

Mahindra University Hyderabad

École Centrale School of Engineering

End Semester / Regular

Program: B.Tech Branch: CSE/AI/ECE/CM Year: III / I Semester: I

Subject: Database Management Systems (CS/AI 3103)

Date: 14/12/2024
Time Duration: 3 Hours

Start Time: 10.00 AM
Max. Marks: 100 Marks

Instructions:

- 1) All parts of a question should be answered consecutively.
- 2) Mobile phones and computers of any kind should not be brought inside the exam hall.
- 3) Use of any unfair means will result in severe disciplinary action.

Q1. Answer the following. Each wrong answer consists of 1 Mark negative marking. [8*2.5=20M]

1.1. Which of the following is not a consequence of non-normalized database?

(A) Update Anomaly (B) Insertion Anomaly (C) Redundancy (D) Lost update problem

1.2. Which is the best file organization when data is frequently added or deleted from a file?

(A) Sequential (B) Direct (C) Index sequential (D) None of the above

1.3. The rule that a value of a foreign key must appear as a value of some specific table is called a

(A) Referential constraint. (B) Index. (C) Integrity constraint. (D) Functional dependency.

1.4. Consider the following two phase locking protocol. Suppose a transaction T accesses (for read or write operations), a certain set of objects {O₁, ..., O_K}. This is done in the following manner:

Step1: T acquire exclusive locks to O₁, ..., O_K in increasing order of their address.

Step2: The required operations are performed.

Step 3: All locks are released

This protocol will guarantee:

- (A) Serializability and deadlock-freedom
(B) Guarantee neither serializability nor deadlock-freedom
(C) Guarantee serializability but not deadlock-freedom
(D) Guarantee deadlock-freedom but not serializability

1.5. Which of the following concurrency control protocol ensure both conflict serializability and freedom from deadlock?

I. 2-Phase locking

II. Time-stamp ordering

- (A) I only (B) II only (C) Both I and III (D) Neither I nor II

1.6. Consider the following four schedules due to three transactions, using read and write on data item x, denoted by r(x) and w(x) respectively. Which one of them is conflict serializable?

- (A) r₁(x); r₂(x); w₁(x); r₃(x); w₂(x);
(B) r₂(x); r₁(x); w₂(x); r₃(x); w₁(x);
(C) r₃(x); r₂(x); r₁(x); w₂(x); w₁(x);
(D) r₂(x); w₂(x); r₃(x); r₁(x); w₁(x);

1.7. Suppose a database system crashes again while recovering from a previous crash. Assume checkpointing is not done by the database either during the transactions or during recovery. Which of the following statement is/ are correct?

- (A) The same undo and redo list will be used while recovering again
- (B) The system cannot recover any further
- (C) All the transactions that are already undone and redone will not be recovered again
- (D) The database will become inconsistent

1.8. Which of the following statement FALSE?

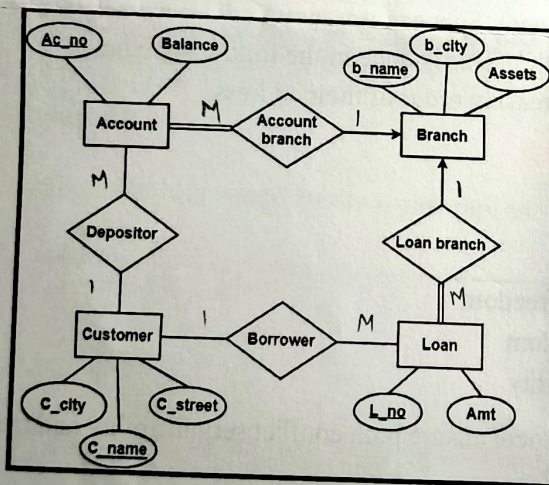
- (A) A primary index is a unordered file
- (B) A Secondary index is an ordered file
- (C) A Clustered indexing is an ordered file
- (D) A primary index is specified on the ordering key field of an ordered file of records

Q2. ER Diagram

[2*10=20M]

2.1. Design an EER diagram for a person superclass having employee, Alumnus, and student as subclasses and employee superclass will have faculty and staff as subclasses and student superclass have graduate student and undergraduate student as subclasses. Also show the disjoint and overlapping constraint along with total and partial participation in this EER diagram.

2.2. Find the minimum number of tables required for the following ER diagram in a relational model. Also identify what will be attributes of these tables. Explain it briefly.



Q3. Functional Dependency & Normal Forms

[2*10=20M]

3.1. You are given the following set of functional dependencies for a relation $R(A, B, C, D, E, F)$, $F = \{AB \rightarrow C, DC \rightarrow AE, E \rightarrow F\}$.

- a. Is this relation in BCNF? If not, explain why by showing one violation.
- b. Is the decomposition R into $R_1(A, B, C, D)$ and $R_2(B, C, D, E, F)$ a dependency preserving decomposition? If not, explain briefly.

Q4. Transaction & Concurrency Management

[2*10=20M]

4.1. Consider the following schedule S. Discuss if this schedule is conflict serializable or not with a precedence graph.

T ₁	T ₂	T ₃
W(A)	R(A)	
		W(B)
W(B)		W(B)
	W(A)	
		R(B)
	R(B)	

4.2. Consider a database with objects X and Y and assume that there are two transactions T₁ and T₂. T₁ first reads X and Y and then writes X and Y. T₂ reads and writes X then reads and writes Y. Give an example of schedule that is not serializable. Explain why your schedule is not serializable.

Q5. File Indexing & Physical Storage

[2*10=20M]

5.1. An ordered file with $r = 100,000$ records stored on a disk block size $B = 2048$ bytes.

File records are of fixed size and with record length $R = 100$ bytes.

(i). Find the blocking factor

(ii). The no. of blocks needed for the file.

(iii). How many block access are needed by a binary search on this data file.

Suppose that a Primary index is created on the data file with key field of size 12 bytes and block pointer's size 8 bytes.

(iv). Find the blocking factor.

(v). How many block access are needed by a binary search on this index file.

(vi). How many block access are needed by a binary search to access the record of data file.

5.2. Show the B+ tree (Left associated) for the following data elements 1,3,5,7,9,2,4,6,8,10 with Order 3.

****ALL THE BEST****