Database Systems

Lab Manual (Lab 1)

****

Session: Fall 2024

LAB INSTRUCTOR: AYESHA MAJID ALI

**Objective:**

1. Getting familiar with ERD diagrams
2. Tool that we will be using

**Software Requirement:**

1. **Online tool (**Sign up for free at: [https://www.lucid.co](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbjFJRFUtT3l5RTlTU2pRY2ZNQnJLNVZ2cTlYd3xBQ3Jtc0tsR2Y5bXlwMHRMcGV0Sk0zTy15X1hsSHNaeWs2aS1KSENEWmZOUnhRRmNUQ2lyVXNxZjVQTGdNb2hoRlBfekppcFc1a1JBMUlWRDhXbTZpallwdjVkeklIdkd2bFpwMENvSmhEUEhCVldlSlZFWXZHcw&q=https%3A%2F%2Fwww.lucid.co%2F&v=xsg9BDiwiJE) )
2. **Online ERD plus**

**Entity Relationship Diagrams**

An ER diagram or Entity Relationship Diagram (ERD) is a type of flowchart or graphical approach

that helps you illustrate how different entities relate to each other. It is a standard way of modelling

databases and business processes

An ER diagram or Entity Relationship Diagram (ERD) is a type of flowchart or graphical approach

that helps you illustrate how different entities relate to each other. It is a standard way of modelling

databases and business processes

An ER diagram or Entity Relationship Diagram (ERD) is a type of flowchart or graphical approach

that helps you illustrate how different entities relate to each other. It is a standard way of modelling

databases and business processes

An ER diagram or Entity Relationship Diagram (ERD) is a type of flowchart or graphical approach

that helps you illustrate how different entities relate to each other. It is a standard way of modelling

databases and business processes

An ER diagram or Entity Relationship Diagram (ERD) is a type of flowchart or graphical approach that helps you illustrate how different entities relate to each other. It is a standard way of modeling databases and business processes.

Following are the main components and its symbols in ER diagram.

* Rectangle: This entity relationship diagram symbol represents entity types.
* Ellipses: Symbol Represents attributes
* Diamonds: This symbol represents relationship types
* Lines: It links attributes to entity types and entity types with other relationship types.
* Primary Key: Attributes are underlined
* Double Ellipses: Represent multivalued attributes

A diagram of er diagram symbols

Description automatically generated

### Strong Entity

* **Definition**: A strong entity can exist independently of other entities. It has a primary key that uniquely identifies each instance of the entity.
* **Example**: Consider a "Customer" entity with attributes like CustomerID (primary key), Name, and Email. Each customer can exist without needing to reference another entity.

### Weak Entity

* **Definition**: A weak entity cannot exist independently and relies on a strong entity for its identification. It does not have a primary key of its own and is often identified by a combination of its attributes and the primary key of the related strong entity.
* **Example**: An "Order" might be a weak entity related to the "Customer" entity. The Order could be identified by a combination of CustomerID (from the Customer entity) and OrderNumber (which may not be unique on its own).

**Components of the ER Diagram:**

This model is based on three basic concepts

* Attributes
* Entities
* Relationships
* Primary Key: is a minimal set of attributes (columns) in a table that uniquely identifies tuples (row) in that table.

**ER Diagram example:**

For example, in a university database we might have entities for students, courses and lecturers. Student entity can have attributes like Rollnumber, Name and DeptID. They might have relationships with courses and lecturers.

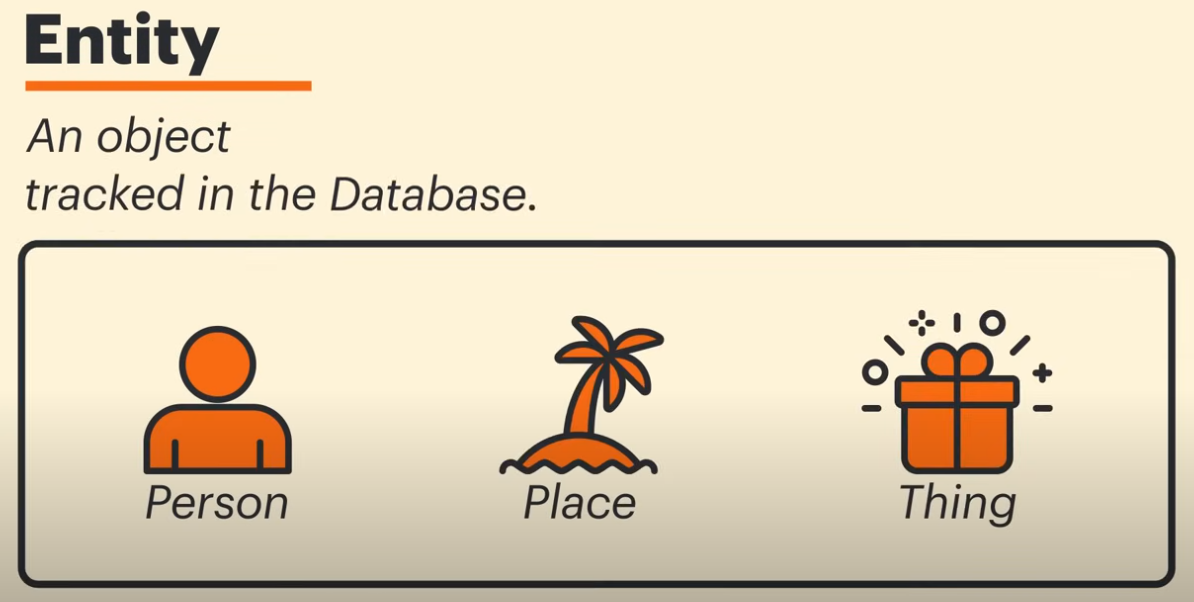
A diagram of a car

Description automatically generated

**What is an entity?**

It is anything in the enterprise that is to be represented in our database. It may be a physical thing or simply a fact about the enterprise or an event that happens in the real world.

An entity can be a place, person, object, event or a concept, which stores data in the database. The characteristics of entities must have an attribute, and a unique key. Every entity is made up of some 'attributes' which represent that entity.



**Example of Entities:**

A university may have some departments. All these departments employ various lecturers and offer several programs. Some courses make up each program. Students register in a particular program and enroll in various courses. A lecturer from the specific department takes each course, and each lecturer teaches a various group of students.

Here entities are: Departments, Lecturers, Programs, Courses, Students

**Relationship**

A relationship is nothing but an association among two or more entities. E.g., Tom works in the Chemistry department. Entities take part in relationships. We can often identify relationships with verbs or verb phrases.

**Attributes**

It is a single-valued property of either an entity-type or a relationship-type. For example, a lecture might have attributes: time, date, duration, place, etc. An attribute in ER Diagram examples, is represented by an Ellipse.

A diagram of a type of attributes

Description automatically generated

**Cardinality**

Defines the numerical attributes of the relationship between two entities or entity sets. Different types of cardinal relationships are:

* One-to-One Relationships
* One-to-Many Relationships
* Many to One Relationships
* Many-to-Many Relationships

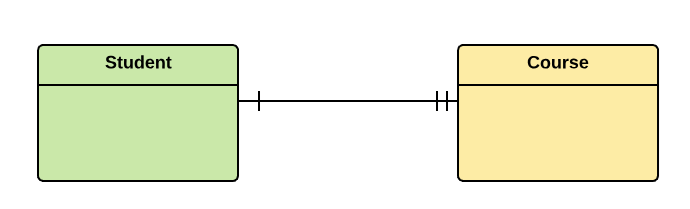
A diagram of a diagram

Description automatically generated

**1.One-to-one:**

One entity from entity set X can be associated with at most one entity of entity set Y and vice versa.

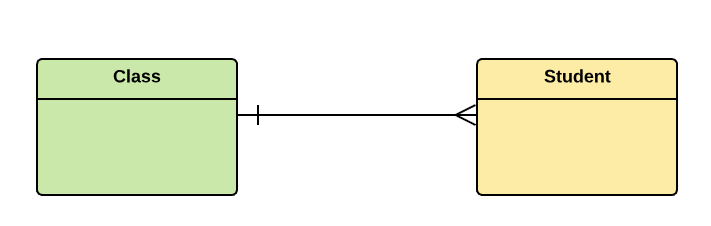
Example: One student can register for numerous courses. However, all those courses have a single line back to that one student.

[](https://www.guru99.com/images/1/100518_0621_ERDiagramTu8.png)

**2.One-to-many:**

One entity from entity set X can be associated with multiple entities of entity set Y, but an entity from entity set Y can be associated with at least one entity.

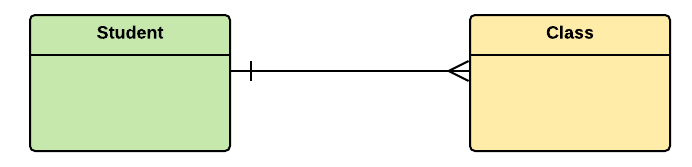
For example, one class is consisting of multiple students.

[](https://www.guru99.com/images/1/100518_0621_ERDiagramTu9.png)

**3. Many to One**

More than one entity from entity set X can be associated with at most one entity of entity set Y. However, an entity from entity set Y may or may not be associated with more than one entity from entity set X.

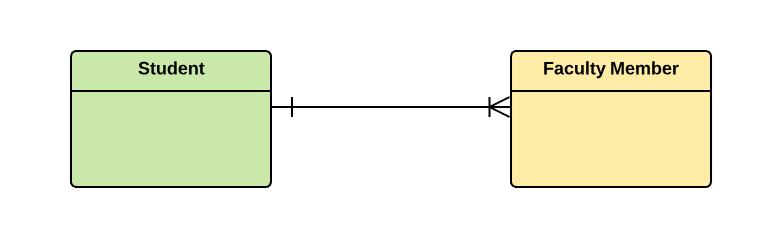
For example, many students belong to the same class.

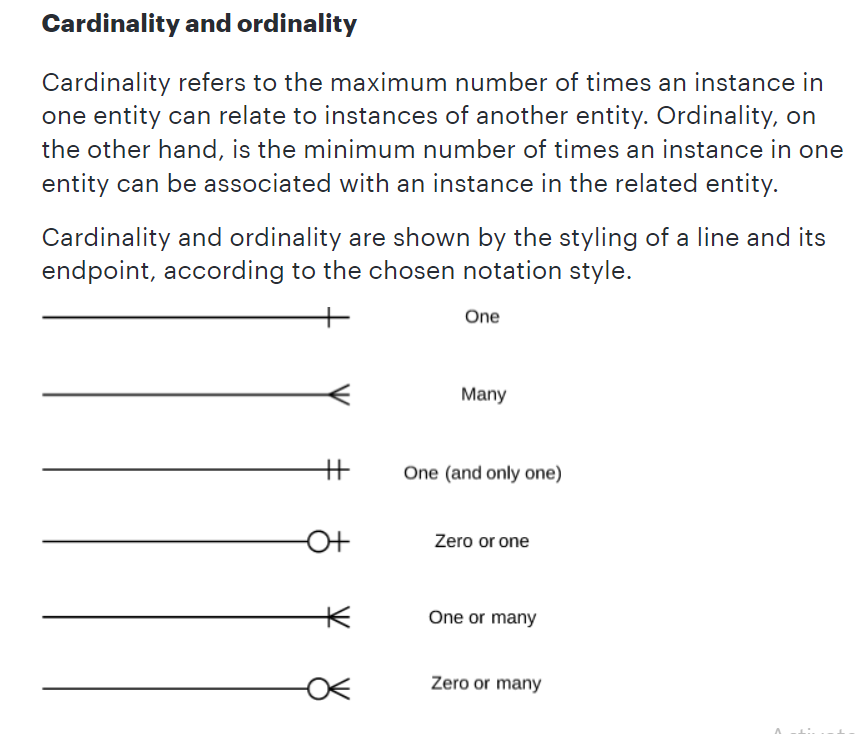
[](https://www.guru99.com/images/1/100518_0621_ERDiagramTu10.png)

**4. Many to Many:**

One entity from X can be associated with more than one entity from Y and vice versa.

For example, Students as a group are associated with multiple faculty members, and faculty members can be associated with multiple students.

[](https://www.guru99.com/images/1/100518_0621_ERDiagramTu11.png)



A diagram of a flowchart

Description automatically generated

A screenshot of a computer

Description automatically generated

**Scenario with Example (Step By Step):**

Let's study them with an Entity Relationship Diagram 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 1: Entity Identification**

We have three entities

* Student
* Course
* Professor

A yellow rectangular object with black text

Description automatically generated

**Step 2: Relationship Identification**

We have the following two relationships

* The student is assigned a course
* Professor delivers a course

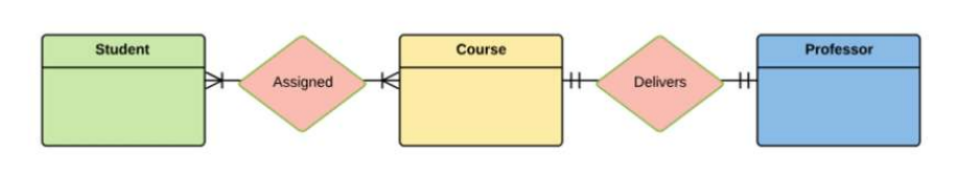
A yellow rectangular object with black text

Description automatically generated

**Step 3: Cardinality and Modality Identification**

For them problem statement we know that,

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



**Step 4: Identify Attributes**

You need to study the files, forms, reports, data currently maintained by the organization to identify attributes. You can also conduct interviews with various stakeholders to identify entities. Initially, it's important to identify the attributes without mapping them to a particular entity. Once, you have a list of Attributes, you need to map them to the identified entities. Ensure an attribute is to be paired with exactly one entity. If you think an attribute should belong to more than one entity, use a modifier to make it unique.

Once the mapping is done, identify the primary Keys. If a unique key is not readily available, create one.

### Important note: Characteristics of a Primary Key:

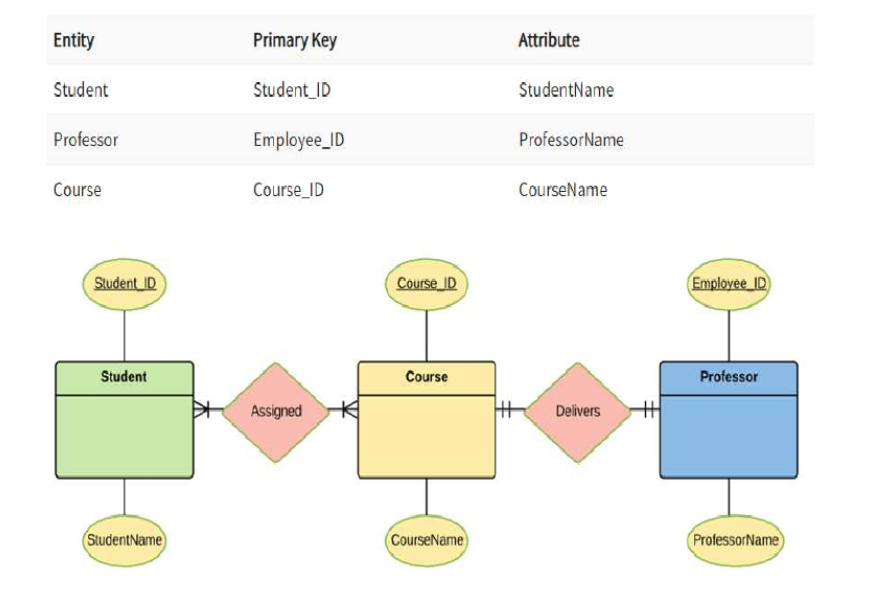
1. **Uniqueness**: Each value in the primary key column(s) must be unique across the table, ensuring that no two records can have the same key value.
2. **Non-null**: A primary key cannot contain null values. Every record must have a valid primary key value.
3. **Immutable**: The value of a primary key should not change. If the primary key value changes, it can affect relationships with other tables.
4. **Single or Composite**: A primary key can consist of a single column (simple primary key) or multiple columns (composite primary key).

### Example:

* In a "Students" table, the "StudentID" column could be used as a primary key. Each student would have a unique StudentID, ensuring that no two students are identified by the same ID.

### Importance:

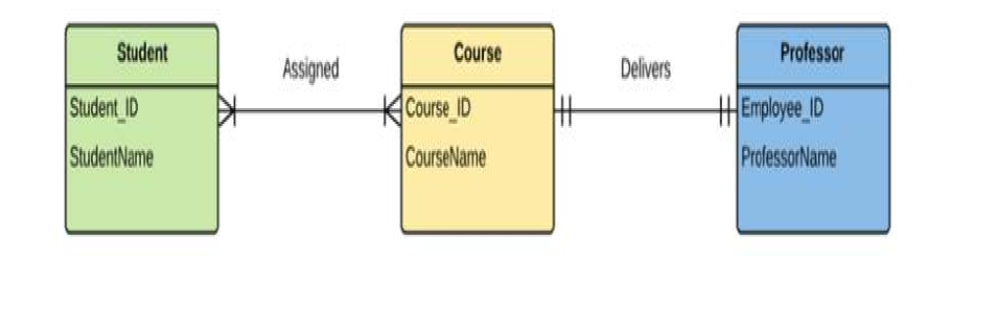
* Primary keys are essential for maintaining data integrity and for establishing relationships between tables in a relational database. They allow for efficient data retrieval and management.



For Course Entity, attributes could be Duration, Credits, Assignments, etc. For the sake of ease we have considered just one attribute.

**Step 5: Create the ERD Diagram**

A more modern representation of Entity Relationship Diagram Example.



A diagram of a company

Description automatically generated

**Lab Tasks:**

**Task 1:**

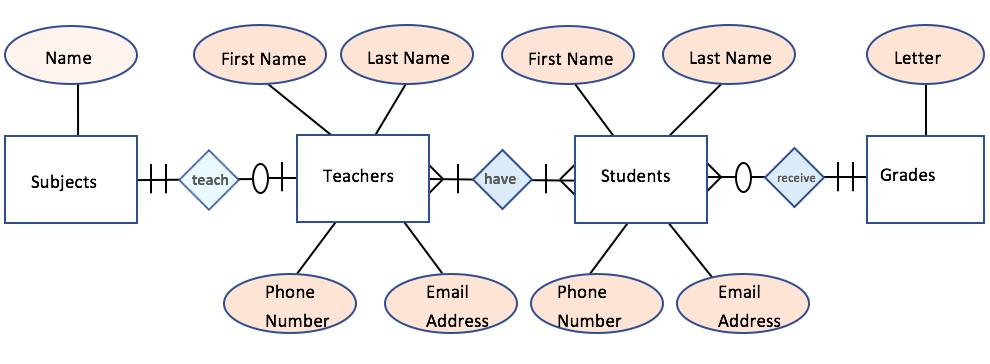
For given ER Diagram identify

i. Entities

ii. Attributes

iii. primary key

iv. Relationships



**Task 2:**

Draw ER diagram for following scenario:

A video store rents movies to members. Each movie in the store has a title and is identified by a unique movie number. A movie can be in VHS, VCD, or DVD format. Each movie belongs to one of a given set of categories (action, adventure, comedy. The store has a name and a (unique) phone number for each member. Each member may provide a favourite movie category (used for marketing purposes).