

DATA MANAGEMENT AND DATABASE DESIGN
HOMEWORK: WEEK- 4

1. What is the purpose of logical database design?

Logical database design is fundamentally used to satisfy the database design requirements of a business organization. It refers to the process of how conceptual data is transformed into a logical one, which is compatible with business requirements.

Purpose of a logical database design:

- ➔ Designed in such a way that data is easier to understand and can be more clearly explained to the clients/stakeholders. Also gives a lot of flexibility to adapt with the changes of business needs.
- ➔ Maintains data integrity by using primary keys, foreign keys, referential integrity constraints in order to maintain the consistency of data.
- ➔ Specifies the entity-relationship, attributes, different constraints etc. which help third party administrators, developers etc. with easy documentation and reference
- ➔ Logical database design serves as a blueprint for the physical database creation, (i.e.) creation, updation and manipulation, etc. of a table.
- ➔ By the creation of a logical database, the physical components are separated, that in turn does not affect the logical database when physical components are updated or manipulated.

2. List and briefly describe the five properties of relations (tables) in a relational database.

A relation refers to a named table that stores data in a database. Properties of tables include:

- a) Attributes: A table consists one or more attribute (also known as a field or column). Properties of an attribute include a name and datatype which refers to what kind of data can be stored in the column. Each attribute within a table is unique name.
- b) Name: Every relation has a unique name which is used for future reference and identification purposes.
- c) Manipulation: In a table, data can be operated, retrieved or manipulated in many different ways, (i.e.) Data can be inserted, updated, deleted or selected etc.
- d) Relationships: In a table, relationships can be established using fields such as primary key, foreign keys etc. which create a link between various tables.
- e) Tuples: A table consists of one or more tuples (also known as rows or records), which represent data entries within the table. Each tuple in a table is unique, which means no two tuples can have the same value.

3. Explain a property of candidate keys that make them suitable for unique identification.

Properties of Candidate keys that make them suitable for unique identification:

- A candidate key makes sure that no two rows have the same value for candidate key, which makes it unique.
- Candidate key can never have a NULL value. NULL values in a table makes them unsuitable to be unique.
- Candidate keys cannot contain redundancies because redundant data leads or loss of data integrity and also compromises on uniqueness.
- No attribute from a candidate key can be removed as it leads to loss of uniqueness.

4. What is the role of referential integrity constraints in the relational model, and how do they maintain data integrity?

Referential integrity refers to how consistency is maintained between the rows of two relations. The rule says that, for a given foreign key in a relation, the foreign key value should either match the primary key of another relation or the foreign key value should be NULL. This makes sure that if one piece of information is changed in a column, the same is reflected in all the other related columns.

This property of referential integrity constraints maintains data integrity because, in this case every foreign key will point to one another unique value in a different table. This in turn makes sure that data is not lost and data quality is maintained.

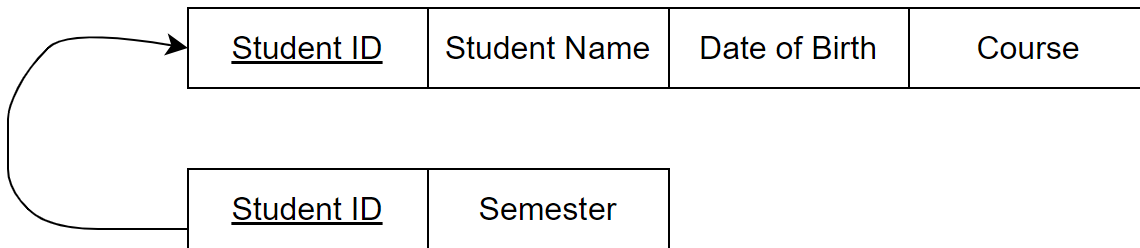
5. Explain the concept of multi-valued attributes in logical database design. Provide an example to illustrate the concept.

Multivalued attributes refer to how multiple attributes are mapped with an entity. They are used when one or more values have to be stored for an attribute. Here the general attributes are separate and the multi-valued entity is separately represented inside of a curly brace.

Eg:

Let us consider a student entity with Student ID (Primary key), Student name, Date of Birth and Course as attributes. There is also another separate attribute "Semester" represented inside of curly braces which is associated with the entity Student.

STUDENT	
PK	<u>Student ID</u>
	Student Name Date of Birth Course {Semester}



6. What are data integrity constraints, and why are they essential in a database?

Data integrity refers to the mechanisms that specify the business rules which are defined to maintain the integrity of data when they are being changed or controlled. Data integrity is essential in a database as it protects the accuracy of the data by ensuring searchability and traceability. It ensures the data is always secure and reliable. Maintaining data integrity is crucial under situations where there is chance for the data to be manipulated by third party entities.

7. What the difference between primary key and unique key constraints?

Primary Key: A primary key is a constraint in a table that uniquely identifies each row in a table. A primary key is important so as to perform operations on the table, like inserting, deleting, updating data as it is a unique identifier for each row. A primary key is also unique for each record and is never a repetitive value. Each table can have only one primary key and never have multiple primary keys.

Unique Key: A unique key, also referred to as candidate key is a group of one or more than one field of a table that uniquely identifies a record in the database. A unique key also prevents duplicate values being recorded in a table. One table can have multiple unique keys. One difference among a primary key and a unique key is that, primary key doesn't store NULL values whereas unique key stores NULL values.

8. What is a foreign key constraint, and how does it maintain referential integrity in a relational database?

A foreign key is one or a set of attributes of a certain table that references to the primary key of another table. A foreign key acts as a link between two tables. It also accepts NULL values unlike a primary key. One table may have multiple foreign key constraints and each foreign key value may belong to a different parent table.

A foreign key helps in maintaining referential integrity because it either matches the primary key value in some other relation of a table or it is NULL.