

Entity Relationship Model

Part-1

Steps in Developing a Database

- Requirements analysis →
- **Conceptual Database design** →
- Logical Database design →
- Schema refinement →
- Physical Database design
- Applications and security

Conceptual Design

- What are the *entities* and *relationships* in the enterprise?
- What information about these entities and relationships should we store in the database?
- What are the *integrity constraints* or *business rules* that hold?
- A database 'schema' in the ER Model can be represented pictorially (*ER diagrams*).
- Can map an ER diagram into a relational schema.



Conceptual Design

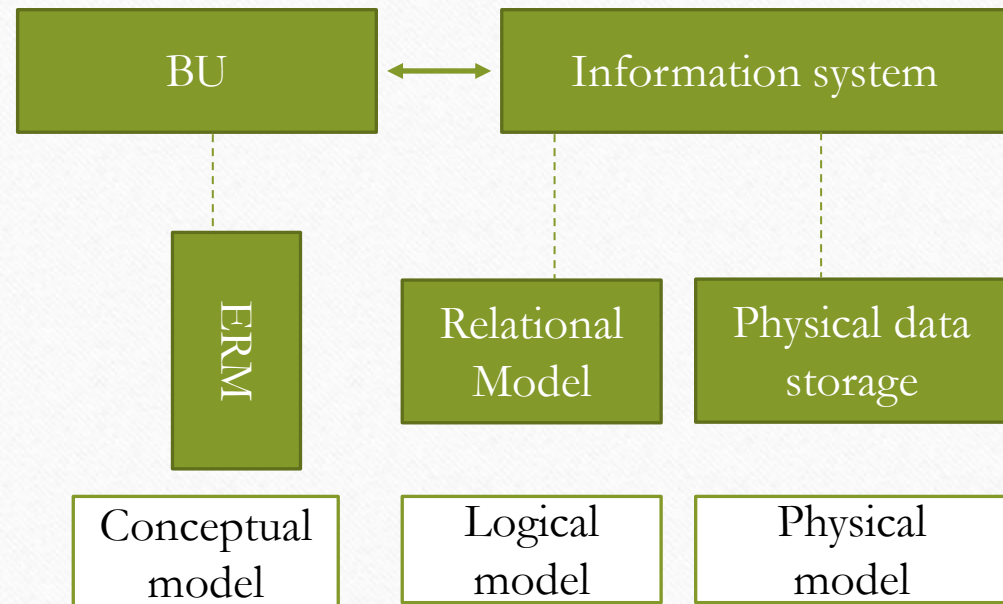
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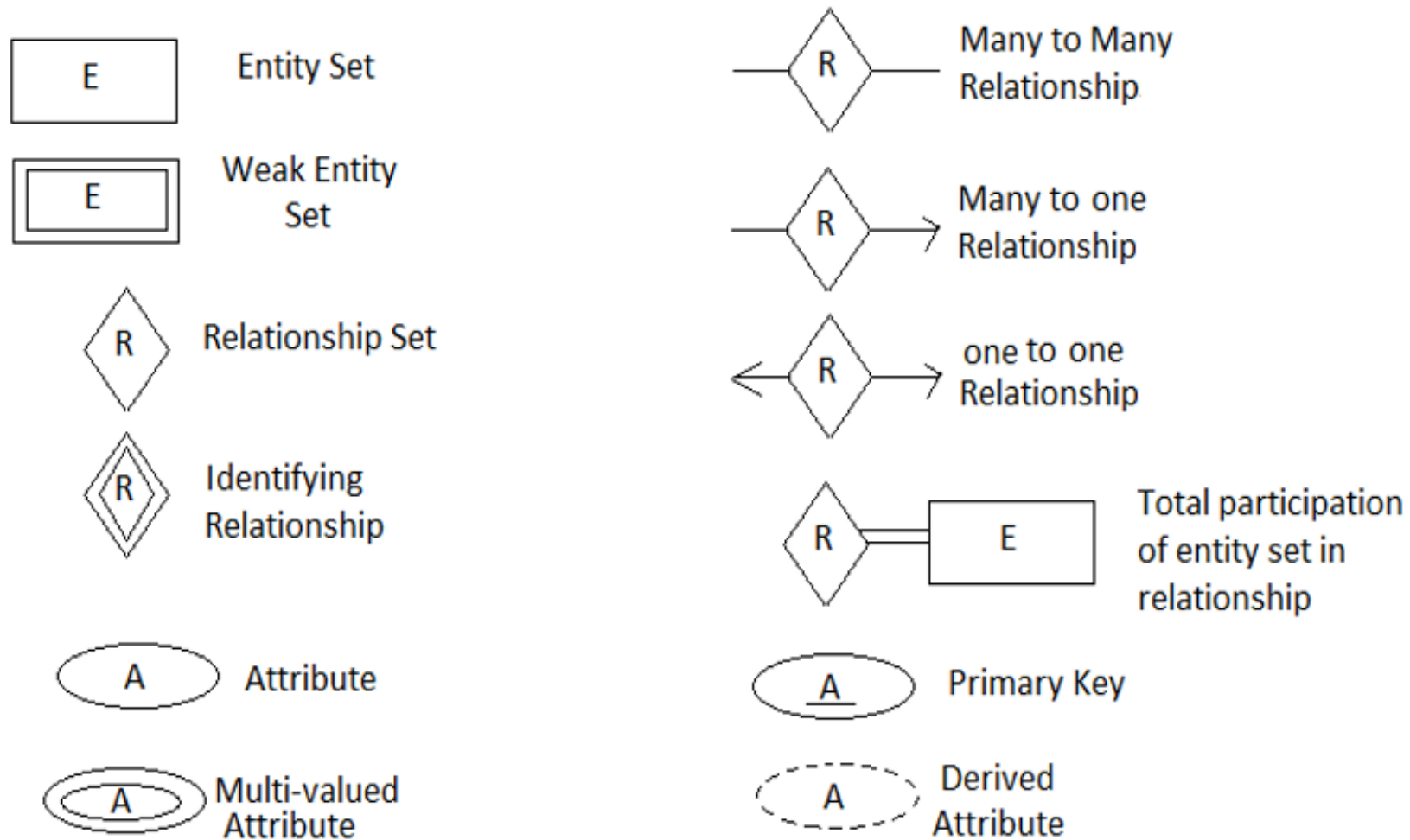


What is ER model?

- ER model is used to show the *Conceptual* schema of an organisation.
- Independent of specific data model or DBMS
- The model is later transformed into a *Logical* model (e.g. relational) on which the physical database is built

- Perspective

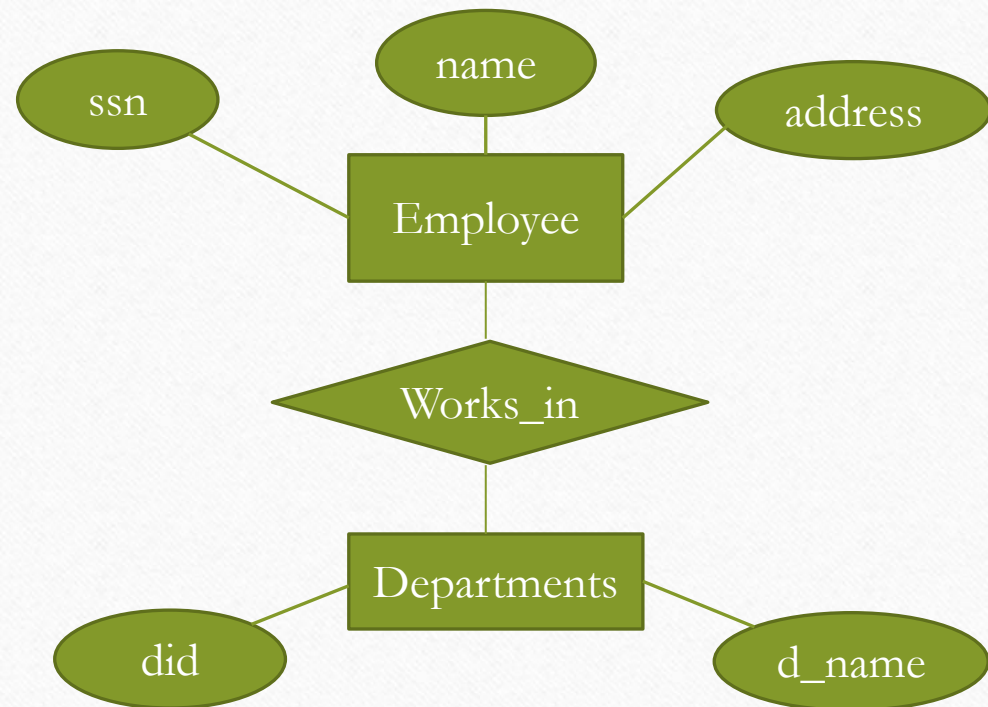




Notations in Entity Relationship Diagram

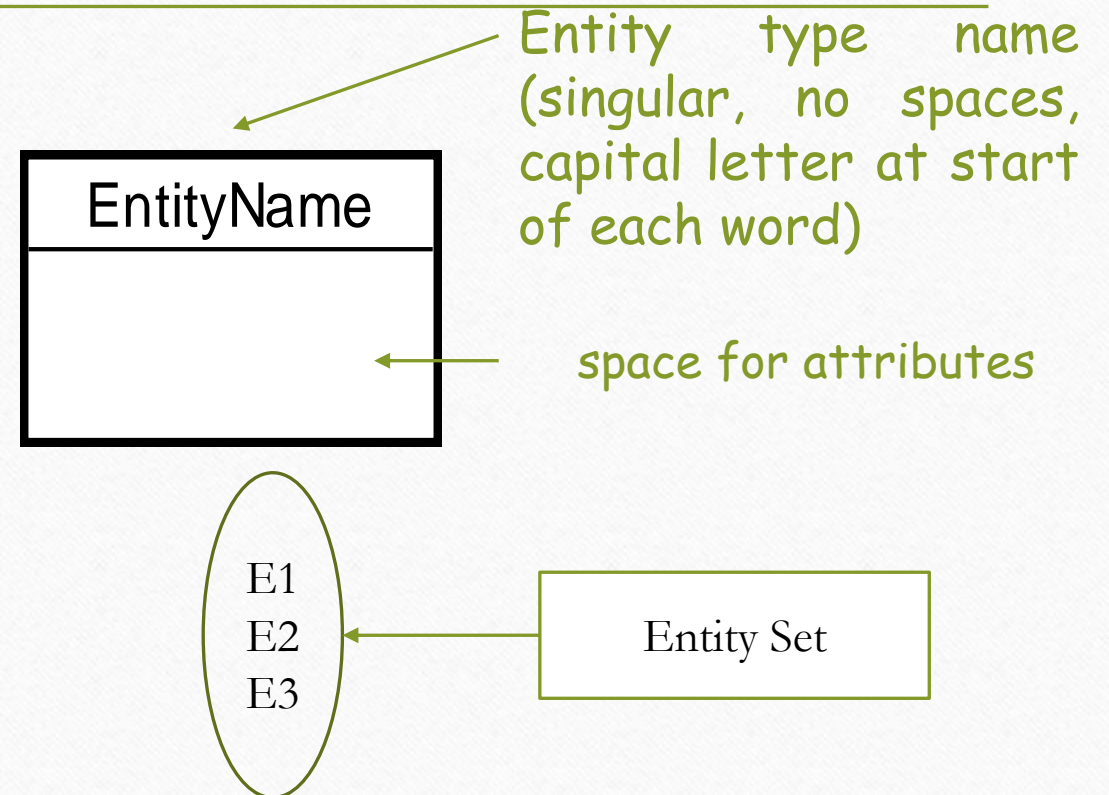
ER Model Basics

- The basics of ER modelling
 - Entity
 - Relationship
 - Attribute



Entity and Entity Set

- Entity: Real-world object distinguishable from other objects. An entity is described using a set of *attributes*. Each attribute has a *domain*.
- Entity Set: A collection of similar entities. E.g., all employees.
 - All entities in an entity set have the same set of attributes.
 - Each entity set has a *key*.



Attributes

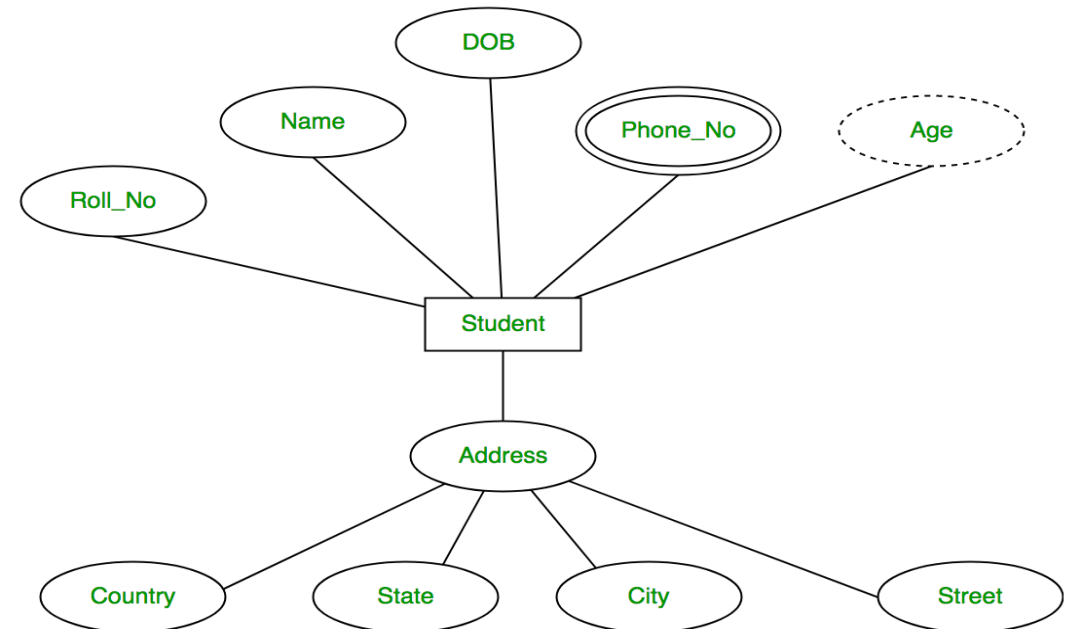
Attributes: Properties associated each entity with a value from a *domain* of values.

- **Simple attribute:** Single valued attribute which can not be divided further e.g., phone.
- **Composite attribute:** Made of more than one simple attribute e.g., name, address etc.
- **Derived attribute:** Values are derived from other attributes present in the database e.g., age, average salary etc.
- **Single-value attribute:** Contains single value e.g., SSN, SID etc.
- **Multivalued attribute:** It may contain more than one values e.g., phone number, email_ address etc.

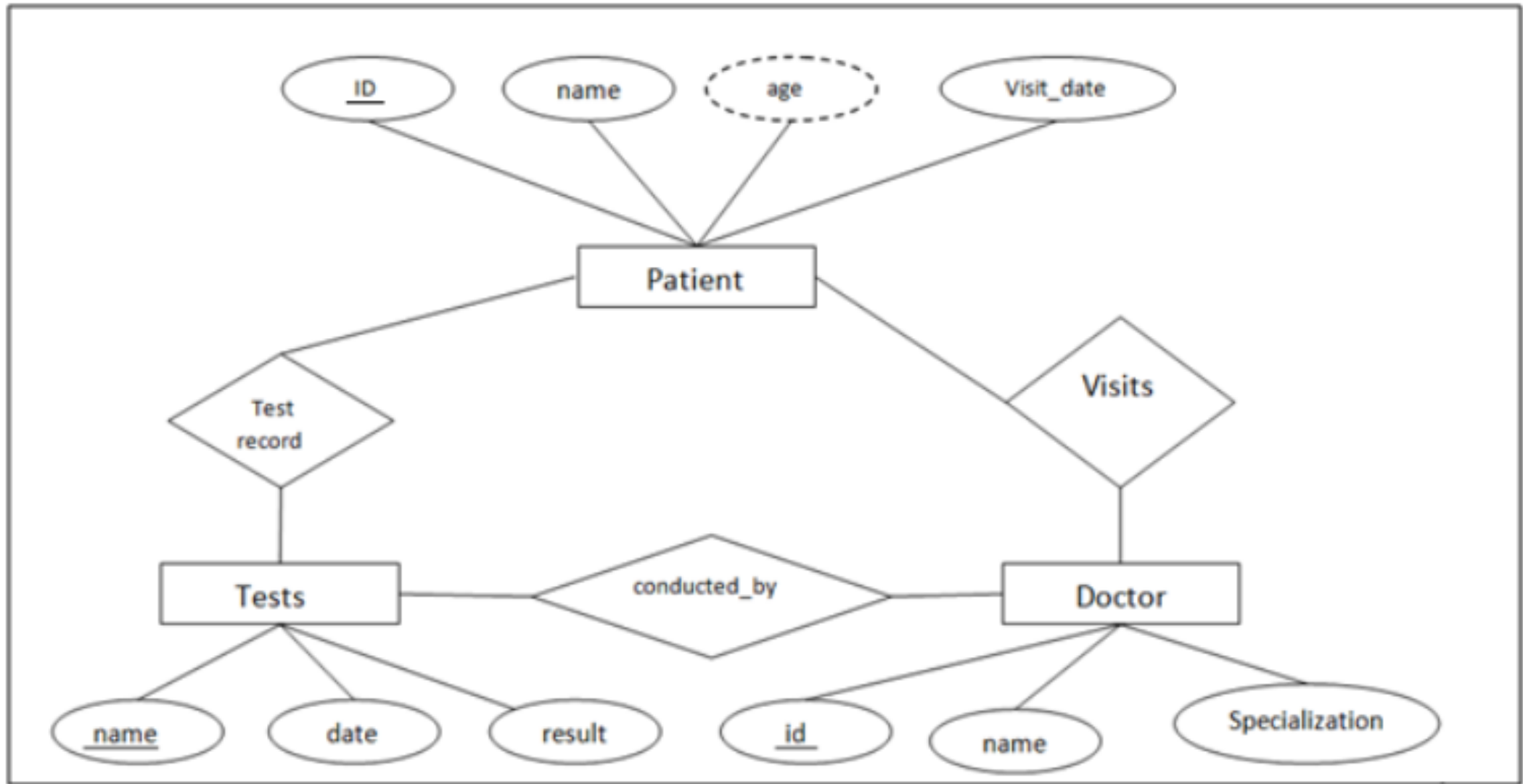
Attributes Contd.

Geometric shapes and their meaning:

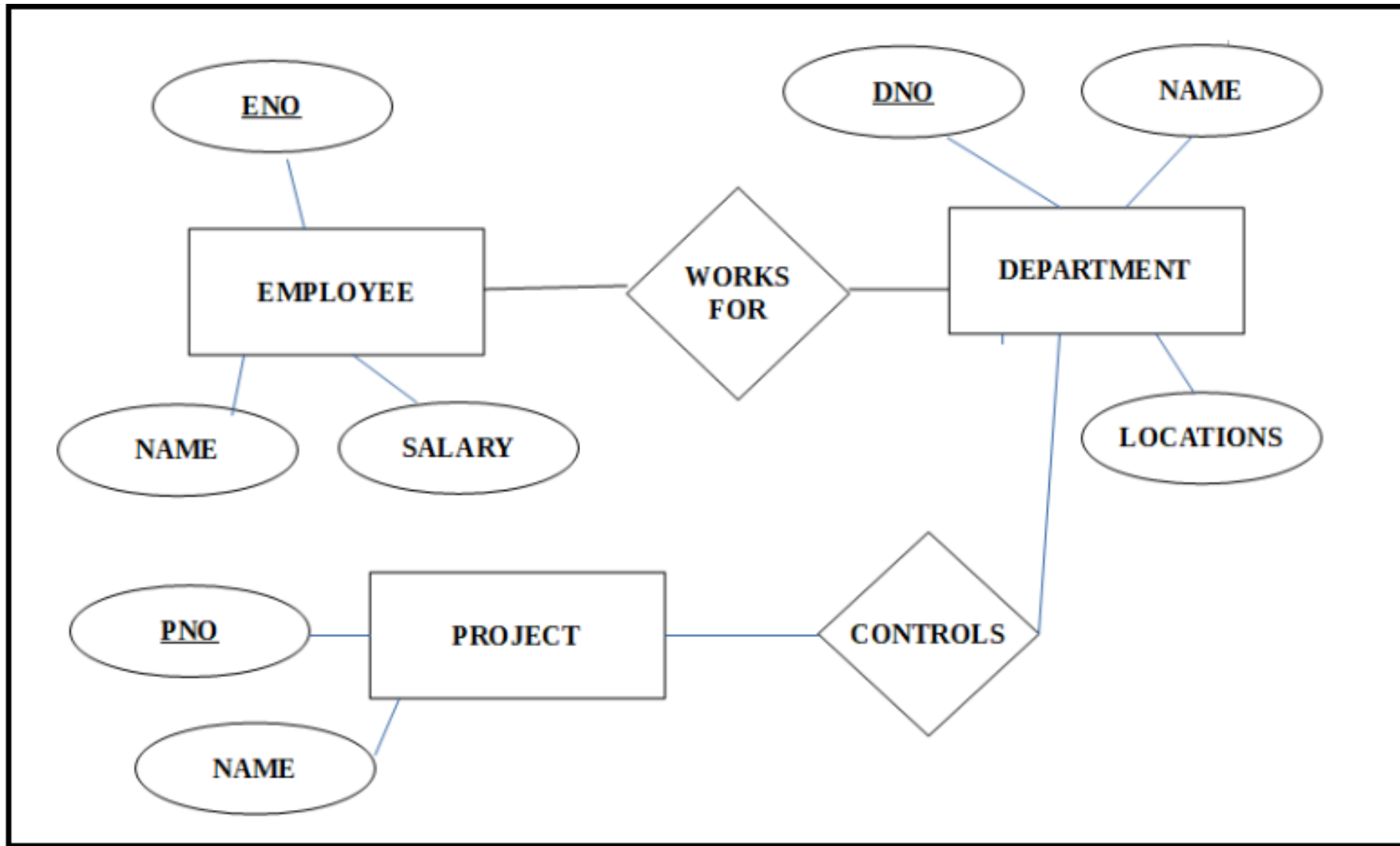
- **Rectangle:** Represents Entity sets.
- **Ellipses:** Attributes
- **Diamonds:** Relationship Set
- **Lines:** They link attributes to Entity Sets and Entity sets to Relationship Set
- **Double Ellipses:** Multivalued Attributes
- **Dashed Ellipses:** Derived Attributes



Entity type Student with its attributes



Hospital ER Model



Company ER Model

MCQ

-
- Entity is a _____
 - Object of relation
 - Present working model
 - Thing in real world
 - Model of relation

MCQ

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 - **Thing in real world**
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MCQ

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- An _____ is a set of entities of same type that share the same properties or attributes.
 - Entity set
 - Attribute set
 - Relation set
 - Entity model

MCQ

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MCQ

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- The descriptive property possessed by each entity set is_____.
- a) Entity
 - b) Attribute
 - c) Relation
 - d) Model

MCQ

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MCQ

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- The function that an entity plays in a relationship is called that entity's _____.
 - a) Participation
 - b) Position
 - c) Role
 - d) Instance

MCQ

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MCQ

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 - b) Composite attribute
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MCQ

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MCQ

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- Which of the following can be a multivalued attribute?
 - a) Phone_number
 - b) Name
 - c) Date_of_birth
 - d) All of the mentioned

MCQ

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MCQ

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- The attribute AGE is calculated from DATE_OF_BIRTH. The attribute AGE is
 - a) Single valued
 - b) Multi valued
 - c) Composite
 - d) Derived

MCQ

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MCQ

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- In a relation between the entities the type and condition of the relation should be specified. That is called as _____ attribute.
 - a) Descriptive
 - b) Derived
 - c) Recursive
 - d) Relative

MCQ

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MCQ

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- Which of the following is a single valued attribute
 - a) Registration_number
 - b) Address
 - c) Subject_taken
 - d) Reference

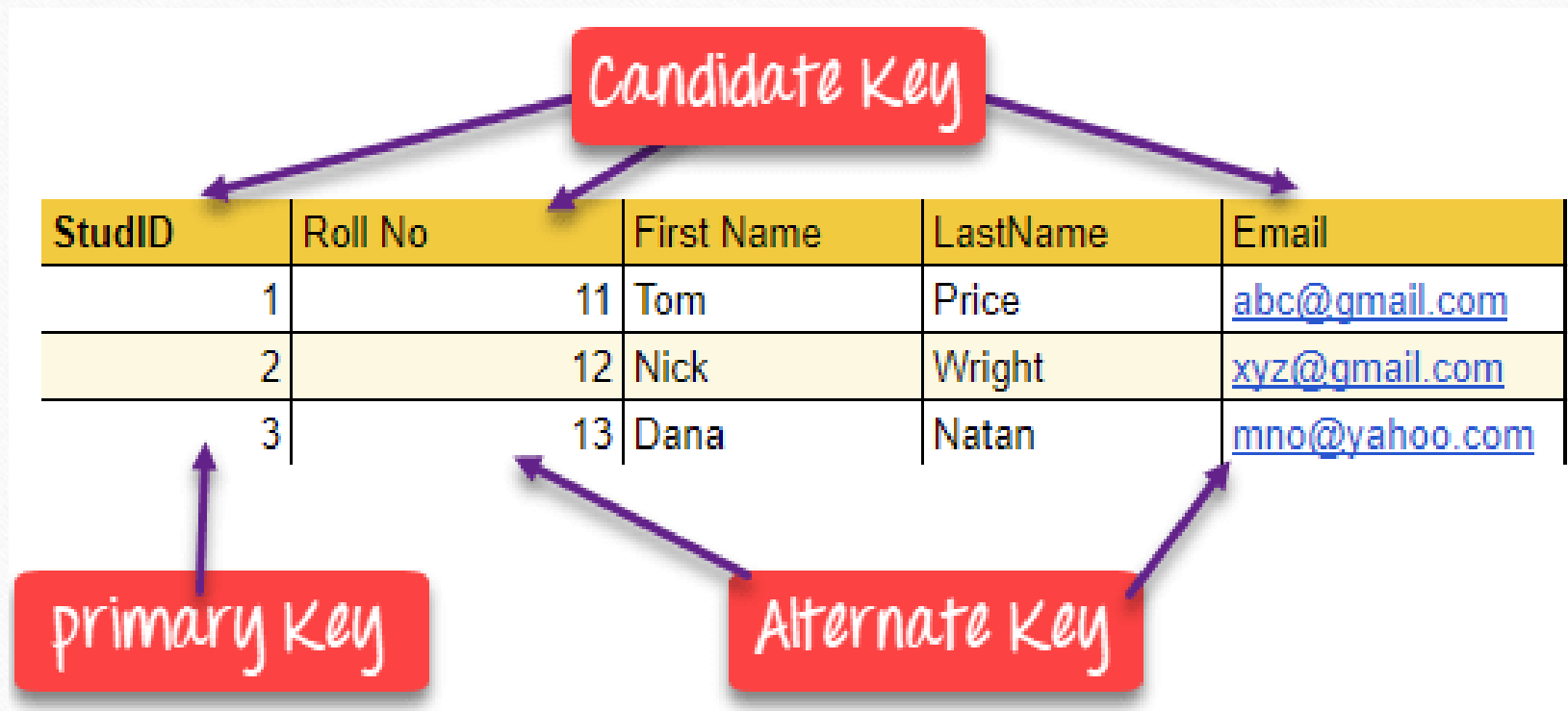
MCQ

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Entity set and Keys

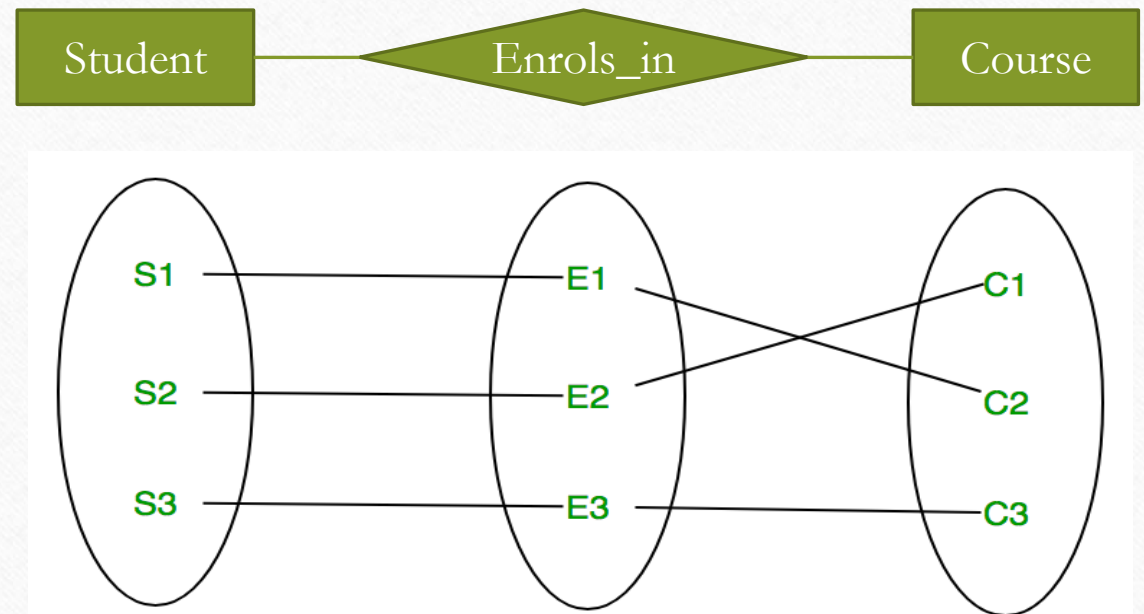
- Key is an attribute or a set of attributes that uniquely identifies an entity among entity set.
- There are mainly three types of keys:
 - **Super key** is a set of attributes that collectively identifies an entity in an entity set.
 - **Candidate key** is a minimal super key and an entity set may have more than one candidate key.
 - **Primary key** is one of the candidate keys chosen by the database designer to uniquely identify the entity set.

Example



Relationship and Relationship Set

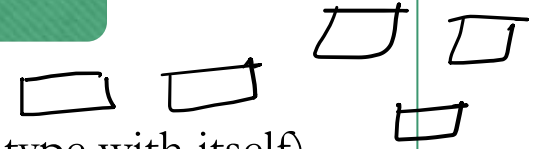
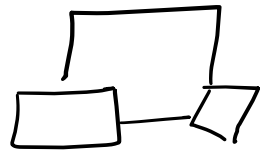
- *Relationship*: Association among two or more entities.
- *Relationship Set*: Collection of similar relationships. Same entity set could participate in different relationship sets, or in different “roles” in same set.
 - Ex. A set of relationships of same type is known as relationship set. The following relationship set depicts S1 is enrolled in C2, S2 is enrolled in C1 and S3 is enrolled in C3.



Relationship: Constraints

degree of a relationship type

- ²binary (connects 2 entity types)
- unary/ recursive (connects 1 entity type with itself)
- complex (connects 3 or more entity types)
- Ternary (connects 3) ₃ #



cardinality

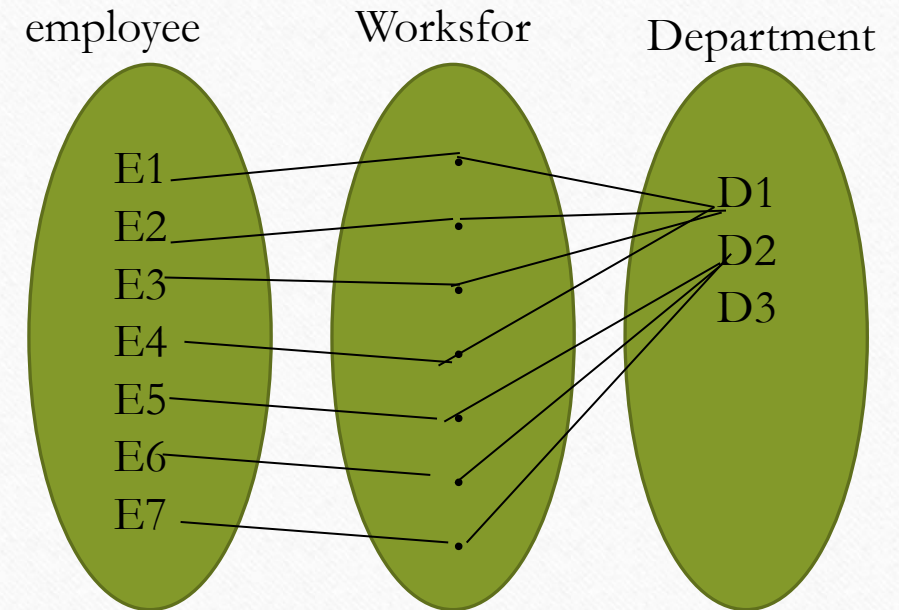
- one to one (1:1) ✓
- one to many (1:m) ✓
- many to many (m:n)

participation

- full/mandatory
- or partial/optional

Example:

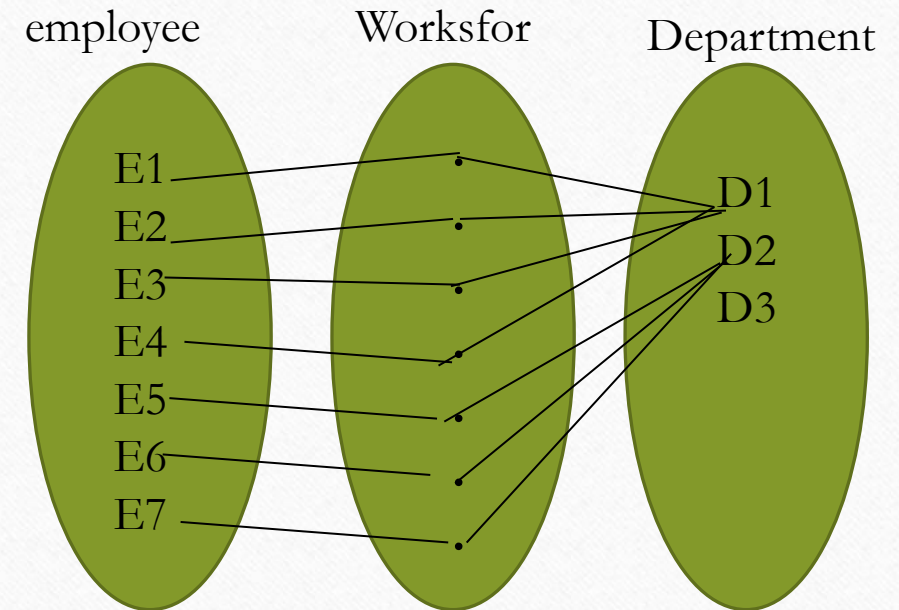
- Every employee works for exactly one department and a department can have many employees.
- New department may not have any employee.



Example:

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DEGREE=2



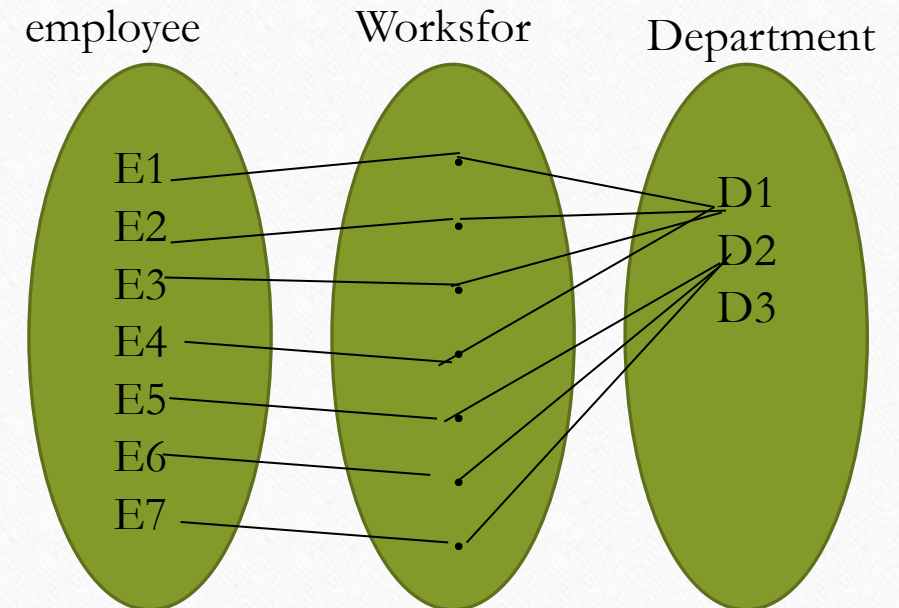
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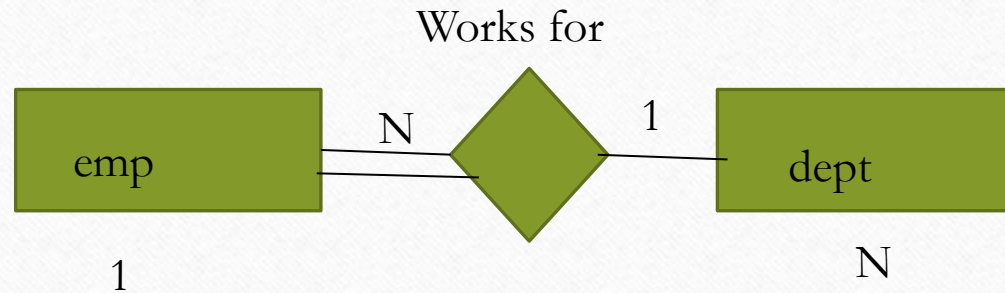
DEGREE=2

CARDINALITY RATIO=MAX (1,N)

**PARTICIPATION/Existence=MIN
(1,0)**

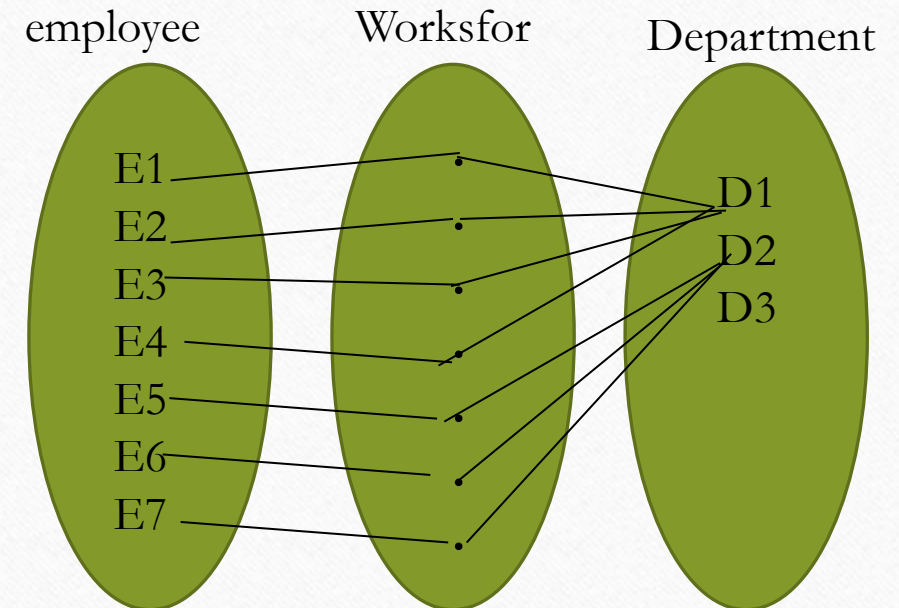


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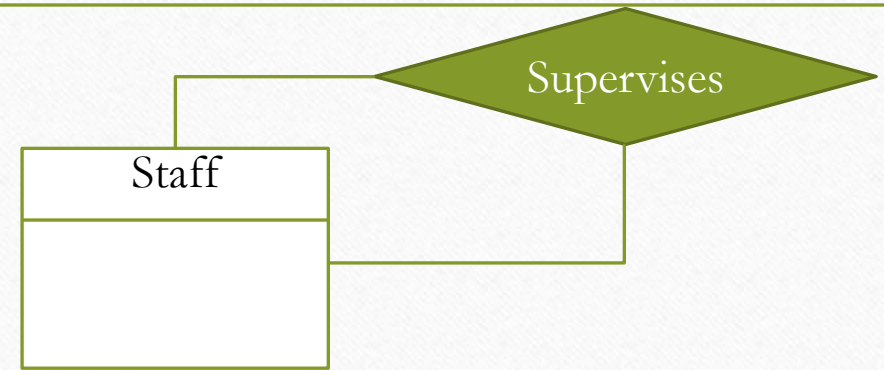
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DEGREE=2
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Binary Relationship



Unary or Recursive Relationship



Ternary Relationship



Quaternary Relationship

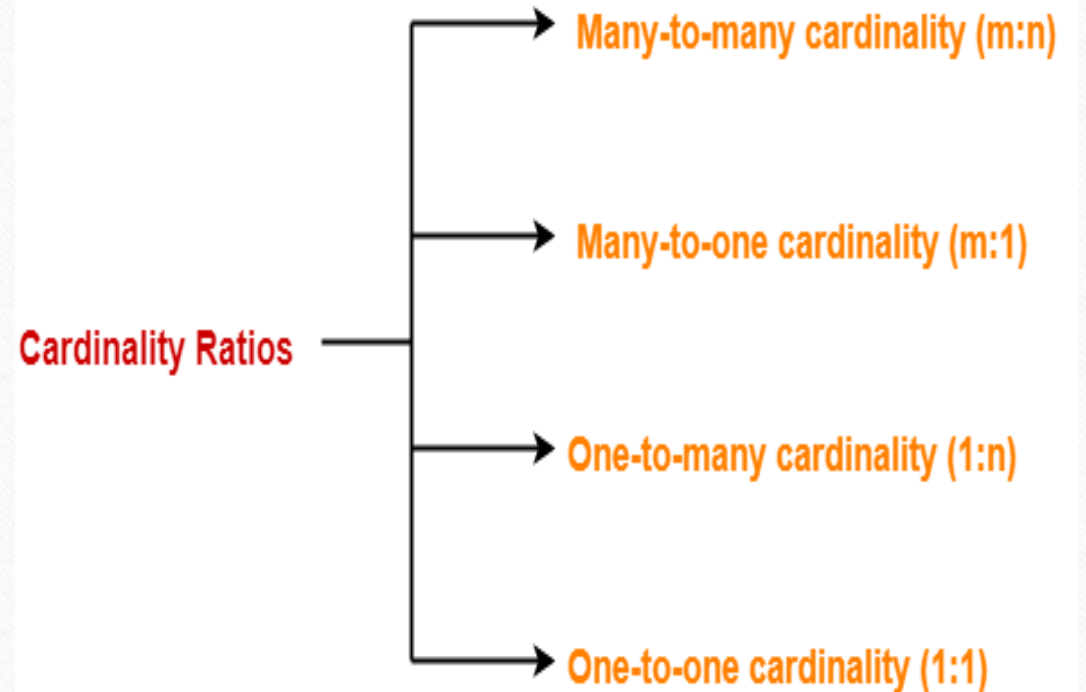


N-ary Relationship

Complex Relationship

Cardinality and Ordinality

- **Cardinality** specifies the number of times an entity of an entity set participates in a relationship.
- **Ordinality** specifies whether a relationship is either mandatory or optional.
- **Cardinality** specifies maximum number of relationships and **ordinality** specifies the absolute minimum number of relationship

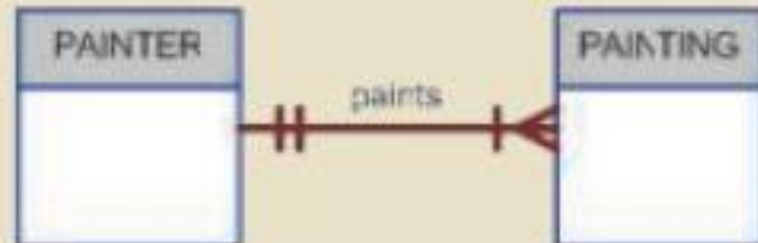


Chen Notation

Crow's Foot Notation

UML Class Diagram Notation

A One-to-Many (1:M) Relationship: a PAINTER can paint many PAINTINGs; each PAINTING is painted by one PAINTER.



A Many-to-Many (M:N) Relationship: an EMPLOYEE can learn many SKILLs; each SKILL can be learned by many EMPLOYEEs.



A One-to-One (1:1) Relationship: an EMPLOYEE manages one STORE; each STORE is managed by one EMPLOYEE.



Participation constraints

- **Participation Constraint** is applied on the entity participating in the relationship set.
- It specifies the number of instances of an entity that are participating in the relationship type.
- It is also called the minimum cardinality constraint.
- There are two types of participation constraint:
 - Total participation
 - Partial participation

Total Participation

- Each entity present in the entity set must mandatorily participate in at least one relationship instance of that relationship set
- It is represented using a double line between the entity set and relationship set



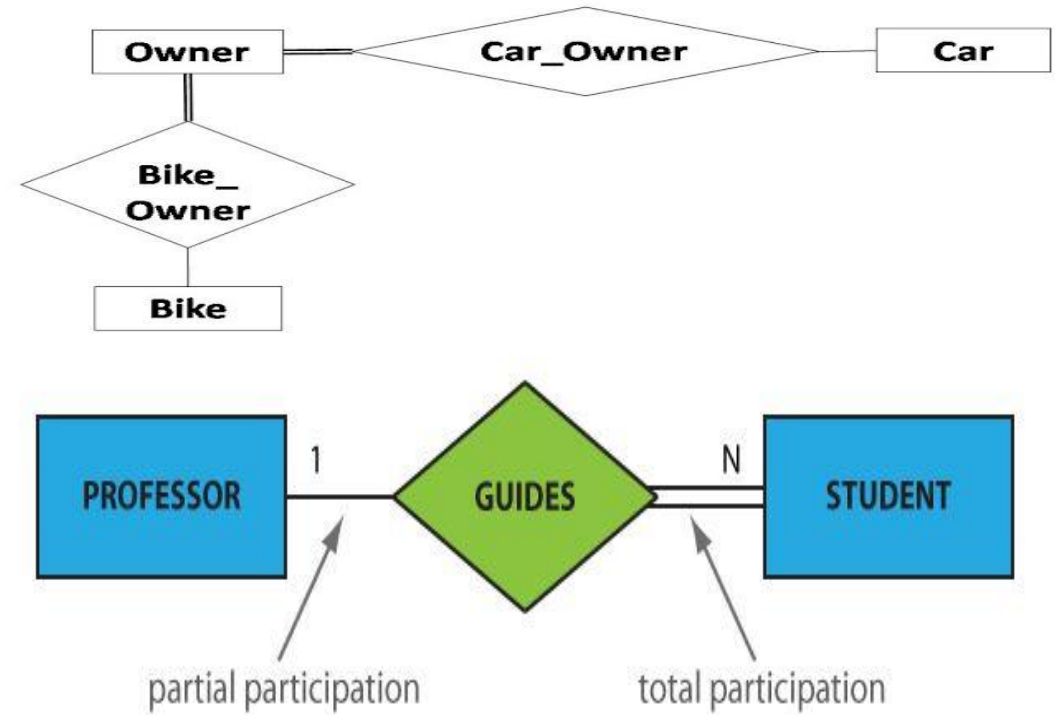
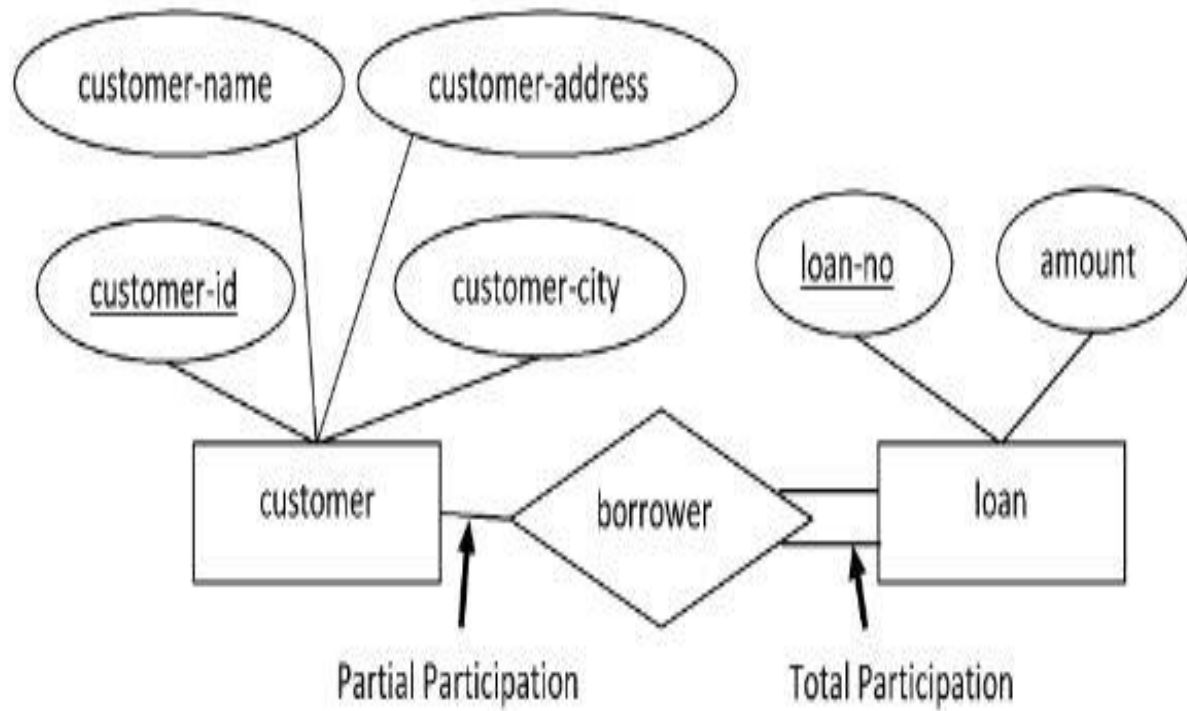
- It specifies that each student must be enrolled in at least one course where the “student” is the entity set and relationship “enrolls” signifies total participation
- It means that every student must have enrolled at least in one course

Partial Participation

- It specifies that **each entity in the entity set may or may not participate in the relationship instance of the relationship set**, is also called as optional participation
- It is represented using a **single line between the entity set and relationship set** in the ER diagram



- A **single line between the entity i.e courses and enrolls a relationship signifies the partial participation**, which means there might be some courses where enrollments are not made i.e enrollments are optional in that case



MCQ

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- A recursive relationship is a relationship between an entity and _____.
 - Itself
 - A subtype entity
 - An instance entity
 - A supertype entity

MCQ

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MCQ

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- In one to many relationship, the entity that is on the one side of the relationship is called a(n) _____ entity.
 - Parent
 - Child
 - Instance
 - Subtype

MCQ

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MCQ

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- The number of entities to which another entity can be associated via a relationship set is expressed as :
 - Entity
 - Cardinality
 - Schema
 - Attributes

MCQ

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References

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