Assignment – 3

[1. Define ACID properties of Transaction. Explain its types in details. 3](#_Toc212547509)

[2. What is sql join ? explain its different types of join Operations with examples. 3](#_Toc212547510)

[3. Compare the DDL and DML with Example. 3](#_Toc212547511)

[4. Define the time stamp base protocol . explain the condition for R/W  operations 3](#_Toc212547512)

[5. A company stores information about EMP(ssn\_no, phone , salary , address,details,remarks ), department (did, name, budget, dno) ,make your own assumptions about the relationships between the entities. Write Inner join , Outer join ,cross join relations for those entities. 3](#_Toc212547513)

[6. Define Referential Integrity Constraints. What is the main purpose of implementing referential Integrity in dbms? 3](#_Toc212547514)

[7. From the given relations, write SQL statements for given queries: 3](#_Toc212547515)

[COMPANY\_details (companyID, companyName, address, phone, estd Year) 3](#_Toc212547516)

[JOBS(ID, jobTitle, jobDescription, company ID, postedDate, lastDateOfApplication) 3](#_Toc212547517)

[APPLICANT (applicantID, fullName, email, phone) 4](#_Toc212547518)

[APPLICATION\_SUBMISSION (jobID, applicantID, submittedDate) 4](#_Toc212547519)

[Find the list of all the companies that were established in the Year 2023. 4](#_Toc212547520)

[Find the name and phone number of all the applicants. 4](#_Toc212547521)

[Display all the applicant whoso name start by S and P letter. 4](#_Toc212547522)

[8. What is a database management system? Discuss the Advantage of DBMS over File System. 4](#_Toc212547523)

[i. Data Redundancy Control: 4](#_Toc212547524)

[ii. Data Consistency: 4](#_Toc212547525)

[iii. Data Sharing: 4](#_Toc212547526)

[iv. Data Integrity: 4](#_Toc212547527)

[v. Security Features: 4](#_Toc212547528)

[vi. Backup and Recovery: 4](#_Toc212547529)

[vii. Data Independence: 4](#_Toc212547530)

[viii. Efficient Query Processing: 4](#_Toc212547531)

[ix. Centralized Management: 4](#_Toc212547532)

[x. Concurrency Control: 4](#_Toc212547533)

[9. What is functional dependency? Explain Different Inference rules. 5](#_Toc212547534)

[10. Explain two-phase locking protocol in detail. 5](#_Toc212547535)

[11. What do you mean by Functional Dependency , write with example. 5](#_Toc212547536)

[12. Explain 2NF, 3NF with suitable examples. 5](#_Toc212547537)

[13. What is a serializable schedule? Characterize schedule based on recoverability. 5](#_Toc212547538)

[14. Draw a transaction state diagram. Discuss each state that a transaction goes through. 5](#_Toc212547539)

[15. What do you mean by view? What is the use of view in SQL. Write the syntax with relevant examples of view. 5](#_Toc212547540)

[16. Write sql and relational algebra statement for the following scheme 5](#_Toc212547541)

[Food(code, packName, price, description) 5](#_Toc212547542)

[Orders(cNo, cName, qty, date, Time) 5](#_Toc212547543)

[Customers(cNo, cName, Contact, address) 5](#_Toc212547544)

[Find name and contact no of all customers from 'Balaju' 5](#_Toc212547545)

[Calculate total price of food ordered by customer "Ishmi" till now. 5](#_Toc212547546)

[17. Construct the ER diagram of the bank using all possible components like different types of entities, attributes, relationship etc  and convert it into a database schema. 5](#_Toc212547547)

[18. Describe different types of join operations used in SQL? 5](#_Toc212547548)

[19. What is data abstraction? Explain with its level. 5](#_Toc212547549)

[20. What is Normalization? Explain any two normal forms in detail. 6](#_Toc212547550)

[21. Define roles of DBA on Relational Database 6](#_Toc212547551)

[22. Explain in detail about ACID properties. 6](#_Toc212547552)

[23. Describe different components of DBMS. 6](#_Toc212547553)

[24. What is the difference between physical and logical data independence? 6](#_Toc212547554)

[25. Define the time stamp base protocol. explain the condition for R/W operations. 7](#_Toc212547555)

[26. Explain different types of locking protocol. 7](#_Toc212547556)

[27. Distinguish between generalization and aggregation. 7](#_Toc212547557)

[28. Distinguish between tuple and domain. 7](#_Toc212547558)

[29. Distinguish between Where and Having clause. 7](#_Toc212547559)

[30. Distinguish between composite attribute and derived attribute. 7](#_Toc212547560)

[31. What do you mean by log based recovery? 7](#_Toc212547561)

[32. Write sql and relational algebra statement for the following scheme 7](#_Toc212547562)

[Food(code, packName, price, description) 7](#_Toc212547563)

[Orders(cNo, cName, qty, date, Time) 7](#_Toc212547564)

[Customers(cNo, cName, Contact, address) 7](#_Toc212547565)

[Find name and contact no of all customers from ‘Tokha’ 8](#_Toc212547566)

[Calculate total price of food ordered by customer "Grishma" till now. 8](#_Toc212547567)

[33. Construct an ER diagram for a university using all possible components like different types of entities, attributes, relationship etc and convert it into a database schema. 8](#_Toc212547568)

[34. List the roles of Database administrator. Explain different types of Database user. 8](#_Toc212547569)

[I. End Users: 8](#_Toc212547570)

[II. Application Programmers: 8](#_Toc212547571)

[III. Database Administrators (DBAs): 8](#_Toc212547572)

[35. List the steps to draw E-R diagrams and Design E-R diagram for Education Portal 9](#_Toc212547573)

[36. Explain about Concurrency Control and also explain about Time stamp based protocol. 9](#_Toc212547574)

[37. Explain Serial schedule with suitable Example. 9](#_Toc212547575)

[38. Define Integrity Constraints. What is the main purpose of implementing Integrity in dbms? Explain its types. 9](#_Toc212547576)

1. Define ACID properties of Transaction. Explain its types in details.

A transaction is a collection of several operations on the database that appears to be a single unit from the point of view of the database user. For example, a transfer of funds from one account to another account is a single operation from customer’s point of view but within the database system, however, it consists of several tasks.

The ACID properties are required to maintain integrity of database. They are:

1. Atomicity: It ensures that the transaction is either completely executed or not at all. If a transaction is unsuccessful due to failure or constraints, any changes applied to the database during the transaction must be undone through ROLLBACK/ABORT command. It prevents the database from staying in partial state.
2. Consistency: It ensures that the transaction, after complete execution without interference from other concurrent transactions, takes the database from one consistent state to another. The state during execution is inconsistent state which must be hidden to user.
3. Isolation: The transaction is not interfered by the concurrent execution of other transactions. The state of database after concurrent execution of transaction must be equivalent to the state reached after serial execution of transaction in same order,
4. Durability: The changes applied to a database after execution of transaction must be persistent. Once a transaction is committed, all updates to the database must remain permanently even during failures like system crash and power loss.
5. What is sql join ? explain its different types of join Operations with examples.

|  |  |
| --- | --- |
| Player | Jersey |
| Son | 7 |

SQL join is a binary relation operation used to combine tuples of multiple relation on the basis of matching values in common attributes. It can be understood as a cartesian product of relation followed by selection criteria.

|  |  |
| --- | --- |
| Club | Player |
| TOT | Bale |
| MUN | Son |

The types of join operations are:

* 1. Inner Join: By using inner join, the resulting join relation only includes the tuples that satisfy the matching criteria, excluding others.

1. Theta Join: It is a type of join operation in which the join consdition can be any comparison operator (<,>,=,<=,>=,!=).

Club |><|(c.Player!=p.Player) Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |

1. Equi Join: It is a type of join operation in which the join consdition can be only equality comparison operator (=).

Club |><|(c.Player=p.Player) Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Natural Join: It is a type of join operation in which tuples are joined by matching same values in common attribute and eliminating redundant attributes.

Club |><| Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Outer Join: By using outer join, the resulting join relation includes the tuples that satisfy the matching criteria as well other tupels with missing criteira.
2. Left Outer Join: It is a type of join operation in which all tuples of left relation are kept. The tuples in left relation without matching values in right relation, have their attributes filled by NULL value.

Club =|><| Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |
| MUN | Son | 7 |

1. Right Outer Join: It is a type of join operation in which tuples of right relation are kept. The tuples in right relation without matching values in left relation, have their attributes filled by NULL value.
2. Club |><| =Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Full Outer Join: It is a type of join operation in which all tuples of both relation are kept. The tuples in any relation without matching values in other relation, have their attributes filled by NULL value.

Club =|><|= Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |
| MUN | Son | 7 |

1. Compare the DDL and DML with Example.

|  |  |  |
| --- | --- | --- |
| Feature | DDL (Data Definition Language) | DML (Data Manipulation Language) |
| Purpose/Role | Used to define data structures and database schemas | Used to perform operations at the conceptual/external level. |
| What it Modifies | Modifies the database schema or data structure. | Modifies the data stored in the database, but not the schema. |
| Control | Defines storage structure and access methods. | Can be procedural (low-level, specifying *how* to get data) or non-procedural (high-level, specifying *what* data is needed). |
| Auto Commit | Yes — changes are permanent immediately. | No — requires explicit COMMIT or ROLLBACK. |
| User | Used by DBA | Used by end user and application programmers |
| Example Statements | CREATE, ALTER, DROP. | Query, Delete, Update, Insert. |

1. Define the time stamp base protocol . explain the condition for R/W  operations.

Time stamp base protocol is a concurrency control technique in which unique transaction identiferes called timestqamps (TS) are associated with erach transaction t ensure serializability. A TS can be generated either by assigning the current value of clock to the transaction or by attaching the value of a logical coiunter. The ording of TS is determined by age of tyransaction. Example: a transaction created at 002 clock time is older than all other transactions which come after and prioiroty may be given to older one.

The time stamp must have following two properties.

1. **Uniqueness:** Ensures that no equal time stamp values can exists
2. **Monotonicity:** Ensures that time stamp values always increase

Data items X in the database are managed using two special timestamps:

* 1. **Write-TS(X):** The latest time the data item has been successfully written into.
  2. **Read-TS(X):** The latest time the data item has been successfully read from.

Whenever a transaction T tries to issue a Read(x) or write(x) operation, the basic timestamp ordering algorithm compares the timestamp of T with ReadTS(x) and WriteTS(x) to ensure that the timestamp order of transaction execution is not violated.

**Case 1:** Transaction T issues Read(x) Operation

If WriteTS(x)>TS(T) then abort and rollback T and reject the operation. If WriteTS(x)<=TS(T) then execute the Read(x) operation of T and set ReadTS(x) to the larger to TS(T) and the current ReadTS(x).

**Case 2:** Transaction T issues Write(x) Operation

If ReadTS(x)>TS(T) or if WriteTS(x)>TS(T) then abort and rollback T and reject the operation, else then execute the Write(x) operation and set WriteTS(x) to TS(T).

Example:

Assume timestamps of T1 and t2 is 100 and 110 respectively and initial value of x is 500.

A table with text and numbers

AI-generated content may be incorrect.

In this example if the transaction T1 is not aborted it will suffer from lost update problem and will make final value of x = 500 rather than 700.

1. A company stores information about EMP(ssn\_no, phone , salary , address,details,remarks ), department (did, name, budget, dno) ,make your own assumptions about the relationships between the entities. Write Inner join , Outer join ,cross join relations for those entities.

We assume that the employee (EMP) table contains a foreign key, dno, which references the primary key did in the DEPARTMENT table.

* 1. Inner Join: SELECT \* FROM EMP AS E INNER JOIN DEPARTMENT AS D ON E.dno=D.did;
  2. Outer Join: SELECT \* FROM EMP AS E LEFT OUTER JOIN DEPARTMENT AS D ON E.dno=D.did;
  3. Inner Join: SELECT \* FROM EMP , DEPARTMENT;

1. Define Referential Integrity Constraints. What is the main purpose of implementing referential Integrity in dbms?

Referential Integrity constraints are rules defined between 2 relations in a database. It is implemented by using a foreign key in one relation(R1) that points to te primary key of another relation(R2).

The main purpose of implementing referential integrity in a DBMS is to maintain consistency among the tuples in the two related tables. This mechanism ensures that if a record exists in one table (the dependent table, R1), the record it references in the other table (the parent table, R2) must also exist. Referential integrity prevents the creation of orphan data—situations where a foreign key points to a primary key value that does not exist or has been deleted.

1. From the given relations, write SQL statements for given queries:

COMPANY\_DETAILS (companyID, companyName, address, phone, estd Year)

JOBS(ID, jobTitle, jobDescription, company ID, postedDate, lastDateOfApplication)

APPLICANT (applicantID, fullName, email, phone)

APPLICATION\_SUBMISSION (jobID, applicantID, submittedDate)

Find the list of all the companies that were established in the Year 2023.

Find the name and phone number of all the applicants.

Display all the applicant whoso name start by S and P letter.

SELECT companyName FROM COMPANY\_DETAILS WHERE estd\_Year=2023;

SELECT fullName,phone FROM APPLICANT;

SELECT \* FROM APPLICANT WHERE fullName LIKE ‘S%’ OR fullName LIKE ‘P%’;

1. What is a database management system? Discuss the Advantage of DBMS over File System.

A Database Management System (DBMS) is a software system designed to store, retrieve, manage, and manipulate data efficiently. It provides a structured way to organize data in databases, ensuring data integrity, security, and easy access.. A Traditional File System is a method of storing data in flat files (e.g., .txt, .csv, .dat) without a structured database. Each file contains records, but there is no relationship between files, leading to data redundancy and inconsistency.

The advantages of using DBMS over traditional filing system are given below:

1. Data Redundancy Control: DBMS minimizes duplication of data through normalization, while file systems often have redundant data across multiple files stored in different locations.
2. Data Consistency: Ensures all data conforms to rules and constraints, unlike file systems where consistency must be manually maintained.
3. Data Sharing: Allows concurrent access by multiple users/applications, while file systems typically allow only one user at a time.
4. Data Integrity: Provides mechanisms to maintain accuracy and validity of data through constraints and validation rules.
5. Security Features: Offers user authentication, authorization, and access controls at various levels.
6. Backup and Recovery: Built-in mechanisms for data backup and recovery from failures.
7. Data Independence: Separates physical storage from logical representation, allowing changes without affecting applications.
8. Efficient Query Processing: Provides powerful query languages (like SQL) for complex data retrieval.
9. Centralized Management: Single repository for data with centralized administration.
10. Concurrency Control: Manages simultaneous access by multiple users to prevent inconsistencies.
11. What is functional dependency? Explain Different Inference rules.
12. Explain two-phase locking protocol in detail.
13. What do you mean by Functional Dependency , write with example.
14. Explain 2NF, 3NF with suitable examples.
15. What is a serializable schedule? Characterize schedule based on recoverability.
16. Draw a transaction state diagram. Discuss each state that a transaction goes through.
17. What do you mean by view? What is the use of view in SQL. Write the syntax with relevant examples of view.
18. Write sql and relational algebra statement for the following scheme

Food(code, packName, price, description)

Orders(cNo, cName, qty, date, Time)

Customers(cNo, cName, Contact, address)

Find name and contact no of all customers from 'Balaju'

Calculate total price of food ordered by customer "Ishmi" till now.

SELECT cName, Contact FROM Customers WHERE address=’Balaju’;

SELECT SUM(O.qty \* F.price) FROM Orders AS O JOIN Customers AS C ON O.cNo = C.cNo JOIN Food AS F ON C.cName = F.packName WHERE C.cName = 'Ishmi';

1. Construct the ER diagram of the bank using all possible components like different types of entities, attributes, relationship etc  and convert it into a database schema.
2. Describe different types of join operations used in SQL?

SQL join is a binary relation operation used to combine tuples of multiple relation on the basis of matching values in common attributes. It can be understood as a cartesian product of relation followed by selection criteria.

|  |  |
| --- | --- |
| Club | Player |
| TOT | Bale |
| MUN | Son |

The types of join operations are:

* 1. Inner Join: By using inner join, the resulting join relation only includes the tuples that satisfy the matching criteria, excluding others.

1. Theta Join: It is a type of join operation in which the join consdition can be any comparison operator (<,>,=,<=,>=,!=).

Club |><|(c.Player!=p.Player) Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |

1. Equi Join: It is a type of join operation in which the join consdition can be only equality comparison operator (=).

Club |><|(c.Player=p.Player) Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Natural Join: It is a type of join operation in which tuples are joined by matching same values in common attribute and eliminating redundant attributes.

Club |><| Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Outer Join: By using outer join, the resulting join relation includes the tuples that satisfy the matching criteria as well other tupels with missing criteira.
2. Left Outer Join: It is a type of join operation in which all tuples of left relation are kept. The tuples in left relation without matching values in right relation, have their attributes filled by NULL value.

Club =|><| Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |
| MUN | Son | 7 |

1. Right Outer Join: It is a type of join operation in which tuples of right relation are kept. The tuples in right relation without matching values in left relation, have their attributes filled by NULL value.
2. Club |><| =Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| MUN | Son | 7 |

1. Full Outer Join: It is a type of join operation in which all tuples of both relation are kept. The tuples in any relation without matching values in other relation, have their attributes filled by NULL value.

Club =|><|= Player

|  |  |  |
| --- | --- | --- |
| Club | Player | Jersey |
| TOT | Bale | NULL |
| MUN | Son | 7 |

1. What is data abstraction? Explain with its level.

The three-schema architecture is a framework to separate the database into three levels of abstraction. Its purpose is to seaparte user applications from physical database, to allow data indepenece and to simplify database management, maintenance and security.



Figure 1: 3-schema architecture

The layers of abstraction are:

1. Internal Level (Physical Schema):

It is the lowest level of abstraction. It describes how data is physically stored in the database. Includes file structures, indexes, compression, storage devices, etc. Example: Student data is stored as binary records in files on a hard disk, sorted by roll.

2. Conceptual Level (Logical Schema):

It is the midlle level of abstraction. It describes the structure of the entire database for a community of users. It is independent of physical storage through logical data independence .It includes entities, relationships, constraints(primary & foreign keys), data types, etc. Example: Student(Roll, Name, Major) is a logical table, with Roll as primary key and possibly foreign keys to other tables.

3. External Level (View Schema):

It is the highest level of abstraction. It describes how individual users or applications see the data. Each user can have a customized view. It allows access control, simplification, and security. Example:

A teacher’s view: Student(RollNo, Name)

A finance department’s view: Student(RollNo, FeeStatus)

1. What is Normalization? Explain any two normal forms in detail.
2. Define roles of DBA on Relational Database
3. Explain in detail about ACID properties.

A transaction is a collection of several operations on the database that appears to be a single unit from the point of view of the database user. For example, a transfer of funds from one account to another account is a single operation from customer’s point of view but within the database system, however, it consists of several tasks.

The ACID properties are required to maintain integrity of database. They are:

1. Atomicity: It ensures that the transaction is either completely executed or not at all. If a transaction is unsuccessful due to failure or constraints, any changes applied to the database during the transaction must be undone through ROLLBACK/ABORT command. It prevents the database from staying in partial state.
2. Consistency: It ensures that the transaction, after complete execution without interference from other concurrent transactions, takes the database from one consistent state to another. The state during execution is inconsistent state which must be hidden to user.
3. Isolation: The transaction is not interfered by the concurrent execution of other transactions. The state of database after concurrent execution of transaction must be equivalent to the state reached after serial execution of transaction in same order,
4. Durability: The changes applied to a database after execution of transaction must be persistent. Once a transaction is committed, all updates to the database must remain permanently even during failures like system crash and power loss.
5. Describe different components of DBMS.
6. What is the difference between physical and logical data independence?

| **Aspect** | **Logical Data Independence** | **Physical Data Independence** |
| --- | --- | --- |
| **Definition** | Ability to change the conceptual schema without affecting external schemas (user views). | Ability to change the internal schema without affecting the conceptual schema. |
| **Level Affected** | Between conceptual and external levels. | Between internal and conceptual levels. |
| **What Changes?** | Modifications to tables, relationships, or constraints (e.g., adding/removing entities or attributes). | Changes in file structures, storage devices, or access methods (e.g., indexing, hashing). |
| **Impact on Users** | Applications not using the modified schema remain unaffected. | No impact on application programs or user queries. |
| **Purpose** | Protects applications from changes in the logical database design. | Protects the database design from changes in physical storage. |
| **Complexity** | Harder to achieve (may require view definitions). | Easier to achieve (handled by the DBMS). |
| **Example** | Adding a phone\_number column to a Student table without breaking existing apps that don’t use this field. | Switching from B-tree to hash indexing for faster searches without altering table structures. |

1. Define the time stamp base protocol. explain the condition for R/W operations.
2. Explain different types of locking protocol.
3. Distinguish between generalization and aggregation.
4. Distinguish between tuple and domain.
5. Distinguish between Where and Having clause.
6. Distinguish between composite attribute and derived attribute.
7. What do you mean by log based recovery?
8. Write sql and relational algebra statement for the following scheme

Food(code, packName, price, description)

Orders(cNo, cName, qty, date, Time)

Customers(cNo, cName, Contact, address)

Find name and contact no of all customers from ‘Tokha’

Calculate total price of food ordered by customer "Grishma" till now.

SELECT cName, Contact FROM Customers WHERE address = 'Tokha';

SELECT SUM(O.qty \* F.price) FROM Orders AS O JOIN Customers C ON O.cNo = C.cNo JOIN Food AS F ON C.cName = F.packName WHERE C.cName = 'Grishma';

1. Construct an ER diagram for a university using all possible components like different types of entities, attributes, relationship etc and convert it into a database schema.
2. List the roles of Database administrator. Explain different types of Database user.

A database user is an individual, application, or system that interacts with a database to perform operations such as storing, retrieving, updating, or managing data. Each user is typically assigned specific access rights and privileges based on their role to ensure security and proper data management.

Database users can be categorized based on their level of interaction with the database system:

1. End Users:

End users are database users who interact with database by issuing commands from a terminal through predefined application programs to perform functions like create, retrieve, modify and delete. Example: Bank tellers using an interface to access customer accounts

1. Application Programmers:

Application programmers are database users who develop applications that interact with the database using programming languages and APIs like Access, FoxPro, COBOL, etc. These application programs are used by end users to operate on data. Example: Developers creating e-commerce websites that connect to product databases.

1. Database Administrators (DBAs):

DBAs are database users who maintains the database description in original form. It is responsible for overall control of the database system. Example: Database managers ensuring that the product database runs smoothly, securely, and efficiently—supporting developers, customers, and business operations.

The responsibilities of a DBA are:

1. **Schema definition and modification:**

The creation and modification of the original description of the database structure and the way that structure is reflected by the files of the physical database.

1. **Storage structure and access method definition:**

The DBA determines how data is physically stored on disk, including file organization, portioning and tablespace management. The DBA also chooses the best access methods for query efficiency through indexing strategies like B-tree, hashmap, bitmaps.

1. **Granting authorization for data access:**

Granting access to the database to different users.

1. **Routine maintenance:**

Making backup copies of the database and repairing damage to the database due to hardware or software failures or misuse.

1. List the steps to draw E-R diagrams and Design E-R diagram for Education Portal
2. Explain about Concurrency Control and also explain about Time stamp based protocol.
3. Explain Serial schedule with suitable Example.
4. Define Integrity Constraints. What is the main purpose of implementing Integrity in dbms? Explain its types.