

① Define 1NF, 2NF, 3NF, BCNF, 4NF and 5th NF with suitable example.

Ans:- 1NF (first normal form):-

A database table is said exist in 1NF iff all its attributes are atomic and single value.

A database table is said to be atomic if every column of the database column has separate header.

Ex:-

Department

Dname	Dnumber	Dmgr-ssn	Dlocation
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2NF (second normal form):

A relational schema is said to be 2NF iff it should be in 1NF and every non primary attributes A in R is fully functionally dependent on primary key of R.

{ESSN, Pno} → Hours

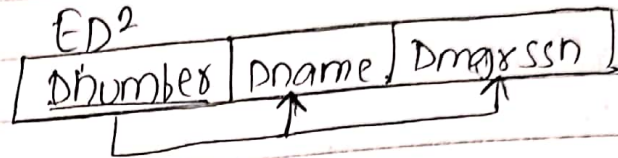
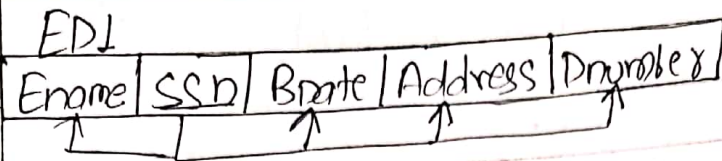
Third Normal form (3NF):-

A relational schema R is in 3NF, if it is in 2NF and no non prime attribute of R is transitively dependent on that primary key.

Emp-Dept

Empname	SSN	Empdate	Address	Dnumber	Dname	Dmgr-ssn
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↓ 3NF Normalization



Boyce-Codd Normal form (BCNF) :

A relation schema R is in Boyce-Codd Normal form if whenever a FD $X \rightarrow A$ holds in R , then X is a superkey of R .

- Each normal form is strictly stronger than the previous one;
- Every 2NF relation is in 1NF Every 3NF relation is in 2NF.
- Every BCNF relation is in 3NF.
- There exist relation that are in 3NF but not in BCNF.

A relation criteria may be needed to ensure the set determinate is an candidate key.

4NF (fourth normal form) :-

A relation R is said to be in the 4NF iff the following condition

- R is already is 3NF or BCNF.
- If it contain no multivalued dependencies

Ex:-

Sid \twoheadrightarrow Course \twoheadrightarrow Hobby

② write short notes on the following

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i) Transaction rollback and cascading rollback

A cascading rollback occurs in database system when a transaction (T₁) causes a failure and a rollback must be performed. Other transactions dependent on T₁'s actions must also be rolled back due to T₁'s failure, thus causing a cascading effect. That is, one transaction's failure causes many to fail.

Rollback is a command that causes all data changes since the last BEGIN WORK to be discarded by the relational database management systems, so that the state of the data is "rolled back" to the way it was before those changes were made.

(ii) transaction support in SQL

An SQL transaction is logical unit of work. The access mode can be specified as READ ONLY or READWRITE. The default is Read write, which allows update, insert, delete, and create commands to be executed.

A sample SQL transaction might look like

```
Exec SQL whenever SQL error goto undo;
```

```
Exec SQL set transaction
```

```
Readwrite
```

```
Diagnostic size 5
```

```
isolation level Serializable;
```

(iii) Shadow Paging:-

This technique does not require log in single user environment. In multi-users may need log for concurrency control method.

Shadow Paging considers

- The database is partitioned into fixed-length blocks referred to as PAGES.
- Page table has n entries - one for each database page.
- Each contain pointer to a page on disk (1 to 1st page on database and so on...).
- During transaction execution, all updates are performed using the current directory and the shadow directory is never modified.

(iv) No-UNDO/REDO Recovery Based on deferred update:-

- These techniques defer or postpone any actual update to the database until the transaction reaches its commit point. If the transaction fails before reaching its commit point, there is no need to undo any operations because the transaction has not affected the database on disk in any way.

A typical deferred update protocol use the following procedure:

- A transaction cannot change the database on disk until it reaches its commit point.
- Recovery technique based on deferred update are therefore known as No UNDO/REDO techniques.

③ write short note on dangling tuples and null values.

Ans:- Dangling tuples:-

The tuples of relation that are not participating in a join are called dangling tuples.

- we have to use null values to indicate dangling tuples in relation.
- A tuple in a relation that does not join with any tuples in the other relation.

Null values in terms of the relational database model, a Null value indicates an unknown value. If we widen this theoretical explanation, the Null value point to an unknown value but this unknown value does not equivalent to a zero value or a field that contains spaces.

④ write an algorithm to find minimal cover set of functional dependencies.

Ans:- The steps are belows:-

- Set $F = E$
- Replace each FD $X \rightarrow \{A_1, A_2, A_3, \dots, A_n\}$ in F by the NFD $X \rightarrow A_1, X \rightarrow A_2, \dots, X \rightarrow A_n$.
- For each FD $X \rightarrow A$ in F for each attribute B that is an element of X if $\{F \rightarrow \{X \rightarrow A\}\} \cup \{(X - \{B\}) \rightarrow A\}$ is equivalent to F then replace $X \rightarrow A$ with $(X - \{B\}) \rightarrow A$ in F .
- For each remaining functional dependency $X \rightarrow A$ in F if $\{F - \{X \rightarrow A\}\}$ is equivalent to F , then remove $X \rightarrow A$ from F .

5. With an example, explain basic Timestamp ordering algorithm for concurrency control.

Ans:- Timestamp-based protocol in DBMS is an algorithm which uses the system time or logical counter as a timestamp to serialize the execution of concurrent transactions.

- Timestamp-ordering ensures that every conflicting read and write operation are executed.
- The older transaction is always given priority in this method.
- It uses system time to determine the timestamp of the transaction.
- This is the most commonly used concurrency protocol.
- Lock-based protocol help you to manage the order between the conflicting transaction when they will execute.

ex:-

Suppose three transactions T_1, T_2 & T_3

T_1 has entered the system at time 0010

T_2 has entered the system at time 0020

T_3 has entered the system at time 0030

Priority will be given to Transaction T_1 then T_2 & T_3 .