Autumn-18

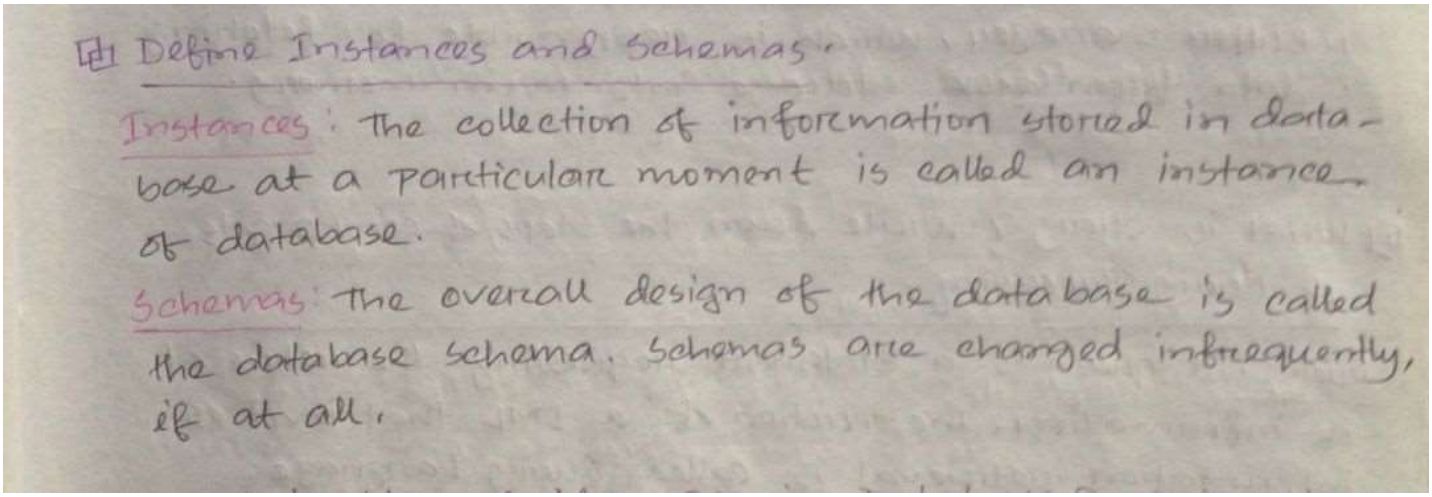
1(a)

Atomicity and concurrency problems in file systems are resolved by the use of transactions in database systems. Transactions ensure that multiple operations are either all executed or not executed at all. This allows for consistency in data and prevents data from being corrupted due to concurrent operations. Database systems also use locks to prevent multiple users from modifying the same data at the same time, which eliminates the possibility of conflicting changes being made to the same data.

For example, suppose you are making a bank transfer from one account to another. A transaction would ensure that either both the debit and credit operations are executed or neither of them is executed. This would prevent any data from becoming corrupted due to concurrent operations. In addition, database systems also use locks to prevent multiple users from modifying the same data at the same time, which eliminates the possibility of conflicting changes being made to the same data.

This ensures that only one user can make changes to a piece of data at a time, and that any data changes are consistent and valid. Transaction logs can also be used to rollback any changes that were made in case of any errors or conflicts. Database systems also use isolation levels to control the level of visibility of data between different transactions. This allows for data to remain consistent even in the event of concurrent operations.

1(b)


Define Instances and Schemas.

Instances: The collection of information stored in database at a particular moment is called an instance of database.

Schemas: The overall design of the database is called the database schema. Schemas are changed infrequently, if at all.

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Compare between DDL and DML

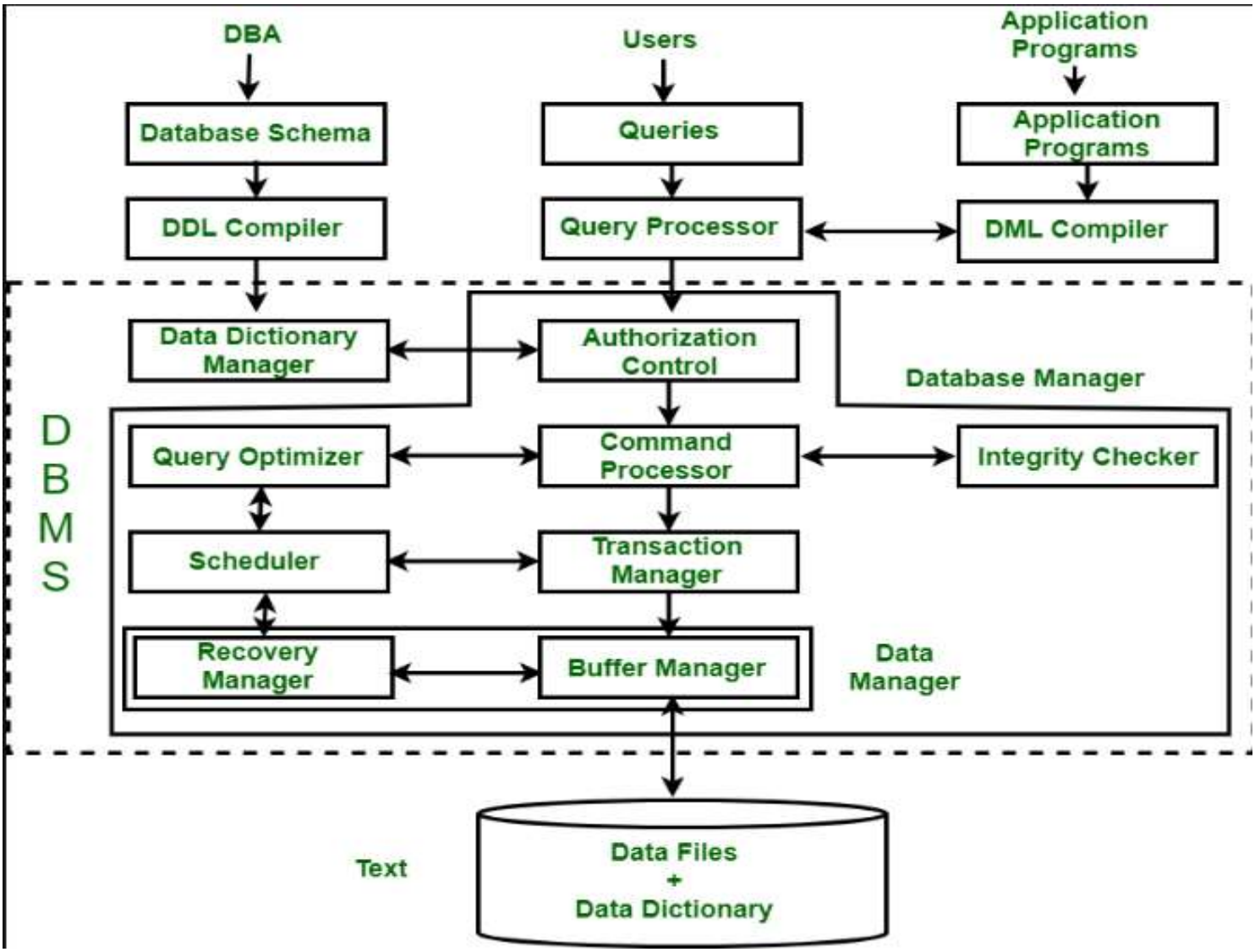
DDL →

(i) DDL Stands for Data Definition Languages
(ii) It is used to create the database Schema
(iii) It is not further classified
(iv) create, Drop, Alter etc
(v) SQL Statement cant be roll back.
(vi) DDL command affect entire database on the table

DML →

(i) DML Stands for Data Manipulation Languages
(ii) It is used to populate and manipulate database.
(iii) It is further classified as procedural and Non procedural DMLs.
(iv) Insert, Delete, update, select etc.
(v) SQL Statement can be rollback
(vi) command affect one or more records in a table.

2(a)



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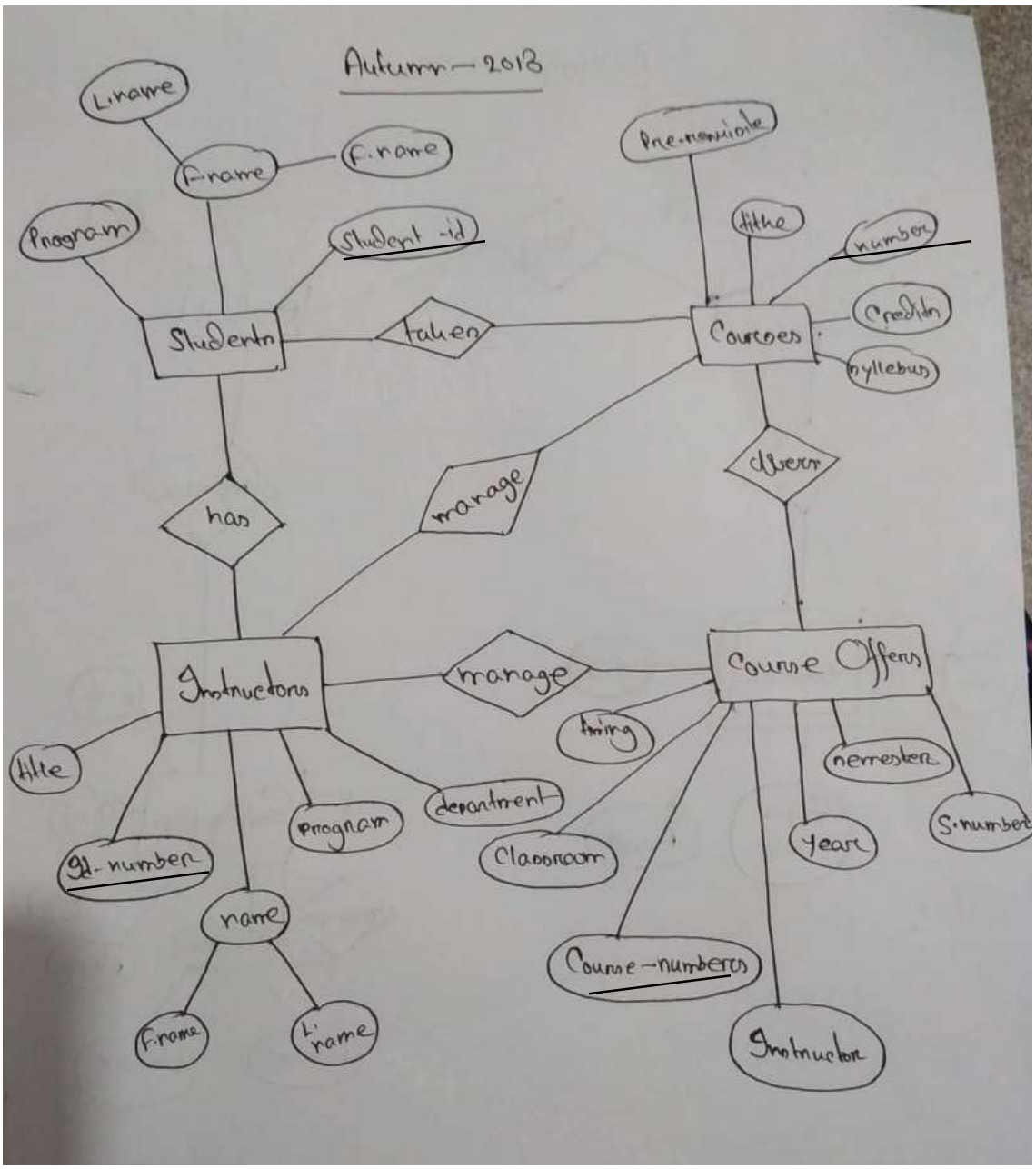
Database Schema:

A database schema is a collection of objects, such as tables, views, and stored procedures, that define how data is organized and accessed in a database.

Queries:

A query in DBMS is a statement that is used to retrieve data from a database.

2(b)



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3(a)

Primary key: The primary key of a relational table uniquely identifies each record in the table.

Example:

The ideal primary key for a table of students would be their **ID number**, as this would uniquely identify each student in the table.

Super key: A super key is a set of one or more keys that are used to identify data or records uniquely in a database table.

Example:

Email: If each customer's email address is unique, the Email attribute can be a superkey.
First_Name and Last_Name: If no two customers have the same first and last name, the combination of First_Name and Last_Name attributes can be a superkey.

Candidate key: A super key such that no proper subset is a super key within relation.

Example:

Emp_Id: An attribute that stores the value of the employee identification number.
Emp_name: An attribute that stores the name of the employee holding the specified employee id.
Emp_email: An attribute that stores the email id of the specified employees.

Foreign key: An attribute or set of attributes within one relation that matches the candidate key of a relation.

Example:

In a table of orders, a foreign key could be a reference to the primery key of the customers table, indicating which customer placed the order.

3(b)

Entity: An entity in DBMS is a collection of related data that describes a real-world object or concept. Examples of entities include customers, orders, products, and employees.

Relationship set: A relationship set in DBMS is a set of relationships between two or more entities. For example, in a database of customers, orders, and employees, there could be a one-to-many relationship between customers and orders, where each customer can have multiple orders.

Composite Attributes: A composite attribute in DBMS is a type of attribute that is composed of multiple sub-attributes. For example, an address attribute may have sub-attributes for street, city, state, and zip code.

Derived Attributes: A derived attribute in DBMS is an attribute that is derived from other attributes in the database. For example, a person's age attribute could be derived from their date of birth.

4(a)

1. Selection (σ): Selects a subset of rows from a relation.

2. Projection (π): Selects a subset of columns from a relation.

3. Union (∪): Combines the tuples of two relations.

4. Intersection (∩): Returns the tuples that are in both relations.

5. Difference (–): Returns the tuples that are in the first relation but not in the second relation.

6. Join (⋈): Combines tuples from two relations based on a condition.

Additional RA operators can be represented by basic RA operators by combining multiple operations. For example, the Division operator (÷) can be represented by a sequence of Selection, Projection, and Difference operations. Specifically, Division can be expressed as: (πA (σR1 (R1–R2))) , Which is the projection of the attribute A from the selection of the tuples from relation R1 that are not in R2 (R1 – R2) in the first relation (R1).

4(b)

(i) $\prod_{\text{p-id, p-name, unit-price}}(\sigma_{\text{c-id="100"}}(\text{Sales X Product}))$

(ii) $\prod_{\text{e-name, data-of-sale, time, quantity}}(\sigma_{\text{quantity>="10000" and date-of-sales="29-DEC-2018"}}(\text{Sales X Employee}))$

(iii) $\prod_{\text{c-name, mobile, street, country, city}}(\sigma_{\text{emp-id="E"}}(\text{Sales X Customer}))$

(iv) $\prod_{\text{e-name, designation, commission, salary, mobile, country, city}}(\sigma_{\text{p-id="P"}}(\text{Sales X Employee}))$

(v) $\prod_{\text{c-name, mobile, street, country, city}}(\sigma_{\text{p-id="P" and city="DHAKA"}}(\text{Sales X Customer}))$

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