- **Apply database concepts and theories in the database design in terms of database integrity and data consistency.**

The concepts of database integrity and data consistency are critical in database design. The accuracy and consistency of data are referred to as data integrity. Data integrity in a database is critical because stored data values are consistent with the data model and type. Data reliability across all tables in a relational database is called data consistency. The relational database model ensures that data consistency is maintained across all tables. In a relational database, constraints can be used to enforce data consistency (Harrington, 2016). To apply these concepts in database design, we can use the following techniques:

1. **Entity Integrity**: Entity integrity refers to the rule that states that each row or record in a database table must be unique and identifiable. This can be enforced by setting a primary key on each table, which ensures that no two rows have the same value for the primary key column.
2. **Referential Integrity**: Referential integrity ensures that the relationships between tables are maintained and that the data in each table is consistent. This can be enforced by creating foreign key constraints that ensure that any values entered into a foreign key column match those in the referenced table's primary key column.
3. **Data Consistency**: Data consistency refers to the accuracy and reliability of data in a database. This can be achieved by using data types appropriate for stored data, setting constraints on the data that enforce business rules and logic, and using transactions to ensure that data changes are atomic and consistent.
4. **Normalization** is organising data in a database to reduce redundancy and improve data consistency. By breaking down tables into smaller, more specialised tables and establishing relationships between them, we can ensure that data is stored most efficiently and consistently as possible.
5. **Validation**: Validation refers to ensuring that the data entered into a database is accurate and conforms to specific rules and constraints. This can be done using data validation techniques like range, format, and data type validation.

In summary, we can design accurate, reliable, and consistent databases by applying database concepts and theories such as entity integrity, referential integrity, data

consistency, normalisation, and validation. This can improve the quality of data stored in a database, making it more valuable for users and stakeholders.

- **Create and manipulate data stored in a database by means of the structured query language SQL.**

SQL (Structured Query Language) is a programming language for managing and manipulating data in a relational database. SQL is used in databases to create, modify, and delete data. It can also be used to retrieve information from a database. SQL is a powerful database management tool widely used in industry (Silva et. al, 2016). For instance, here are some examples of SQL commands to create and manipulate data in a database:

1. **Creating a Database:**

CREATE DATABASE database_name;

2. **Creating a Table:**

```
CREATE TABLE table_name (
        column1 datatype1,
        column2 datatype2,
        column3 datatype3,
        ....);
```

3. **Inserting Data:**

```
INSERT INTO table_name (column1, column2, column3, ...)
VALUES (value1, value2, value3, ...);
```

4. **Updating Data:**

```
UPDATE table_name SET column1 = new_value1, column2 = new_value2
WHERE condition;
```

5. Deleting Data:

```
DELETE FROM table_name
WHERE condition;
```

6. Retrieving Data:

```
SELECT column1, column2, ...
FROM table_name WHERE condition;
```

7. Joining Tables:

```
SELECT column1, column2, ...
FROM table1
JOIN table2
ON table1.column = table2.column
WHERE condition;
```

These are just a few examples of SQL commands. Many more commands are available, including commands for creating indexes, views, and stored procedures. To become proficient in SQL, it is essential to learn the syntax and semantics of the language and practice writing queries and commands. Many resources are available online for learning SQL, including tutorials, online courses, and reference guides.

- **Review the security and maintenance methods of a database.**

Database security and upkeep are critical aspects of database management. Enforcing the principle of least privilege, conducting regular access reviews, monitoring database activity, encrypting sensitive data, knowing what data you have and where it is stored, testing backup, export and restoration, hardening, patching, and configuring are some methods for maintaining database security. Threat modelling intersection points are another method (Teimoor, 2021).

Database maintenance tasks include regularly backing up data, testing backups to ensure they can be restored when needed, monitoring database performance, and tuning it as needed (IBM, N.D.).

Database security and maintenance are critical aspects of database management. A well-maintained and secure database ensures that data is available, reliable, and secure (Moyle & Chapple, N.D). For instance, here are some methods to review for database security and maintenance:

1. **Access Control**: Implement access control mechanisms to ensure only authorised users can access the database. This includes setting up user accounts with passwords, access privileges, and permissions.
2. **Data Backup and Recovery**: Regularly back up the database and test the recovery process to ensure that data can be restored during a disaster. Backups should be stored offsite or in a secure location to protect against theft, damage, or natural disasters.
3. **Database Encryption**: Implement encryption techniques to protect sensitive data stored in the database. This includes using encryption for data at rest and data in transit.
4. **Monitoring and Auditing**: Implement monitoring and auditing mechanisms to track user activities and detect any suspicious or unauthorised access to the database. This includes tracking login attempts, user actions, and system events. Patching and Updates: Regularly apply patches and updates to the database management system and other software components to ensure that security vulnerabilities are addressed and the system is up-to-date.
5. **Performance Optimization**: Regularly monitor the database performance and optimise the database structure, indexing, and query performance to ensure the system runs smoothly and efficiently.
6. **Disaster Recovery Planning**: Develop a disaster recovery plan to ensure that the database can be restored during a disaster. This includes identifying critical data, establishing recovery procedures, and regularly testing the plan.

In summary, database security and maintenance are critical aspects of database management. By implementing access control, backup and recovery procedures, encryption techniques, monitoring and auditing mechanisms, patching and updates, performance optimisation, and disaster recovery planning, database administrators can ensure their databases are secure, reliable, and available.

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