

ER Model

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Purpose and Function: The E-R model aids in representing real-world entities, their meanings, and interactions within a conceptual schema for database design.

Concepts of the E-R Model:

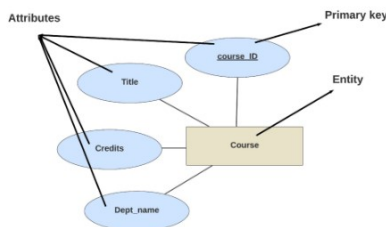
- **Entity Sets:** Represent groups of similar entities from the real world. Each entity set corresponds to a table in a relational database.
- **Relationship Sets:** Capture associations between different entity sets. These relationships establish connections between data elements.
- **Attributes:** Describe characteristics or properties of entities or relationships, helping to define their attributes and properties.

Entity Sets

- **Entity Set:**
 - An entity set is a group of entities of the same kind sharing common attributes or properties.
 - For instance, "instructor" represents all university instructors, and "student" represents all university students.
- **Abstract and Concrete Usage:**
 - In modeling, we use "entity set" in a general way, not tied to specific entities.
 - The actual entities in the set are referred to as the "**extension**" of the entity set.
- **Extension vs. Entity Set:**
 - The real collection of entities is the "extension" of an entity set.
 - Similar to the difference between a relation and a relation instance.
- **Non-Disjoint Entity Sets:**
 - Entity sets can overlap these sorts of entity sets are called non-disjoint sets.
 - Example: "person" entity set includes instructors, students, both, or neither.

Attributes

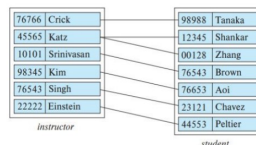
- Entities are represented by specific attributes.
- Attributes are qualities or characteristics of each entity.
- They signify the type of information stored for each entity.
- Every entity possesses its own set of values for attributes.
- Example: Instructors have unique values for attributes like ID, name, dept name, and salary.



UNIVERSITY

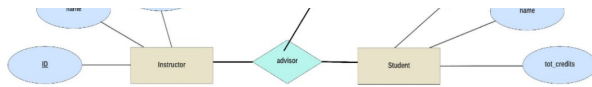
- **What is a Relationship:**
 - A relationship signifies connections between entities.
 - Example: "advisor" links instructor Katz to student Shankar.
- **Relationship Set:**
 - A relationship set contains relationships of the same type.
 - Example: "advisor" relationship set links students and their advisors.

- **Entity Sets and Relationships:**
 - Consider "instructor" and "student" entity sets.
 - "advisor" relationship set signifies student-advisor connections.



- **Representation in E-R Diagram:**
 - In an E-R diagram, relationships are depicted by diamonds.
 - Lines connect the diamond to relevant entity sets (rectangles).
- For example let us try and represent the advisor relation



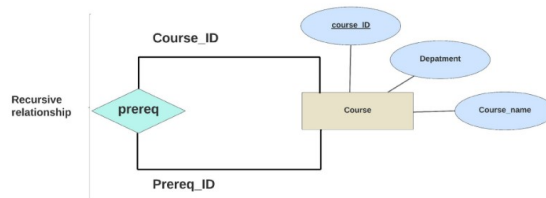


Relationship sets

- Formally, a relationship set is a mathematical relation on $n \geq 2$ (possibly nondistinct) entity sets.
- If E_1, E_2, \dots, E_n are entity sets, then a relationship set R is a subset of $\{(e_1, e_2, \dots, e_n) \mid e_1 \in E_1, e_2 \in E_2, \dots, e_n \in E_n\}$ where (e_1, e_2, \dots, e_n) is a relationship instance.
- The association between entity sets is referred to as participation; i.e., the entity sets E_1, E_2, \dots, E_n participate in relationship set R .

Recursive Relationships

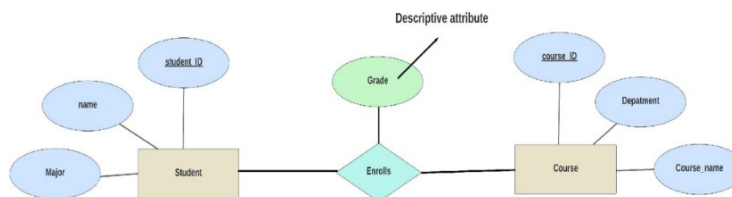
- We indicate roles in E-R diagrams by labeling the lines that connect diamonds to rectangles.
- The diagram below shows the role indicators course id and prereq id between the course entity set and the prereq relationship set.



- Actually if we observe this attribute is associated with the relation 'enroll' i.e. only if the student enrolls for the particular course, he can get a grade. Such type of attributes are called **Descriptive attributes**

Descriptive Attributes

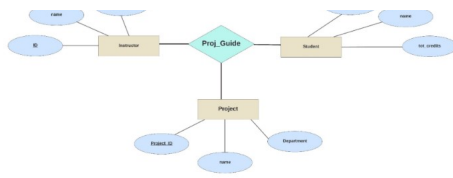
- A relationship may also have attributes called descriptive attributes.
- An attribute of a relationship set is represented in an E-R diagram by an oval connected to the relationship's diamond
- The below diagram shows the discussed example in the form of an ER diagram



- Occasionally, however, relationship sets could even involve more than two entity sets. The number of entity sets that participate in a relationship set is the **degree of the relationship set**.
 - A binary relationship set is of degree 2;
 - A ternary relationship set is of degree 3.

- To represent the above situation, we would have to relate the three entity sets through a **ternary relationship set** **proj_guide**. This ternary relation relates entity sets instructor, student, and project.
- An instance of projguide indicates that a particular student is guided by a particular instructor on a particular project.
- Note that a student could have different instructors as guides for different projects, which cannot be captured by a binary relationship between students and instructors.





Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Identifying Relationship
	Attribute
	Key Attribute
	Multivalued Attribute
	Composite Attribute
	Derived Attribute
	Total Participation of E_2 in R
	Cardinality Ratio 1 : N for $E_1 : E_2$ in R

Figure 1
Summary of ER notation symbols