دوره‌ی پایتون- جنگو

بوت‌کمپ ۵۱
SQL-ERD

مدرس: میمنت جلیلیان

Database

Store
Organize
Use
Data

Database

DBMS
RDBMS
SQL
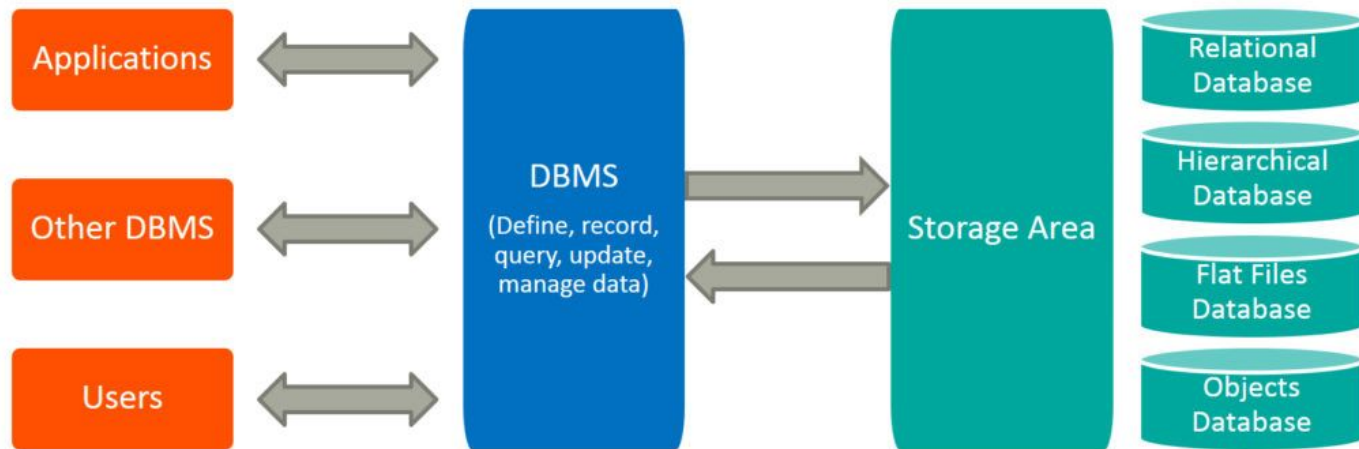
Database Models

Relational

     MySQL, Oracle,...

Document

     MongoDb,...

Key,Value

     Redis,...

Graph

     Neo4j

Column Base

     Apache Cassandra

To Study more...
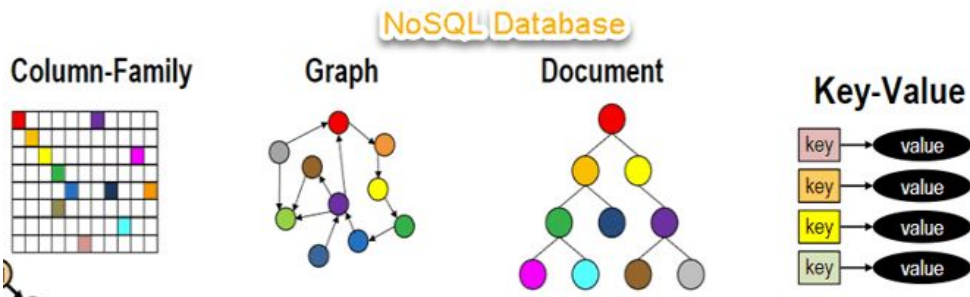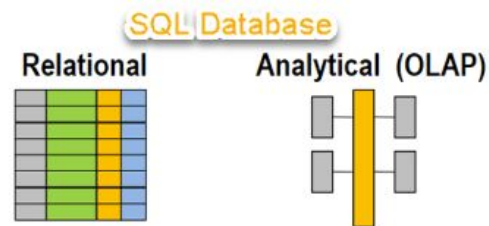
Relational Model

Table Structure

link

CREATE   READ   UPDATE   DELETE

C R U D
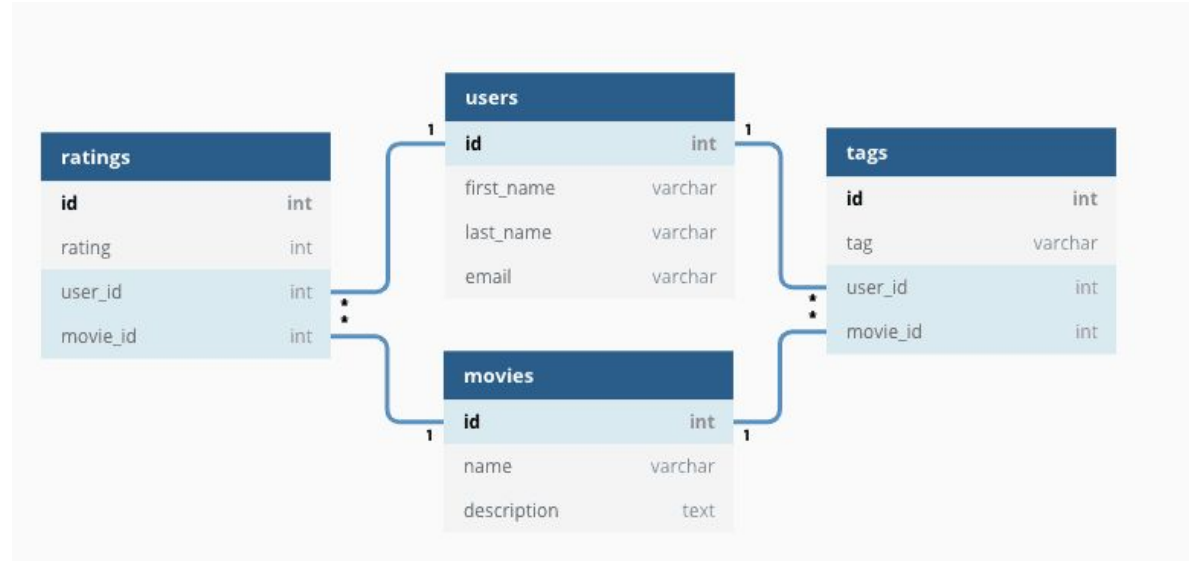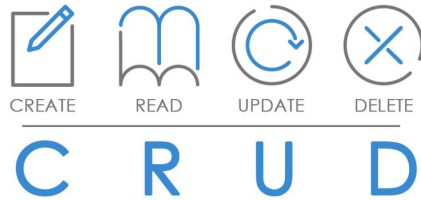
ER Model

Entity Relationship Model

E-R Diagram for Library Management System
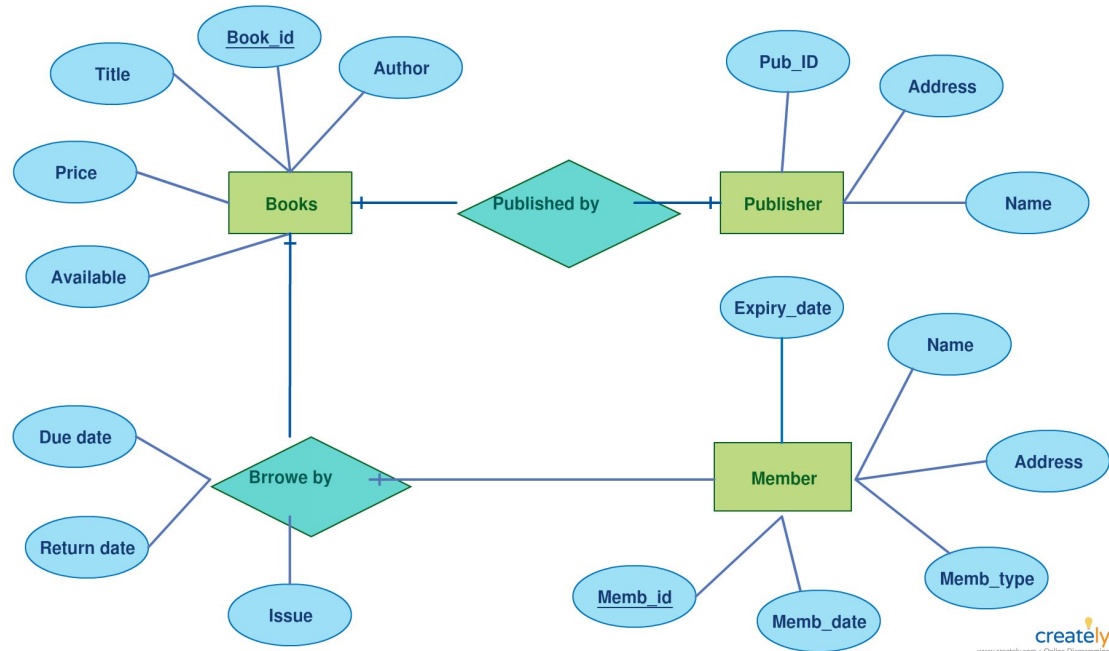
ER Model- basic

Entity

Attributes

Relationship

Entity
Person, place, object, event or concept about which data is to be maintained
Example: Car, Student

Attribute
Property or characteristic of an entity
Example: Color of car Entity Name of Student Entity

Relation
Association between the instances of one or more entity types
Example: Blue Car Belongs to Student Jack
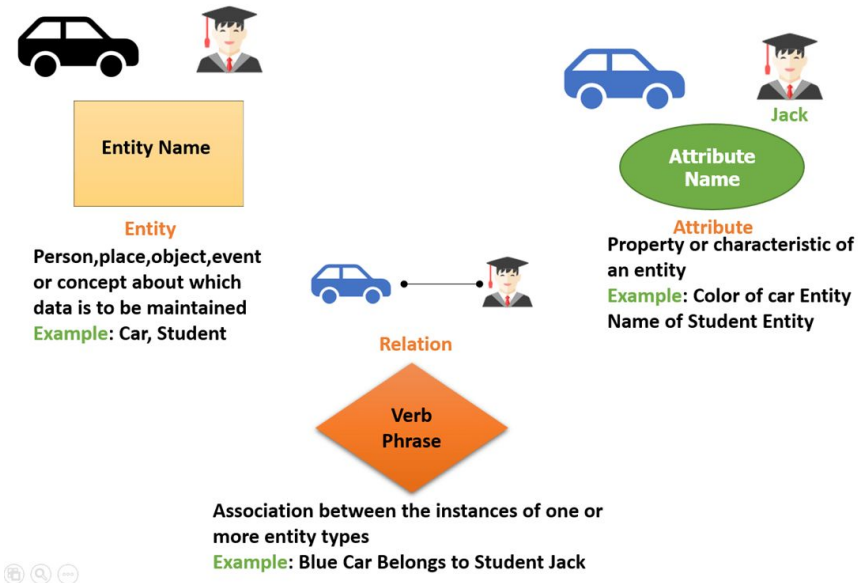
ER Model- attribute types

- **Simple attribute** − Simple attributes are atomic values, which cannot be divided further. For example, a student's phone number is an atomic value of 10 digits.
- **Composite attribute** − Composite attributes are made of more than one simple attribute. For example, a student's complete name may have first_name and last_name.
- **Derived attribute** − Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database. For example, average_salary in a department should not be saved directly in the database, instead it can be derived. For another example, age can be derived from data_of_birth.
- **Single-value attribute** − Single-value attributes contain single value. For example − Social_Security_Number.
- **Multi-value attribute** − Multi-value attributes may contain more than one values. For example, a person can have more than one phone number, email_address, etc.

Entity Sets and Keys

Key is an attribute or collection of attributes that uniquely identifies an entity among entity set.

For example, the roll_number of a student makes him/her identifiable among students.

- Super Key − A set of attributes (one or more) that collectively identifies an entity in an entity set.
- Candidate Key − A minimal super key is called a candidate key. An entity set may have more than one candidate key.
- Primary Key − A primary key is one of the candidate keys chosen by the database designer to uniquely identify the entity set.

Relationships

The association among entities is called a relationship. For example, an employee works_at a department, a student enrolls in a course. Here, Works_at and Enrolls are called relationships.

Relationship Set

A set of relationships of similar type is called a relationship set. Like entities, a relationship too can have attributes. These attributes are called descriptive attributes.

Degree of Relationship

- Binary = degree 2
- Ternary = degree 3
- n-ary = degree

Relationships

Mapping Cardinalities:

One to One

One to Many

Many to One

Many to Many
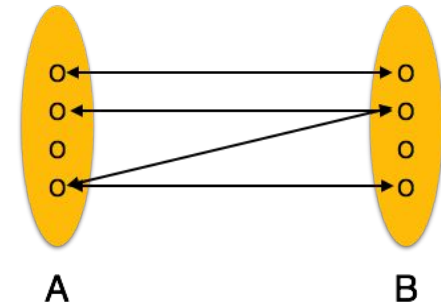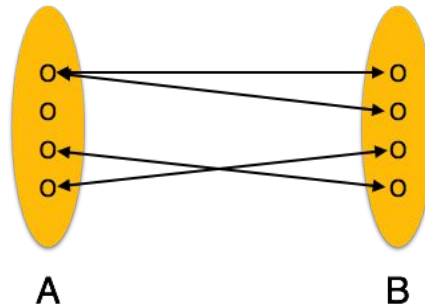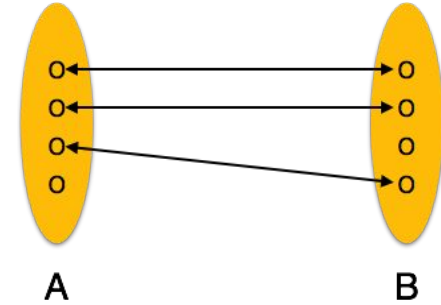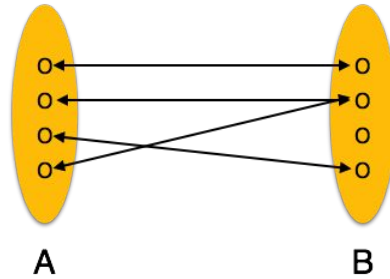
Codd's Rule

1. **Information Representation**
2. **Guaranteed Access**
3. **Systematic Treatment of Null Values**
4. **Database Description Rule**
5. **Comprehensive Data Sub-Language**
6. **View Updating**
7. **High-Level Update, Insert, Delete**
8. **Physical Data Independence**
9. **Logical Data Independence**
10. **The Distribution Rule**
11. **Non-Subversion**
12. **Integrity Rule**

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

1.Entity Identification

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

1.Entity Identification

- Student
- Course
- Professor

Student

Course

Professor

Example

Entity Identification → Relationship Identification → Cardinality Identification → Identify Attributes → Create ERD

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

Step 2) Relationship Identification

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

Step 2) Relationship Identification

Example

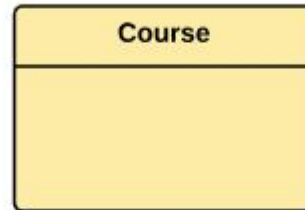Entity Identification → Relationship Identification → Cardinality Identification → Identify Attributes → Create ERD

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Step 3) Cardinality Identification

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course
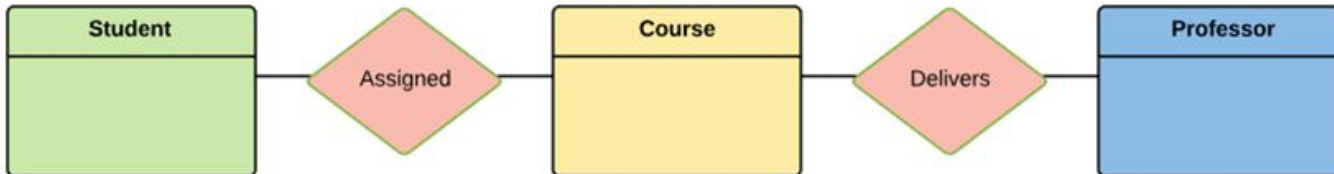
Step 3) Cardinality Identification

For them problem statement we know that,

- A student can be assigned multiple courses
- A Professor can deliver only one course

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course
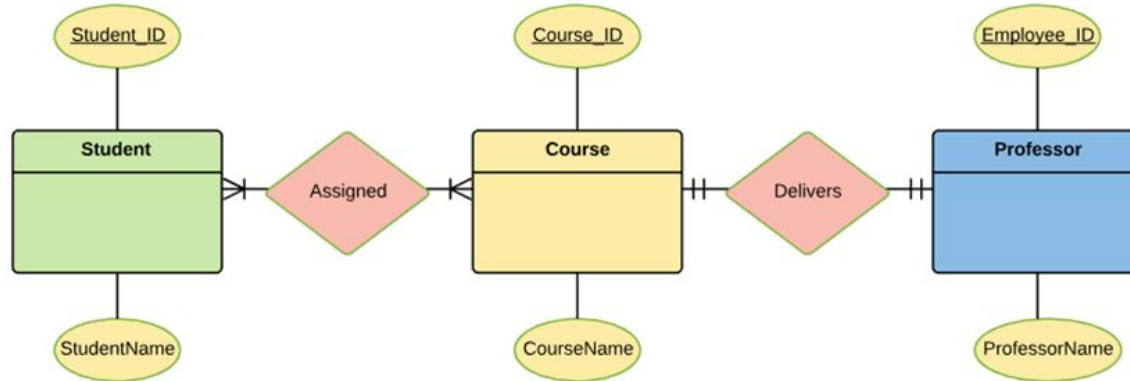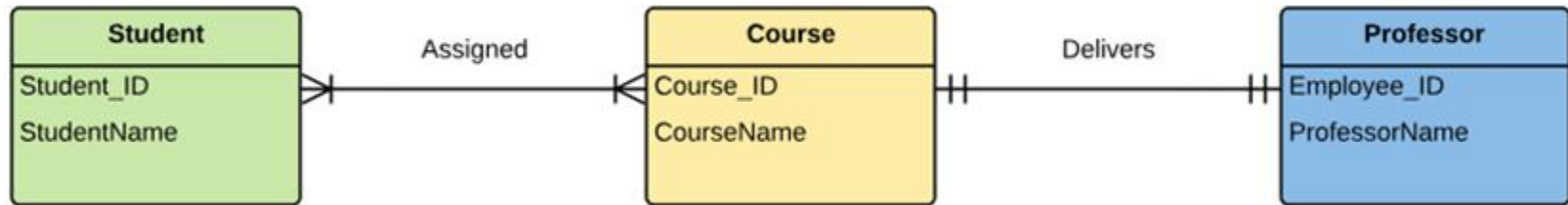
Step 4) Identify Attributes

Example

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

Step 5) Create the ERD Diagram

Participation

Participation Constraint is applied on the entity participating in the relationship set.

1. **Total Participation –** Each entity in the entity set **must participate** in the relationship. If each student must enroll in a course, the participation of student will be total. Total participation is shown by double line in ER diagram.

2. **Partial Participation –** The entity in the entity set **may or may NOT participate** in the relationship. If some courses are not enrolled by any of the student, the participation of course will be partial. The diagram depicts the 'Enrolled in' relationship set with Student Entity set having total participation and Course Entity set having partial participation.

Weak entity

The entity sets which do not have sufficient attributes to form a primary key are known as **weak entity sets** and the entity sets which have a primary key are known as strong entity sets.

Weak entity is **depend on strong entity** to ensure the existence of weak entity.

Weak entities have total participation constraint (existence dependency) in its identifying relationship with owner identity

Conceptual, logical and physical data models

ER models and data models are typically drawn at up to three levels of detail:

Conceptual data model: The highest-level view containing the least detail. Its value is showing overall scope of the model and portraying the system architecture. For a system of smaller scope, it may not be necessary to draw. Instead, start with the logical model.

Logical data model: Contains more detail than a conceptual model. More detailed operational and transactional entities are now defined. The logical model is independent of the technology in which it will be implemented.

Physical data model: One or more physical model may be developed from each logical model. The physical models must show enough technology detail to produce and implement the actual database.

Database development life cycle
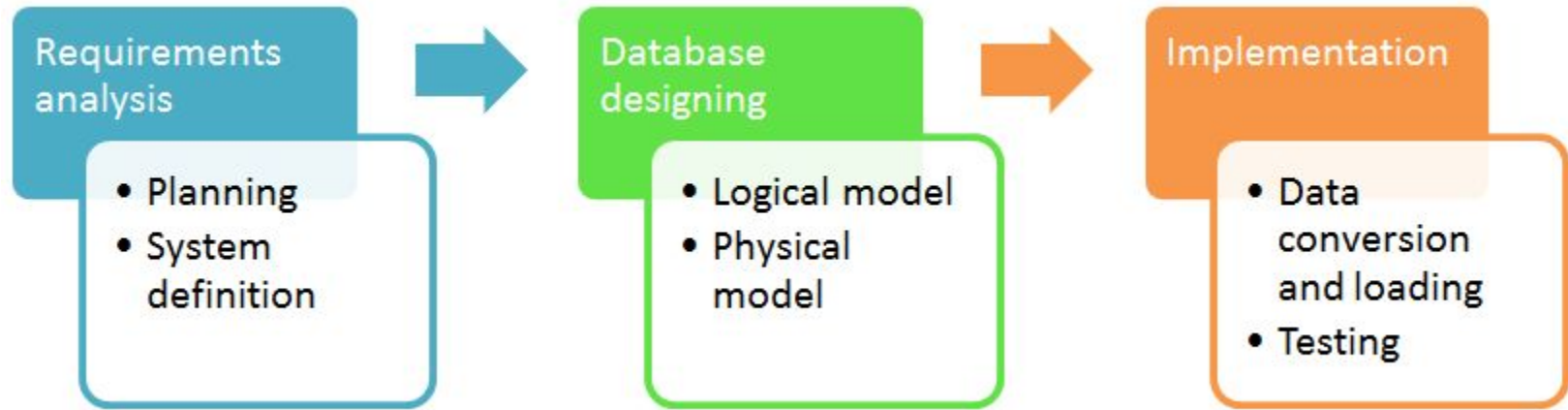
Normalization

Normalization is a database design technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update and Deletion Anomalies. Normalization rules divides larger tables into smaller tables and links them using relationships. The purpose of Normalization in SQL is to eliminate redundant (repetitive) data and ensure data is stored logically.

- 1NF (First Normal Form)
- 2NF (Second Normal Form)
- 3NF (Third Normal Form)
- BCNF (Boyce-Codd Normal Form)
- 4NF (Fourth Normal Form)
- 5NF (Fifth Normal Form)
- 6NF (Sixth Normal Form)

1NF (First Normal Form) Rules

- Each table cell should contain a single value.
- Each record needs to be unique.

FULL NAMES	PHYSICAL ADDRESS	MOVIES RENTED	SALUTATION
Janet Jones	First Street Plot No 4	Pirates of the Caribbean, Clash of the Titans	Ms.
Robert Phil	3rd Street 34	Forgetting Sarah Marshal, Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

FULL NAMES	PHYSICAL ADDRESS	MOVIES RENTED	SALUTATION
Janet Jones	First Street Plot No 4	Pirates of the Caribbean	Ms.
Janet Jones	First Street Plot No 4	Clash of the Titans	Ms.
Robert Phil	3rd Street 34	Forgetting Sarah Marshal	Mr.
Robert Phil	3rd Street 34	Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

primary key

- A primary key cannot be NULL
- A primary key value must be unique
- The primary key values should rarely be changed
- The primary key must be given a value when a new record is inserted.

composite key:

a primary key composed of multiple columns used to identify a record uniquely

Composite Key

Robert Phil	3rd Street 34	Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

Names are common. Hence you need name as well Address to uniquely identify a record.

2NF (Second Normal Form) Rules

- Rule 1- Be in 1NF
- Rule 2- Single Column Primary Key

MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION
1	Janet Jones	First Street Plot No 4	Ms.
2	Robert Phil	3rd Street 34	Mr.
3	Robert Phil	5th Avenue	Mr.

MEMBERSHIP ID	MOVIES RENTED
1	Pirates of the Caribbean
1	Clash of the Titans
2	Forgetting Sarah Marshal
2	Daddy's Little Girls
3	Clash of the Titans

Foreign key

- A foreign key can have a different name from its primary key
- It ensures rows in one table have corresponding rows in another
- Unlike the Primary key, they do not have to be unique. Most often they aren't
- Foreign keys can be null even though primary keys can not

3NF (Third Normal Form) Rules

- Rule 1- Be in 2NF
- Rule 2- Has no transitive functional dependencies

transitive functional dependency:

A transitive functional dependency is when changing a non-key column, might cause any of the other non-key columns to change

MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION ID
1	Janet Jones	First Street Plot No 4	2
2	Robert Phil	3rd Street 34	1
3	Robert Phil	5th Avenue	1

MEMBERSHIP ID	MOVIES RENTED
1	Pirates of the Caribbean
1	Clash of the Titans
2	Forgetting Sarah Marshal
2	Daddy's Little Girls
3	Clash of the Titans

SALUTATION ID	SALUTATION
1	Mr.
2	Ms.
3	Mrs.
4	Dr.

+3

4NF (Fourth Normal Form) Rules

If no database table instance contains two or more, independent and multivalued data describing the relevant entity, then it is in 4th Normal Form.

5NF (Fifth Normal Form) Rules

A table is in 5th Normal Form only if it is in 4NF and it cannot be decomposed into any number of smaller tables without loss of data.

6NF (Sixth Normal Form) Proposed

6th Normal Form is not standardized, yet however, it is being discussed by database experts for some time. Hopefully, we would have a clear & standardized definition for 6th Normal Form in the near future...