. The data tems are A and B.

S1 : { $r_2(B)$; $r_2(A)$; $r_1(A)$; $w_1(A)$; $r_3(A)$; $w_3(A)$; $r_2(B)$; $w_3(A)$; $w_2(B)$; $r_3(B)$; $w_3(B)$; }

Now, check if it is conflict serializable using a precedence graph. Give complete working not just Yes or No.

Note: $r_2(A)$- means - Transaction T2 reads data item A
$w_2(A)$- means- Transaction T2 writes data item A [10M]

Q.8. Assume that we use ***Extendible hashing*** technique in some situation and we use the hash Function used is - K mod 4. Assume that a bucket (one block) can accommodate 2 records. Now insert the records with following keys in same order and show the dynamic structure of the hashing scheme after each insertion. Start with GD=1 and LD=1.

Keys to be inserted are: 14, 31, 60, 36, 5, 39, 68, 23. (Note: use the conventions taught in the class; complete working is to be given.) [12M]

** The End***