Database Model

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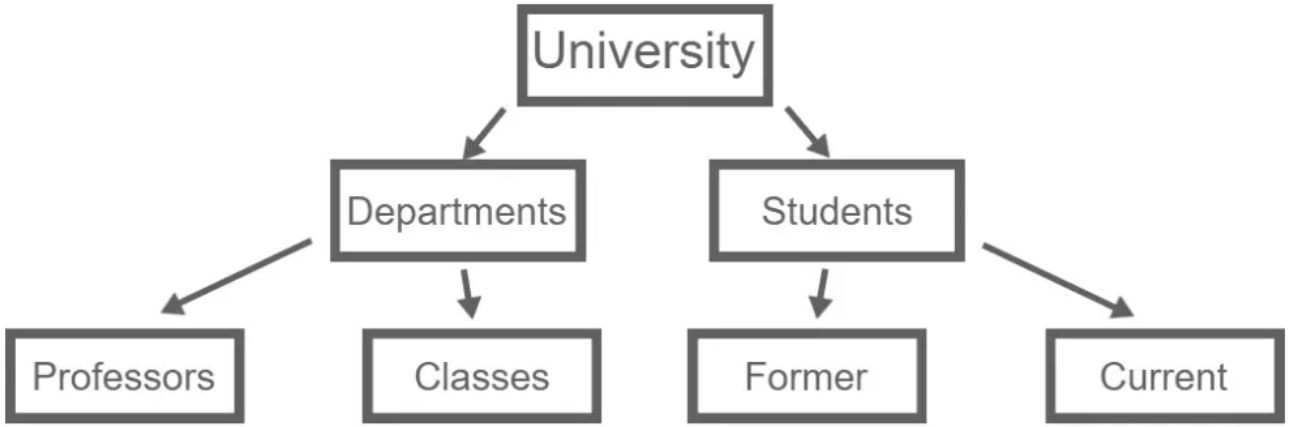
- A database model refers to the structure of a database and determines how the data within the database can be organized and manipulated
- Multiple types of relationships can be supported in database modeling.
- **One to one (1-1)**
- **One to many (1-M)**
- **Many to One (M-1)**
- **Many to Many (M-M)**

Type of Database Model

- Hierarchical Model
- Network model
- Relational model
- Object oriented Model

Hierarchical Model

- It is one of the oldest database model developed by IBM for information Management System.
- In Hierarchical Model, data are organized in a tree structure that links a number of different elements to one “Parent” primary record.
- The hierarchical database model was popular in the early days of the digital database in the 1950s and 1960s as people transitioned from the paper filing of data.



Advantage:

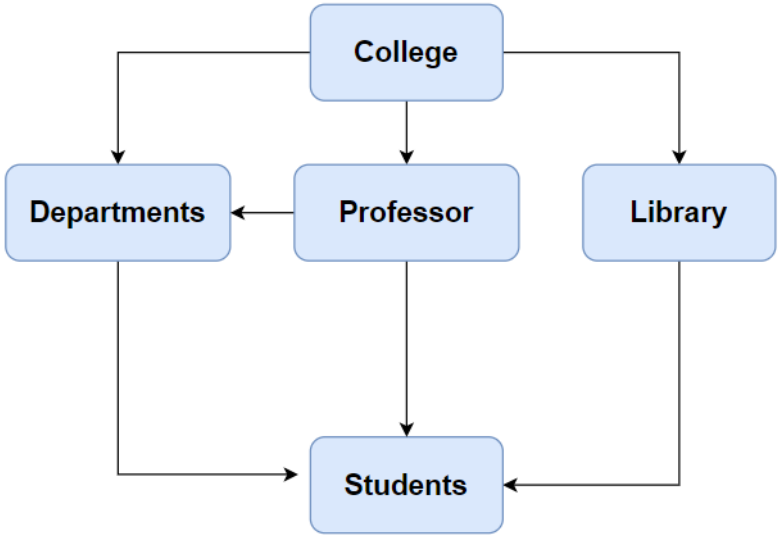
- Easy addition and deletion of data
- Data at the top of the Hierarchy is very fast to access.
- It worked well with linear data storage mediums such as tapes.

Disadvantage:

- This model support only one to many relationships, many to many relationships are not supported.
- It requires data to be repetitively stored in many different entities.
- Slow to search
- Changes to the model require extensive programming

Network model

- The network database model is an extension of hierarchical model.
- It was introduced in the late 1960s as a response to the inefficiencies of the hierarchical model. The major inefficiency solved by the network model was the many-to-many relationships that allowed for faster searches.



In the figure , we can see that node student has three parents i.e. Department and Library and Professor . This type of relationship is not possible in the hierarchical model.

Advantage:

- The data access is easier and flexible than the hierarchical model. Flexible
- Support Many to Many Relationship
- Less Data redundancy than the hierarchical model.

Disadvantage:

- The structural changes to the database is very difficult.
- More Expensive than the hierarchical model
- Complex Data Structure

Relational Model

- A relational database is developed by E. F. Codd in 1970. The different software systems used to maintain relational databases are known as a relational database management system (RDBMS)
- In relational model data is represented using two dimensional table called relations. The two dimensional are row and column, column is also known as field and row is also known as record or tuples . To establish a relationship between two table ; primary key of one tables will be referred into another table as foreign key.
- A **primary key** uniquely defines relationship within a database. Primary key must not repeat.
- A **Foreign key** is a key used to link two tables together. Foreign key is a field that refers to the primary key in another table.

Purchase table

Transaction ID	Customer ID	Product ID	Purchange date
1112	24221	8977	03-22-2010
1113	24222	8978	03-22-2010
1114	24223	8979	03-22-2010

Customer ID	Customer	Address
24221	Bob	123 East street
24222	Alice	223 Main street
24223	Martha	465 North street

Customer table

Product ID	Name	Price
8977	Banana	.79
8978	TV	400
8979	Watch	50

Product table

Customer ID is a primary key in customer table.
Product ID is a Primary key in Product table.
Primary key of customer table (**Customer ID**) and Product table (**Product ID**) used as a foreign key in Purchase Table.

MySQL ,Microsoft SQL Server, Oracle are the some popular Relational Database.

Flat File Database

Student ID	Student Name	Student Major	Student Email	Course	Grade
1234	John Smith	Marketing	jsmith@ university.edu	MKT211	A
1234	John Smith	Marketing	jsmith@ university.edu	MIS315	B
2345	Robert Jackson	MIS	rjackson@university.edu	ACT211	B
2345	Robert Jackson	MIS	rjackson@university.edu	MIS315	B
3456	Anne Sun	Accounting	asun@university.edu	ACT211	A
3456	Anne Sun	Accounting	asun@university.edu	FIN311	A
4567	Mary Brown	Finance	mbrown@university.edu	ACT211	A
4567	Mary Brown	Finance	mbrown@university.edu	FIN311	B
9991	Alex Wilson	Marketing	abrown@university.edu	MKT211	B

Flat File Database includes one dimensional table of data organized in rows and columns.

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Relational Database

Grades Table

Student ID	Course	Grade
1234	MKT211	A
1234	MIS315	B
2345	ACT211	B
2345	MIS315	B
3456	ACT211	A
3456	FIN311	A
4567	ACT211	A
4567	FIN311	B
9991	MKT211	B

Student Table

Student ID	Student Name	Student Major	Student Email
1234	John Smith	Marketing	jsmith@ university.edu
2345	Robert Jackson	MIS	rjackson@university.edu
3456	Anne Sun	Accounting	asun@university.edu
4567	Mary Brown	Finance	mbrown@university.edu
9991	Alex Wilson	Marketing	abrown@university.edu

Relational Database includes multiple tables of data that are related by a common field.

Relational Database includes multiple tables of data that are related by a common field

Advantages:

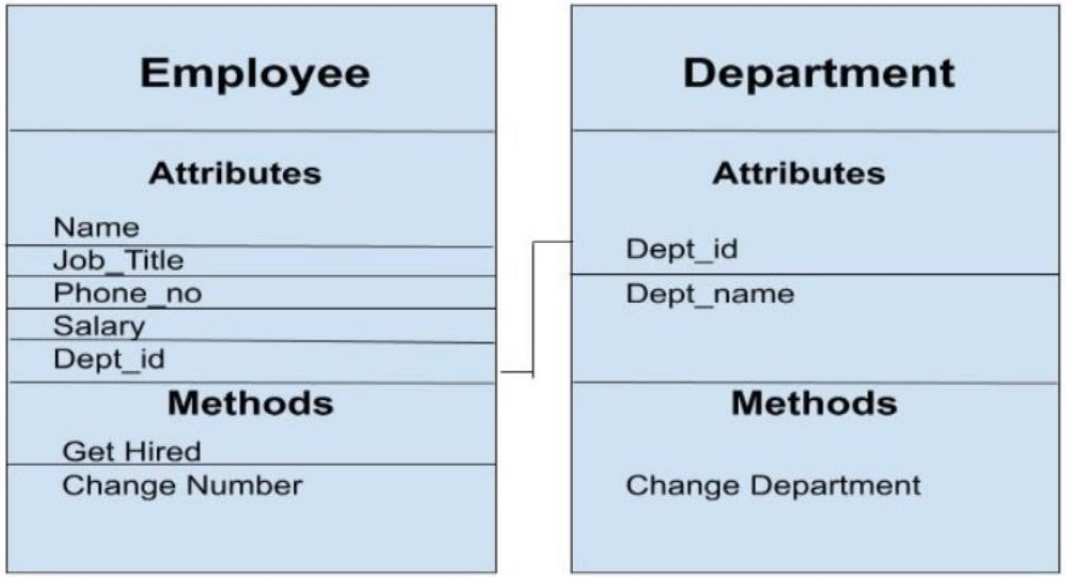
- Structured data storage and management with data integrity.
- Powerful querying capabilities using SQL (Easy to access and manage data)
- Support for complex data modeling and relationships.
- Transactional support for data consistency.
- Concurrency control for simultaneous access and updates.
- Data independence, allowing changes to the database structure without affecting applications
- prevent unauthorized access and protect data

Disadvantage:

- Limitations in handling unstructured or semi-structured data.
- Increased complexity in database design and management.
- Need more disk space for program storage then file management system.
- High cost of hardware, software, and staff training

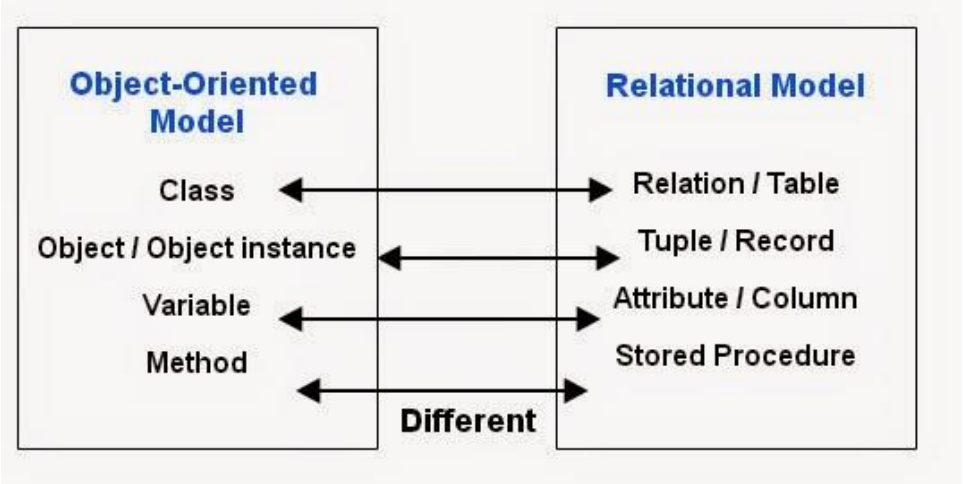
Objective Oriented Model

- A database management system in which information is represented in the form of objects as used in object-oriented programming.



Object_Oriented_Model

Difference between relation and object-oriented database model.



Advantage:

- Object-oriented databases provide us code reusability, real world modelling, and improved reliability and flexibility.
- Object database can handle different types of data while relational data base handles a single data.

Disadvantages

- In comparison to RDBMSs the use of OODBMS is still relatively limited.
- Complexity - Require a deeper understanding of object-oriented programming principles.
- Object-oriented databases can face challenges when it comes to scaling and handling large volumes of data.

What is RDBMS ? What are the advantage and disadvantage of RDBMS?

- RDBMS is database management system, it is based on relational model. In RDBMS two dimensional table represent the data and their relationship . The two dimensional are row and column, column is also known as field and row is also known as record . To establish a relationship between two table , primary key of one tables will be referred into another table as foreign key.
- A primary key uniquely defines relationship within a database. Primary key must not repeat.
- A Foreign key is a key used to link two tables together. Foreign key is a field that refers to the primary key in another table.

Advantages:

Widely used

Easy to understand

Avoids inconsistent Records

Easy to change data

Data can be added and removed easily

Easier to maintain security

Users need not consider issues such as storage structure and access strategy

Disadvantage:

Relatively slow to execute for large database

Data Redundancy(data duplication)

Why MS Access known as DBMS or RDBMS?

- It is a database because it allows the user to create a database and then access, retrieve and use the data in it. we know that database is a collection of data related to particular topics or purpose.
- MS Access facilitates creation of database in several ways manages database structures, import and export database from various data sources and file formats, backup, restore and perform other operation in easy to use graphical user interface.

- Access is a part of Microsoft office suite(group of related computer program distributed together) of application. only access has the facility to be used a relational database.one can store all kind of information in an access database, use query to analyze the data and create professional reports.it is very easy to integrate the access with other office packages like MsWord, MsExcel etc.

Feature of MS Access

- Redundancy can be reduced
- Inconsistency can be avoided
- Data can be shared
- Security restriction can be applied
- Integrity can be maintained
- Providing multiple user interface
- Providing backup and recovery

Due to these feature and characteristics we can conclude that Ms Access is known as DBMS/RDBMS

Entity-Relationship Diagram (ERD)

- An Entity-Relationship Diagram (ERD) is a visual representation of entities, their attributes, and the relationships between them. It is primarily used in database design and modeling.
- **Key Components of an ERD:**
- **Entity**: Represents objects or concepts and is represented using rectangle symbols.
- **Attribute**: Represented by ovals, attributes describe the characteristics of entities.
- **Relationship**: Represented by diamonds, these symbols are used to connect multiple entities.
- **Cardinality**: Indicates the number of instances of one entity associated with instances of another (e.g., One-to-One, One-to-Many).

➢ Keys

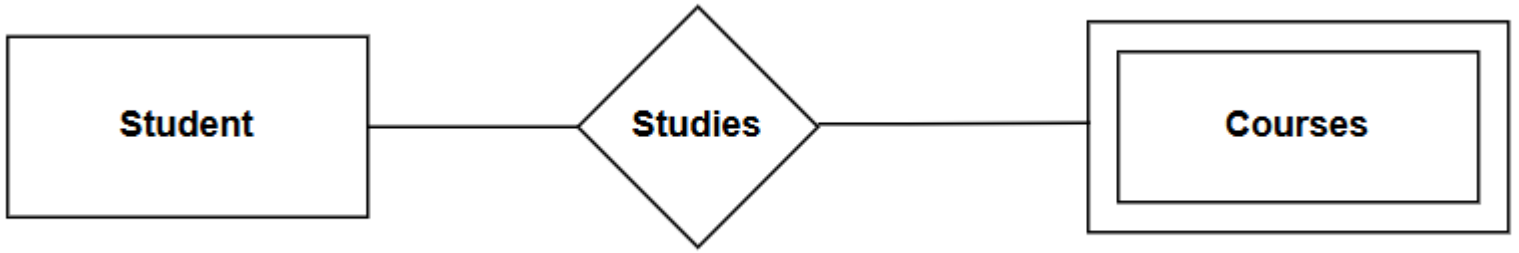
- **Primary Key:** A unique identifier for each entity (e.g., StudentID for Student entity).
- **Foreign Key:** A field in one entity that links to the primary key of another entity, representing relationships.

➢ Entity

- An entity is an object, person, place, or concept that has its own meaning.
- Entities can be classified as **strong entities** and **weak entities**
- **Strong Entity:**
- A strong entity has its own unique identifier (primary key), can exist independently, and is represented by a single rectangle in an ER diagram.
- **Weak Entity:** A weak entity depends on a strong entity for identification because it lacks its own unique identifier, and is represented by a double rectangle in an ER diagram

- Example:

In college management system, entities might include **Student, Course, and Instructor**.



Strong Entity *Relation* *Weak Entity*

➢ Attributes

- Attributes describe the properties or characteristics of an entity.
- Represented as ovals connected to their entity or relationship.
- **Types**:

Prime Attributes: Primary key(e.g. Roll Number).

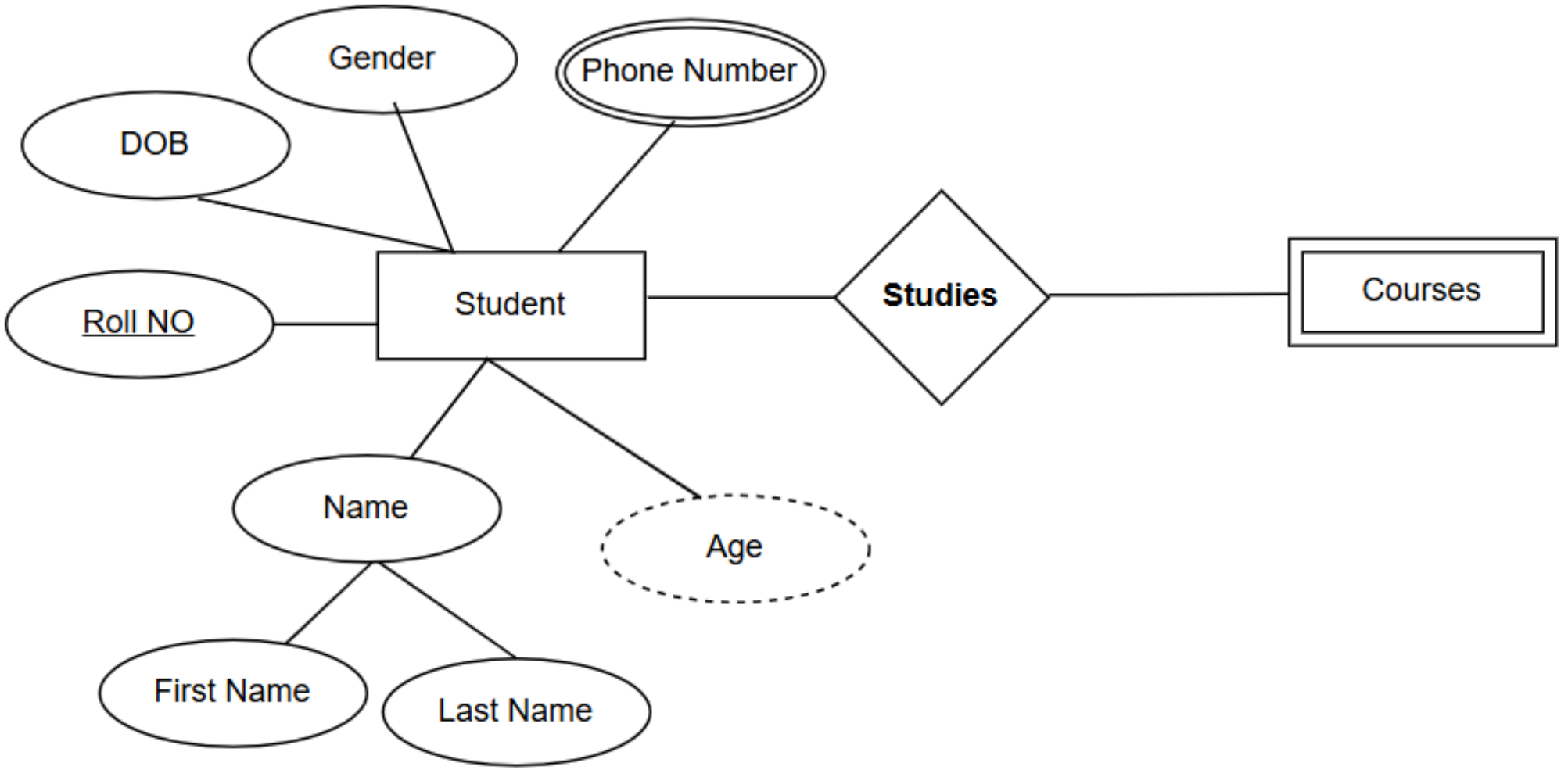
Simple Attributes: Cannot be divided further (e.g. Gender, DOB).

Composite Attributes: Can be divided into smaller parts (e.g., Full Name into First Name and Last Name).

Derived Attributes: Can be calculated from other attributes (e.g., Age derived from Date of Birth).

Multivalued Attributes: Can have multiple values (e.g., Phone Numbers).

- Example:


Gender
Phone Number
DOB
Roll NO
Student
Studies
Courses
Name
Age
First Name
Last Name

➢Relationships

- Relationships represent associations between entities.
- Represented as diamonds connecting entities.

Types:

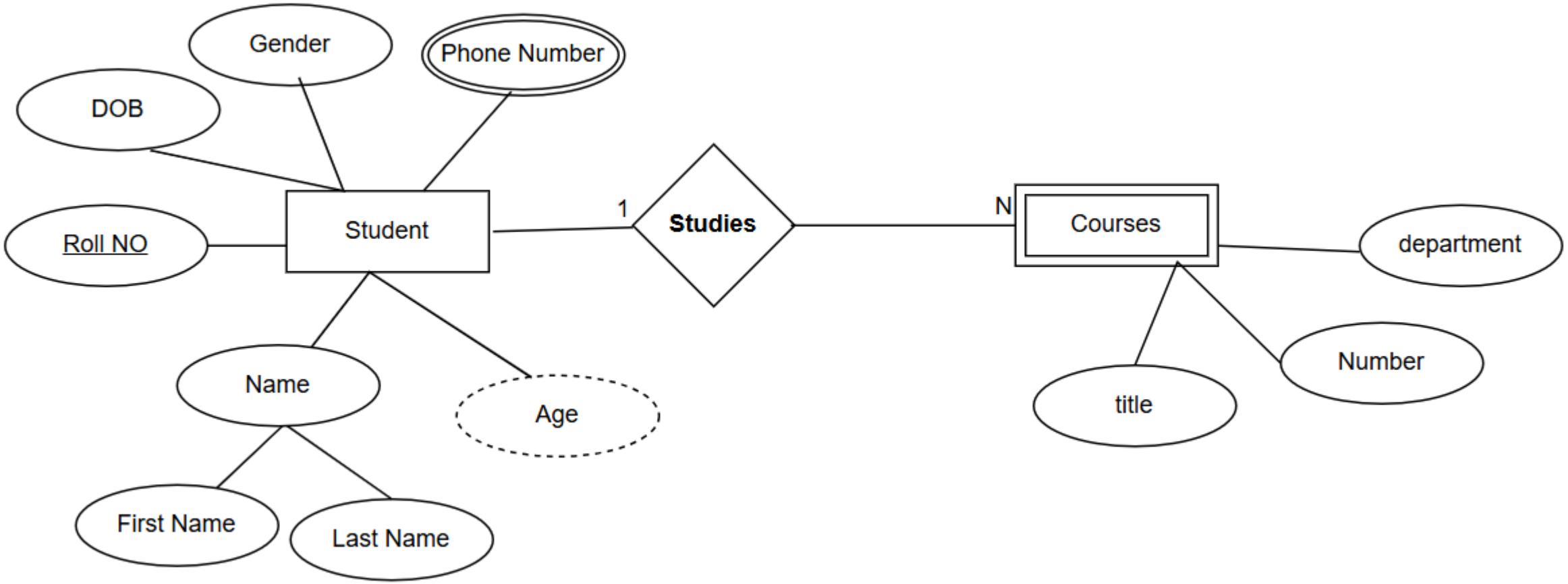
- **One-to-One (1:1):** One entity is related to exactly one other entity.

One-to-Many (1:N): One entity is related to many instances of another entity.

Many – to – One (N:1): One entity is related to many instances of another entity.

- **Many-to-Many (M:M):** Many instances of one entity are related to many instances of another.

- **Example**: A Student entity can enroll in multiple Courses (1:N)



End !!!