

Data Modeling

ERD

Outline:

- What Entity relationship diagrams (ERD) are.
- What Entities in an ERD are?
- What Attributes in an ERD are?
- What Relationships in an ERD are?
- How to start an ERD .

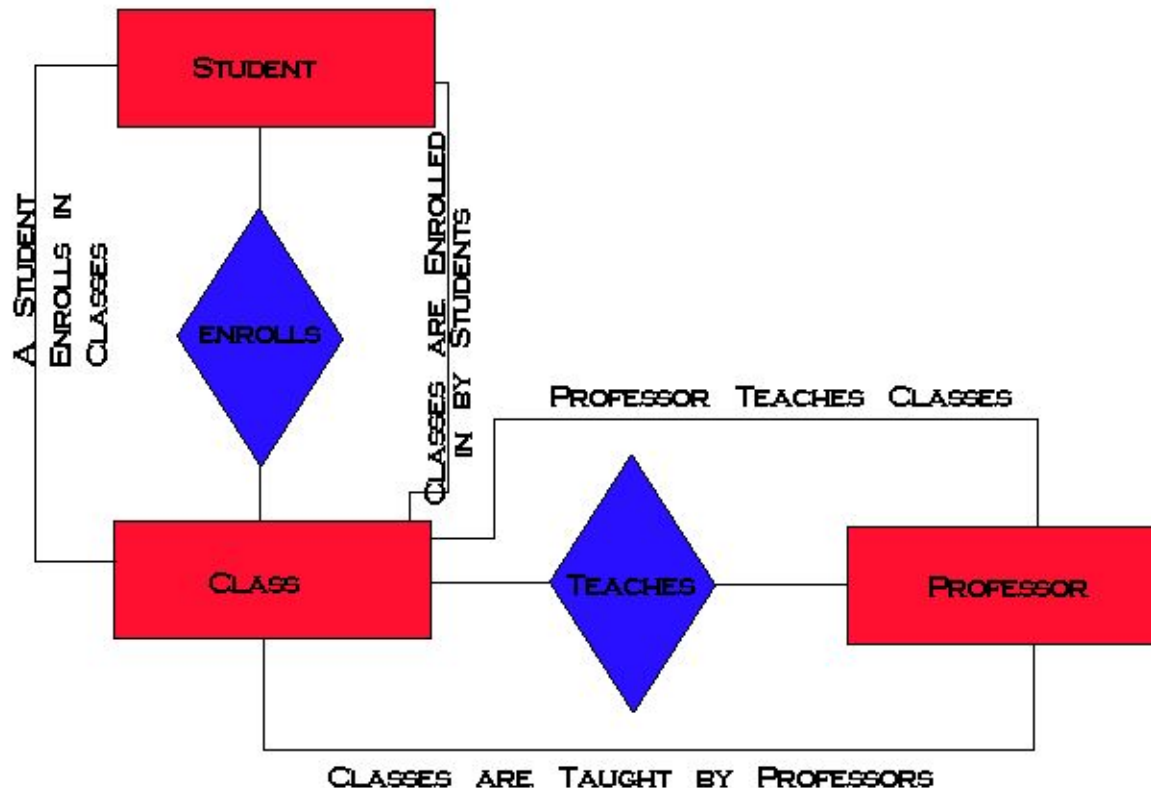
ERM and ERD

- **Entity-Relationship Data Model (ERM)** is a detailed, logical representation of the data for an organization or for a business area.
 - Expressed in terms of:
 - Entities
 - Attributes
 - Relationships
- **Entity-Relationship Diagram (ERD)** is a graphical representation of a Entity-Relationship Model.

ERD

- The purpose of an ERD is to capture the richest possible understanding of the meaning of data necessary for an information system or organization.
- ERDs are made from Entities, Attributes, and Relations.

University Entity-Relationship Diagram



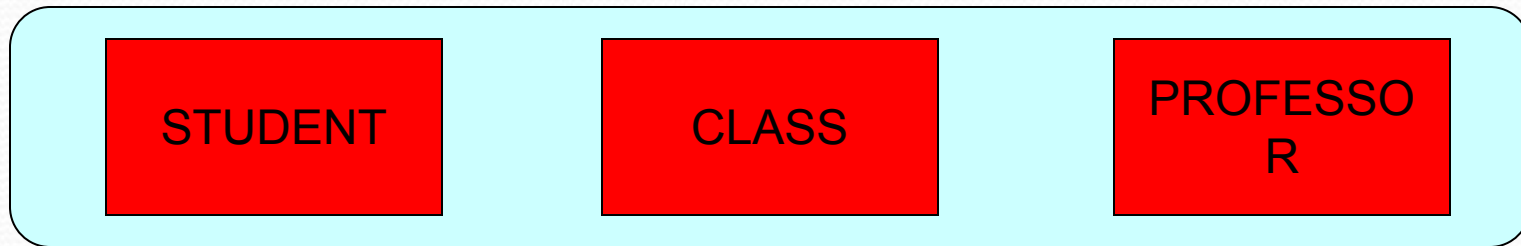
Entity

- What is an Entity?
- Has its own identity that distinguishes it from other entities.
 - Examples:
 - Person: PROFESSOR, STUDENT
 - Place: STORE, UNIVERSITY
 - Object: MACHINE, BUILDING
 - Event: SALE, REGISTRATION
 - Concept: ACCOUNT, COURSE

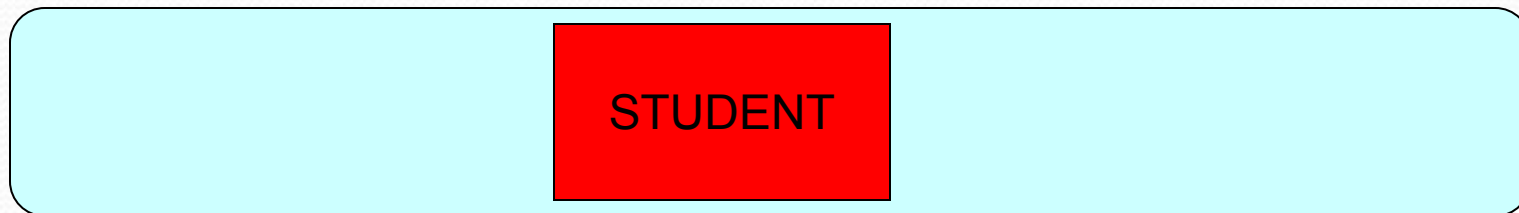
Entity

(Entity Type vs. Entity Instances)

- **Entity Type** is a collection of entities that share common properties or characteristics.



- **Entity Instance** is a single occurrence of an entity type.



- Entities should always be placed in a rectangle!

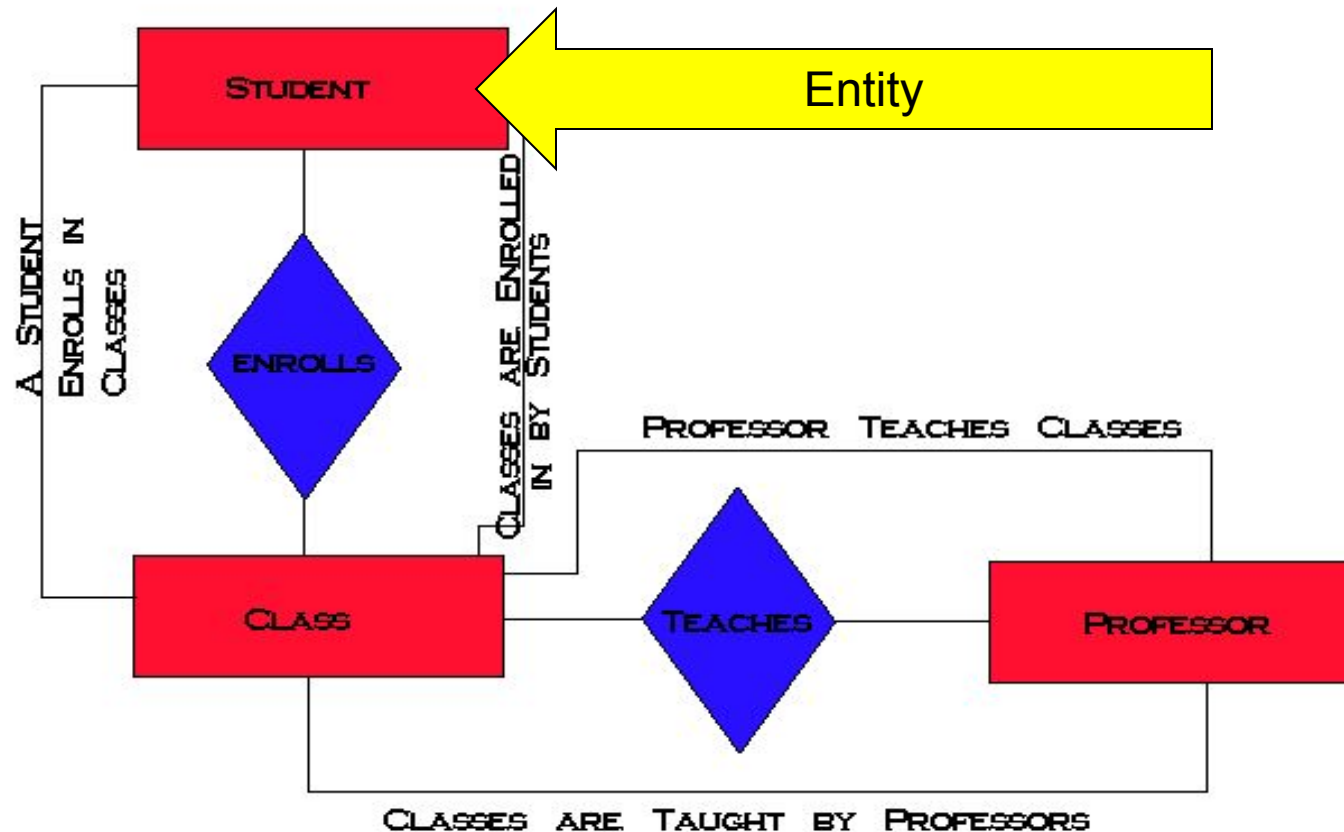
Entity Types

(Naming Guidelines)

Entity type name should be:

- A *singular noun* and in *capital letters*.
- *Descriptive* and *specific* to the organization.
- *Concise*.
- Named for the *result of the event*, not the activity or process of the event.

University Entity-Relationship Diagram



Entity Types

(Defining Guidelines)

- **An Entity type definition should:**
 - Include a statement of *what the unique characteristics are* for each instance.
 - Make clear what *entity instances are included and not included*.
 - Include a description of when an instance of the entity type is *created* and *deleted*.
 - Specify when an instance *might change* into an instance of another entity type.
 - Specify *what history is to be kept about entity instances*.

Attributes

- Each Entity has a set of Attributes
- **Attribute** is a property or characteristic of an entity that is of interest to the organization.
 - Example:
 - STUDENT: Student_ID, Student_Name, Phone_Number, Major

Attributes

Student

Student_ID
Student_Address
Student_Phone

Attributes

(Naming Guidelines)

- **An attribute name:**

- Should be a *noun* and *capitalize the first letter of each word*. (Example: Student_ID.)
- Should be *unique*.
- Should follow a *standard format*. (Example: Student_GPA, not GPA_of_Student.)

- Similar attributes of different entity types should use similar but distinguished names.

- Example: Faculty_Residence_City_Name and Student_Residence_City_Name

Attributes

(Defining Guidelines)

- **An attribute definition should:**
 - State what the attribute is and why it is important.
 - Make clear what is and isn't included in the attribute's value.
 - Define any aliases.
 - Indicate if the attribute is required or not.
 - Indicate any relationships with other attributes.

Attributes

- **Candidate Key** = is an attribute that uniquely identifies each instance of an entity type.
- **Identifier** = A candidate key that has been selected as the unique, identifying characteristic of an entity type. (Should be underlined).
- Other types of Attributes: multivalued, required, optional, composite, and derived.

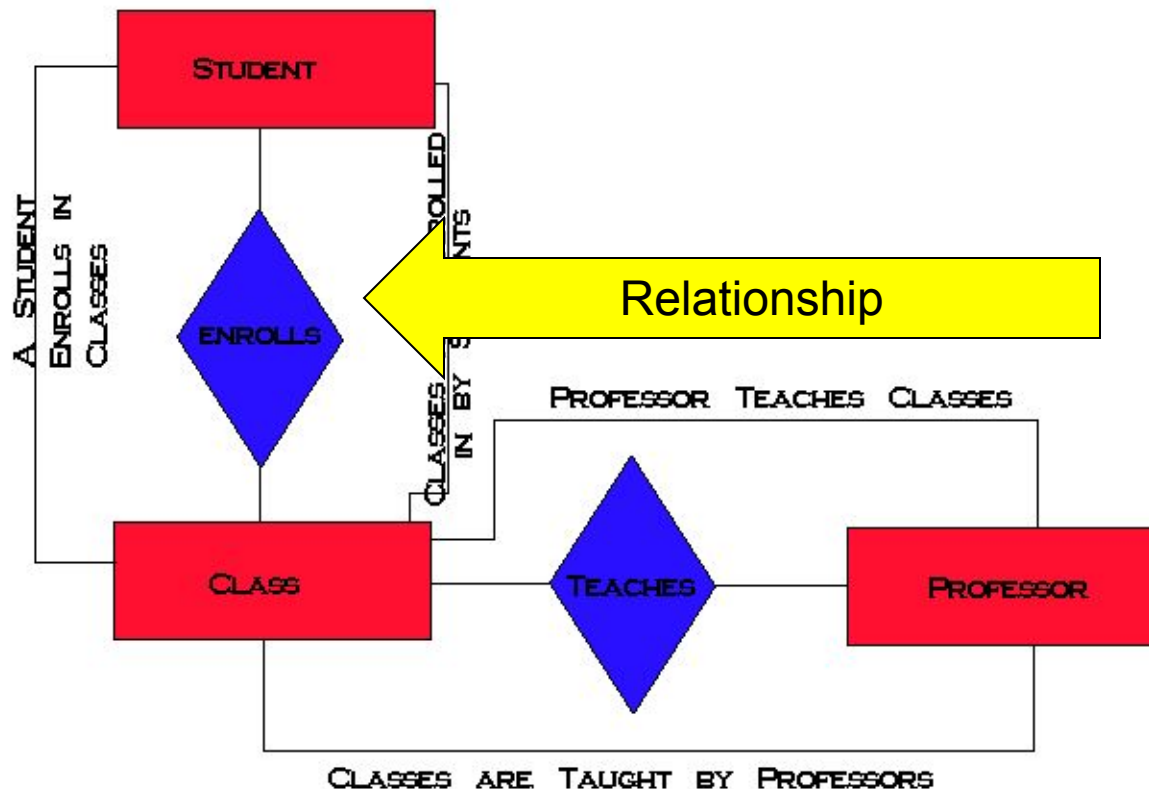
Criteria for Selecting Attributes

- Choose a candidate key that will not change its value.
- Choose a candidate key that has valid values and not be null.
- Avoid using codes, such as a 2 digit warehouse location.

Relationships

- **Relationships** are associations between one or more entity types.
- Are the “*glue*” that holds together components of an E-R model.
- **The degree of a relationship** = is the number of entity types that participate in a relationship.
 - There are 3 common relationships:
 1. Unary (degree one)
 2. binary (degree two)
 3. Ternary (degree three)

University Entity-Relationship Diagram



Relationships

(Naming Guidelines)

- A relationship name should:
 - Be a verb phrase, such as `Is_assigned_to`.
 - Avoid vague names, such as “Has”.

Relationships

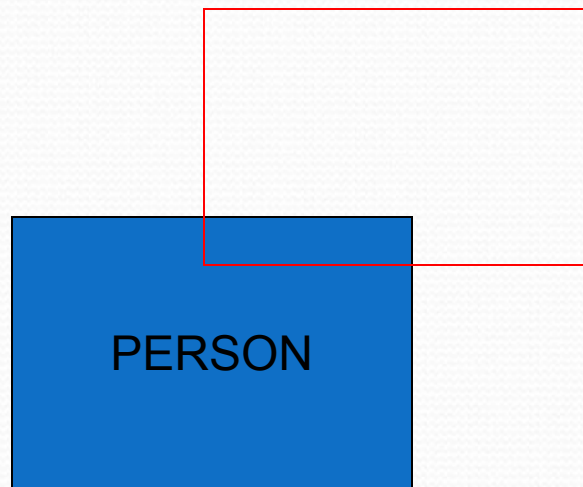
(Naming Guidelines)

- A relationship definition should Explain:
 - What action is being *taken* and *why* it is important.
 - If there is any *optional* participation.
 - The history that is kept in the relationship.
 - What any restrictions on participation in the relationship.
 - For example: An EMPLOYEE may only be able to participate in two PROJECTS.

Unary Relationship

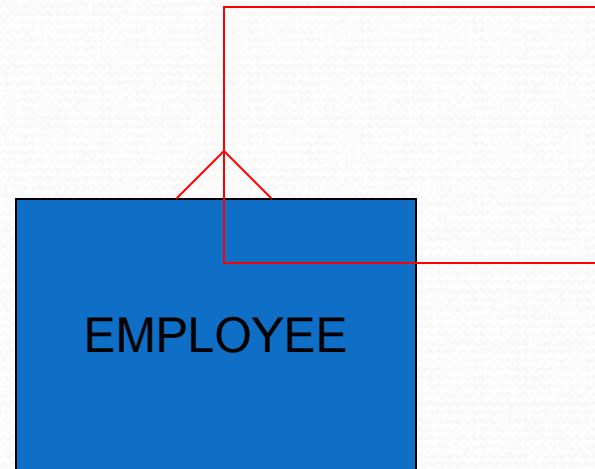
- Relationship between the instances of one entity type.

Is_married_to



One-to-one

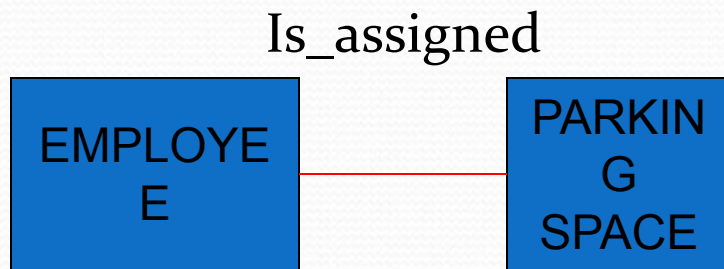
Manages



One-to-many

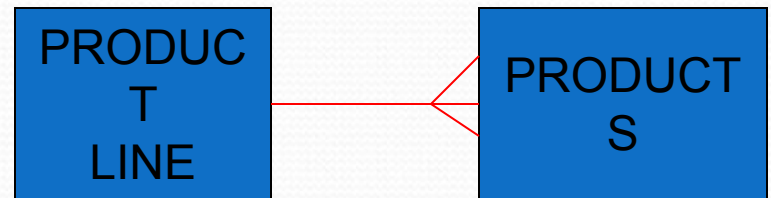
Binary Relationship

- Relationship between the instances of two entity type.



One-to-One

Contains

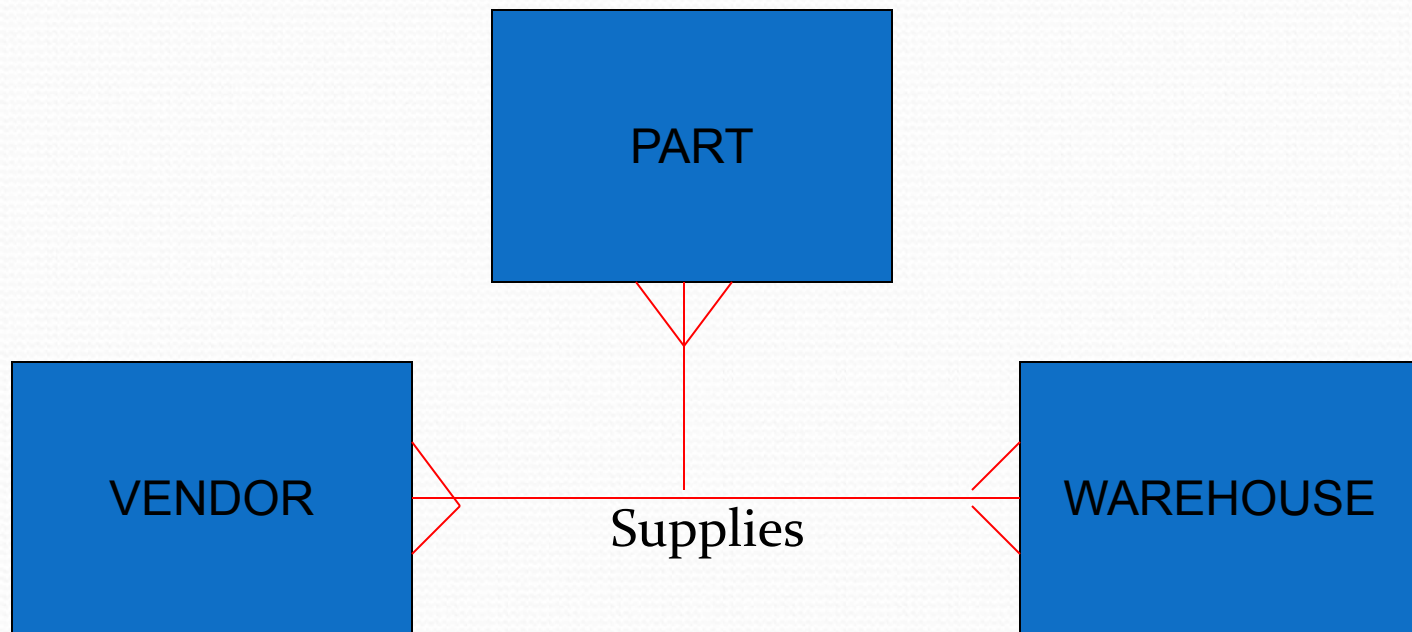


One-to-Many

Can also have many to many!

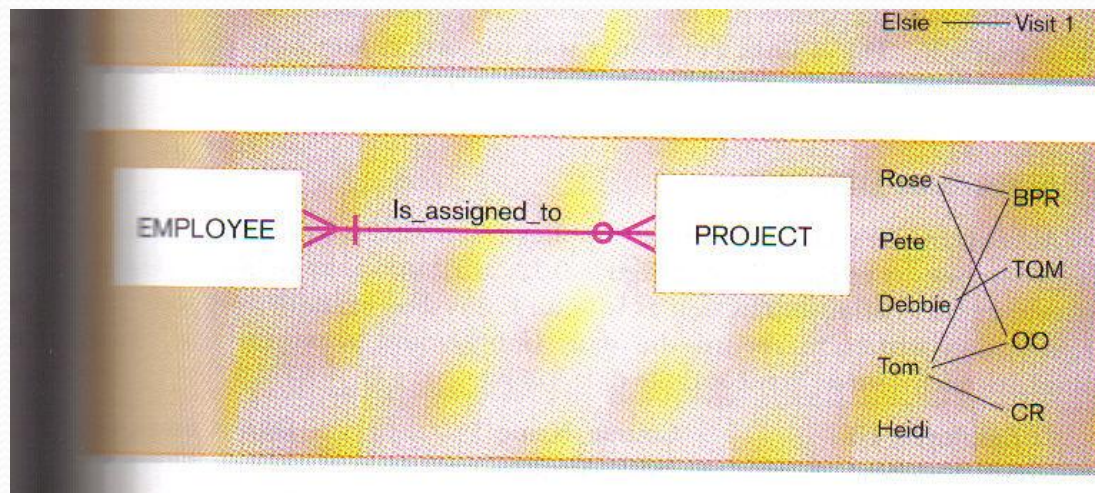
Ternary Relationship

- A simultaneous relationship among instances of three entity types.



Relationship Cardinalities

- **Mandatory Cardinalities** = The entity must participate in another entity.
- **Optional Cardinalities** = The entity has a the option to participate in another entity.



(b) One optional, one m cardinality

Starting an ERD

1. Define the Entities.
2. Define the Relationships.
3. Add attributes to the relationships.
4. Add cardinality to the relationships.
5. Don't forget to use proper naming conventions and symbol representation.

Guidelines for Drawing ERDs

- Lay out the diagram with minimal line crossing.
- Place subject entity types on the top of the diagram.
- Place plural entity types below a single entity type in a one-to-many relationship.
- Place entity types participating in one-to-one and many-to-many relationships alongside each other.
- Group closely related entity types when possible. Try to keep the length of relationship lines as short as possible. Also try to minimize the number of changes of direction in a single line.
- Show the most relevant relationship name. One name must always be shown.