

Units: Data Security and Transaction Processing - (weightage - 10 marks)

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(Database Management System - 22319)

Questions

- Q1) Explain GRANT and REVOKE command with example. (4m)
- Q2) Explain the most common types of database failures. (4m)
- Q3) Explain properties of transaction (4m)
- Q4) State with neat sketch desirable Transaction States Diagram (4m)
- Q5) Explain recovery techniques with example. (4m) (4m)
- Q6) Explain ACID properties of transaction. (4m)
- Q7) Explain / Describe any four functions or responsibility of DBA (4m)
2m
- Q8) State types of database user.
- Q9) State concept of database recovery.
- Q10) Explain database security with its requirement in detail. (4m)
- Q11) Describe database backup with its type (4m)
- Q12) Describe database privileges, procedure for granting & revoking. (6m)

Queries

- Q1) i) Create user 'RAM'
ii) Grant create, insert, select, update, delete
privileges to user 'RAM'
iii) Remove update privilege from user 'RAM'. } 6m

Q2) Write SQL command for following.

- i) Create user.
ii) Grant privileges to user -
iii) Remove privileges from user. } 6m
- Q3) i) Create user 'Rahul'
ii) Grant create, select, update, insert, delete -
drop privilege to 'Rahul'.
iii) Remove the select privilege from user 'Rahul'.

Functions of DBA (Database Administrators)

Granting of Authorization for Data Access.

DBA is responsible for granting the access to database

② Schema Definition : Database schemas are written by database administrator. These database schemas are translated by PDL compiler

Introduction:

What is database Security?

Database: It is a collection stored in a computer.

Security: It is being free from dangerous subjects.

Database Security: It is the mechanism that protect the database against intentional or accidental threats.

Need of database Security?

1. Data will be easily corrupted.
2. It is important to restrict access to the database from unauthorized users to protect sensitive data.
3. To secure sensitive data and maintain the confidentiality, availability, and integrity of the database.

* Concepts of Database Security / Data Security Requirements

Data Security Requirements → The availability

→ There are 3 main aspects:

- 1] Secrecy or Confidentiality
- 2] Integrity
- 3] Availability

1] Confidentiality: It is protecting the database from unauthorized users.

② Ensures that users are allowed to do the things they are trying to do.

③ Encryption is a technique or a process by which the data is encoded in such a way that only authorized users are able to read the data.

④ In short, it specifies that only selected intended recipients should be able to access the contents of a message.

2] Integrity: Protecting the database from authorized users.

② Ensures that what users are trying to do is correct.

③ E.g. - An employee should be able to modify his or her own information.

④ 3] Availability: The goal of availability to ensure that the data, or the system itself, is available for use when the authorized user wants it.

Database must have no unplanned downtime.

To ensure this following steps should be taken:

- Restrict the amount of the storage space given to each user in the database.
- Limit the number of concurrent sessions made available to each.
- Back up data at periodic intervals to ensure data recovery in case of application users.

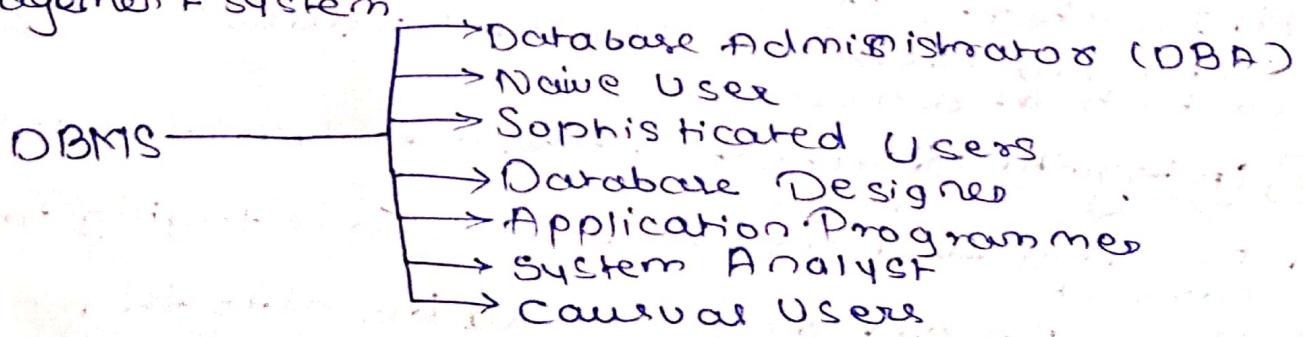
* Database Security Requirements:

The list of requirement for database security.

- Physical database Integrity: Recover from power failures, disk crashes, etc.
- Logical database Integrity: Use backups, restore points. The structure of the database is preserved. That is modification of one field does not affect other fields.
- Element Integrity: The data contained in each element must be accurate. Using field check, access control & change log.

* Types of Database Users:

- Database users are categorized based upon their work and interaction with the database.
- There are 7 types of database users in database management system.



1] DBA [Database Administrator(DBA)]:

- This is the person, who defines schema and also have controls over the 3 levels of database.
- And has many Rights to creating new user account and Troubleshooting login issue etc.
- DBA has a DBA account in the Database system which called as a super-user account or system account.
- DBA is also responsible for providing security to the database & he allows only the authorized users to access / modify the database.

2] Naive Users:

- Naive users are the unsophisticated who don't have any knowledge about DBMS but they are frequently using the database application in their daily life.
e.g. Clerk of any Bank is a Naive user because they haven't any knowledge about DBMS but still they using the database & also perform their tasks.

3] Sophisticated Users:

- Sophisticated users can be engineers, scientist, business analyst who are familiar with the database.
- They can develop their own database application according to their requirement.

4] Database Designer:

- D.B.D are the user who design the structure of D.B which includes tables, indexes, views, constraints, triggers, stored procedures, etc.
- They control what data must be stored & how the data items to be related.

5] Application Programmers:

- They are back-end programmers in Programming Lang. who writes code for the application program.
- This program could be written in Programming Languages like C, Fortran, COBOL, etc.

Functions of DBA:

- 1) Storage structure & access method definition:
The DBA creates appropriate storage structure and access methods by writing a set of definitions which is translated by data storage & data definition lang. compilers.
- 2) Schema Definition: Database schema are written by DBA.
- 3) Backup & Recovery: DBA also take backup of the data on a backup storage devices so that if data is lost it can be recovered.
- 4) Granting of Authorization for Data Access:
DBA is responsible for granting the access to the database.

- Creating Altering & Deleting Users:

A database may have many users. Each user must have a user account. DBA are users with authority to specify new user.

- 1) Create new user account & new roles.
- 2) Grant roles for user.
- 3) Revoke roles from user.
- 4) Delete user &
- 5) Change user attributes, especially Password.

- A new user account is created with the stat.

'create user'

Syntax: create user username identified by password

E.g : Create user SHREYAS identified by SHREYA_123@%

* The statement is not available for normal user
Only DBA may use it.

SHREYA

Creating Database

- A role is created with the statement 'create role'.
Syntax: create role rolename.
e.g. create role user;
- * Roles are assigned to user with 'grant' St.
Syntax: grant rolename1, rolename2... to username1, username2... [with admin option].
e.g. Grant users to SHREYAS;
 If the clause 'with admin option' is included, the user may pass the role forward to some other user.
- A role is deleted with 'revoke' -Statement.
Syntax: revoke rolename1, rolename2... from username1, username2...
e.g. revoke users from SHREYAS;
- A role is deleted with 'drop-role' Statement.
Syntax: drop role rolename
e.g. drop role user;
- A user account is deleted with a 'drop' user's statement. Only DBA is allowed to use this statement.
Syntax: drop user username [cascade]
e.g. drop user SHREYAS cascade;
- The password or other attributes of user account may be changed with 'alter-user' statement.
Syntax: alter user username identified by password.
 alter user SHREYAS identified by SHREYAS

* Database Privileges:

A privilege in a database management system is the permission to execute certain actions on the database.

Privileges can be permitted to:

1. Access a table
2. Access permission to execute a database command.
3. Access another user's object.

Database privileges make certain actions possible, such as connecting to a database, creating a table, and executing another user's stored procedure.

There are two types of privileges:

System P. Object P.

1] **System Privileges:** System privileges are given to users to allow them to perform certain functions that deal with managing the database and the server.

e.g: Create user, create table, Drop table etc.

2] **Object Privileges:** Object privileges are privileges given to users as rights and restrictions to change contents of database objects.

Where d.b. obj. are things like tables, stored procedures, indexes, etc.

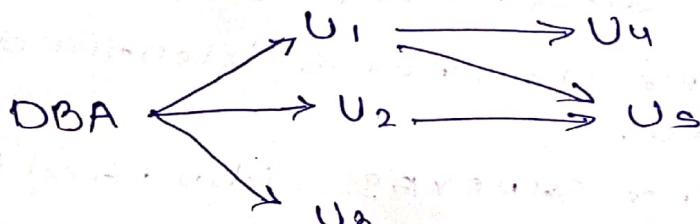
e.g Select, insert, delete, update, execute etc.

System P

Allows users to CREATE, ALTER OR DROP the database objects.

Object P.

It is a privilege to perform a specific action on a particular table / function or package.



Assigning privilege.



Procedure for granting privilege:

Grant: This command is used to give permission to user to do operations on the other user's object.

Syntax: Grant <object privileges> on <object name> to <username> [with grant option];

e.g. Grant select, update on emp to user1;

Procedure for revoking privilege:

Revoke: This command is used to withdraw the privilege that has been granted to a user.

Syntax: Revoke object privileges on object name from username;

e.g.: Revoke select, update on emp from user1;

- **TRANSACTION:** ① A transaction is a single logical unit of work which accesses and possibly modifies the contents of a database.
- ② Transactions access data using read and write operations.
- ③ In order to maintain consistency in a database, before and after the transaction certain properties are followed. They are called ACID properties.

ACID properties in DBMS

ACID

A = Atomicity → The entire transaction takes this entire block of operations place at once or doesn't and nothing happens at all.

C = Consistency → The database must be consistent before and after the transactions.

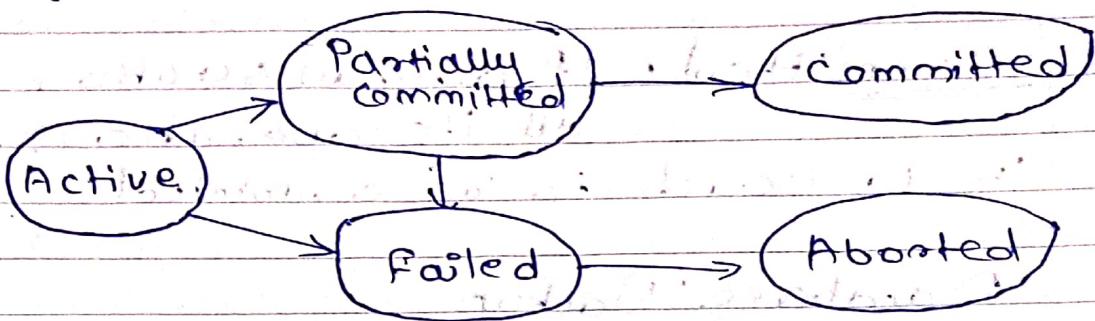
I = Isolation → Multiple Transactions occur independently without interference.

D = Durability → The changes of a successful transaction occurs even if the system failure occurs.



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* States of transaction with the help of diagram-



1. Active: the initial state; In this state, the transaction is being executed. This is the initial state of every transaction.

2. Partially Committed: When a transaction executes its final operation, it is said to be in a partially committed state.

3. Failed: A transaction is said to be in a failed state if any of the checks made by the database recovery system fails. A failed transaction can no longer proceed further.

4. Aborted: After the transaction has failed & entered into a failed state, all the changes made by it have to be undone. To undo the changes made by the transaction it becomes necessary

To roll back the transaction:

S. Committed: If a transaction executes all its operations successfully, it is said to be committed.

• Database Backup



• Types of failures

↳ There are two types of failures:

1. Transaction Fail: This is the condition in the transaction where a transaction cannot execute it further. This type of failure affects only few tables.

2. System Crash: This can be because of hardware or software failure or because of external factors like power failure.

3. Disk Failure: These are the issues with the hard disk

like formation of bad sectors, disk head crash, unavailability of disk etc.

↳ Disk head crash: It occurs due to damage of disk head.

↳ Bad sectors: It occurs due to damage of disk platters.

↳ Unavailability of disk: It occurs due to damage of disk platters.



Recovery techniques with examples:

Concept of database recovery:

→ Database recovery: To restore a database to a consistent state after a failure or error has occurred.

The main goal of recovery technique is to ensure data integrity & consistency & prevent data loss.

Recovery techniques:

- ① When recovering the database, it must redo the effects of the previous transactions. This is called Rolling Forward Recovery.
- ② Not all but some active transaction that didn't complete successfully needs to roll back, when the disk drive crashed. Such kind of rollback is called backward recovery.

i)

REDO operation (The Redo Log & Rolling Forward).

- An entry in redo log files that holds a group of change vectors in oracle RDBMS.
- 1) Redo log files save redo records.
 - 2) Used for rolling forward database changes.
 - 3) Protect against data loss.

2] Rollback Segments and Rolling Back

(Undo operation), used to be rolled back

- A record of a transaction before it is committed in oracle RDBMS
- Undo segments store undo records.
- Used for rollback and read consistency.
- Protects against inconsistent reads in multivector systems.



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* Explain most common type of database failures

- There are many different types of failures that can affect database processing; each of which has to be dealt with in a different manner.
- The below are the causes of failure:

- 1] Hardware error: Resulting in data loss.
- 2] Software errors: Leading to crashed or corruption.
- 3] Human error: Human error such as accidental data deletion.
- 4] Network problems disrupting communication between the database and applications.
- 5] System Crasher: The system hangs up and need to be rebooted.
- 6] User Error: An example of a user error is a user unintentionally deleting a row or dropping a table.
- 7] Application Software Errors: Application S.E. include logical errors in the program that is accessing the database, which cause one or more transactions to fail.
- 8] Natural Physical Disasters:

* Explain / Describe any four functions or responsibility of DBA.

- 1) A database Administrator (DBA) is responsible for managing and maintaining an organization's database systems.
- 2) Their functions include:

1. Database Design: Designing the structure and organization of database to meet the requirements of applications and users.

2. Installation and Configuration: Installing and configuring database software, ensuring proper settings for optimal performance and security.

3. Security Management: Managing security measures to protect the database from unauthorized access.

4. Backup & Recovery: Developing and implementing backup and recovery plans to safeguard against data loss and ensure business continuity.



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5] User Access control: Managing user access and permission, ensuring appropriate levels of access for different users or roles.

6] Database documentation: creating and maintaining documentation related to database structure

DBA's play a crucial role in ensuring the reliability, security & performance of databases, contributing to the overall effectiveness of an organization's information system.