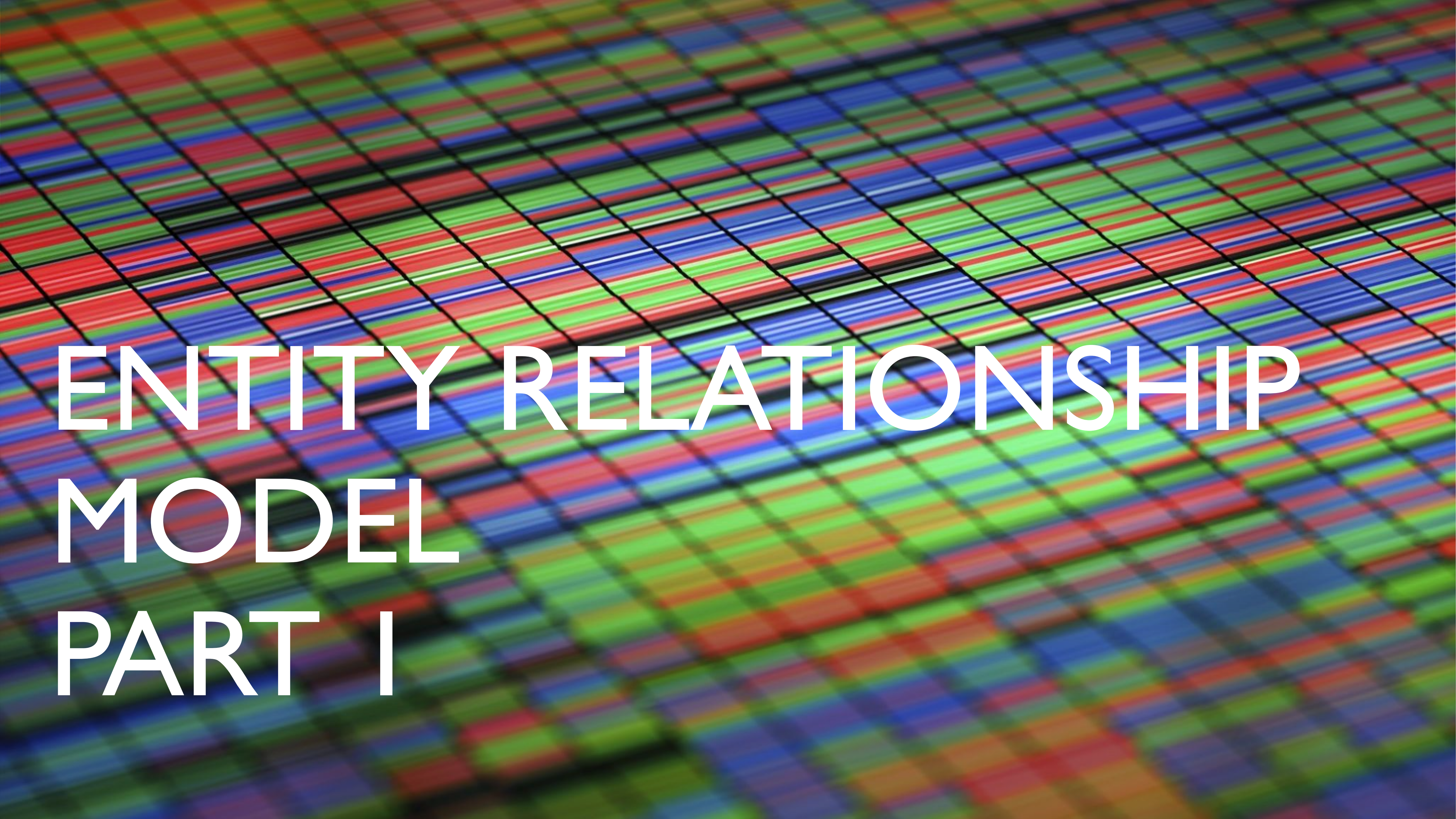
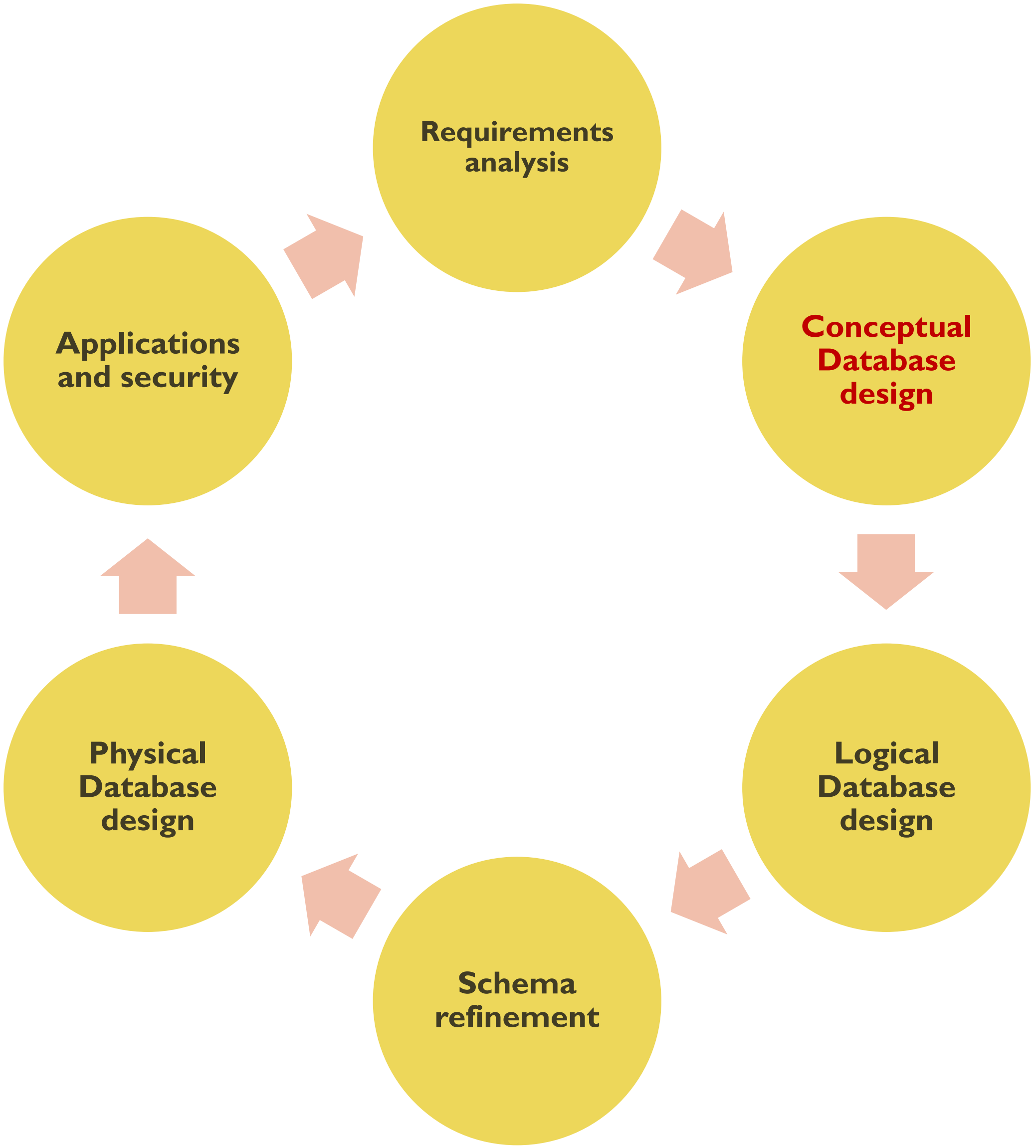


ENTITY RELATIONSHIP MODEL PART I

STEPS IN DEVELOPING A DATABASE



Requirements analysis

Conceptual Database design

Logical Database design

Schema refinement

Physical Database design

Applications and security

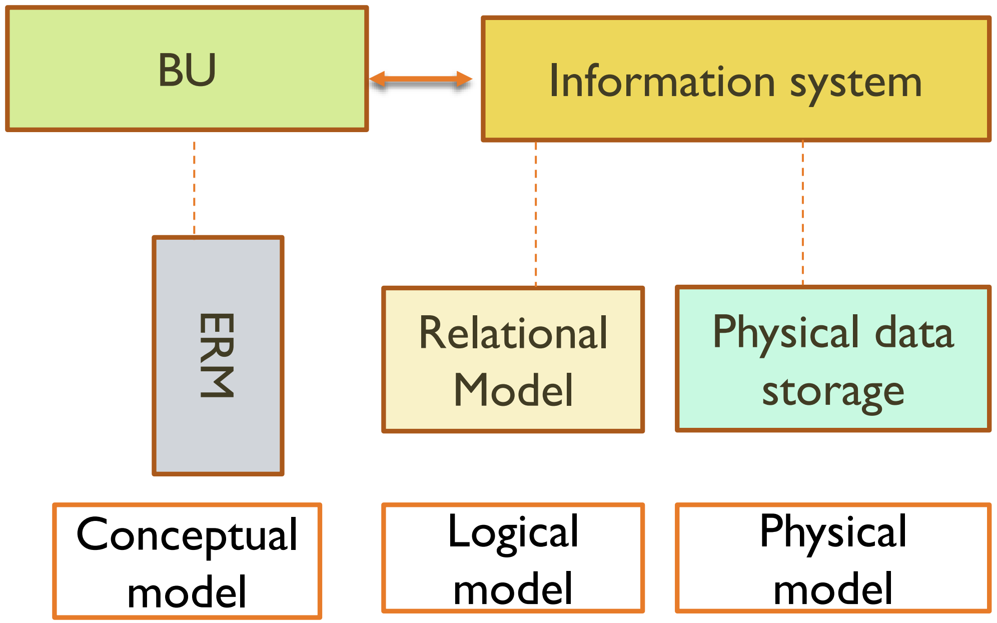
CONCEPTUAL DESIGN

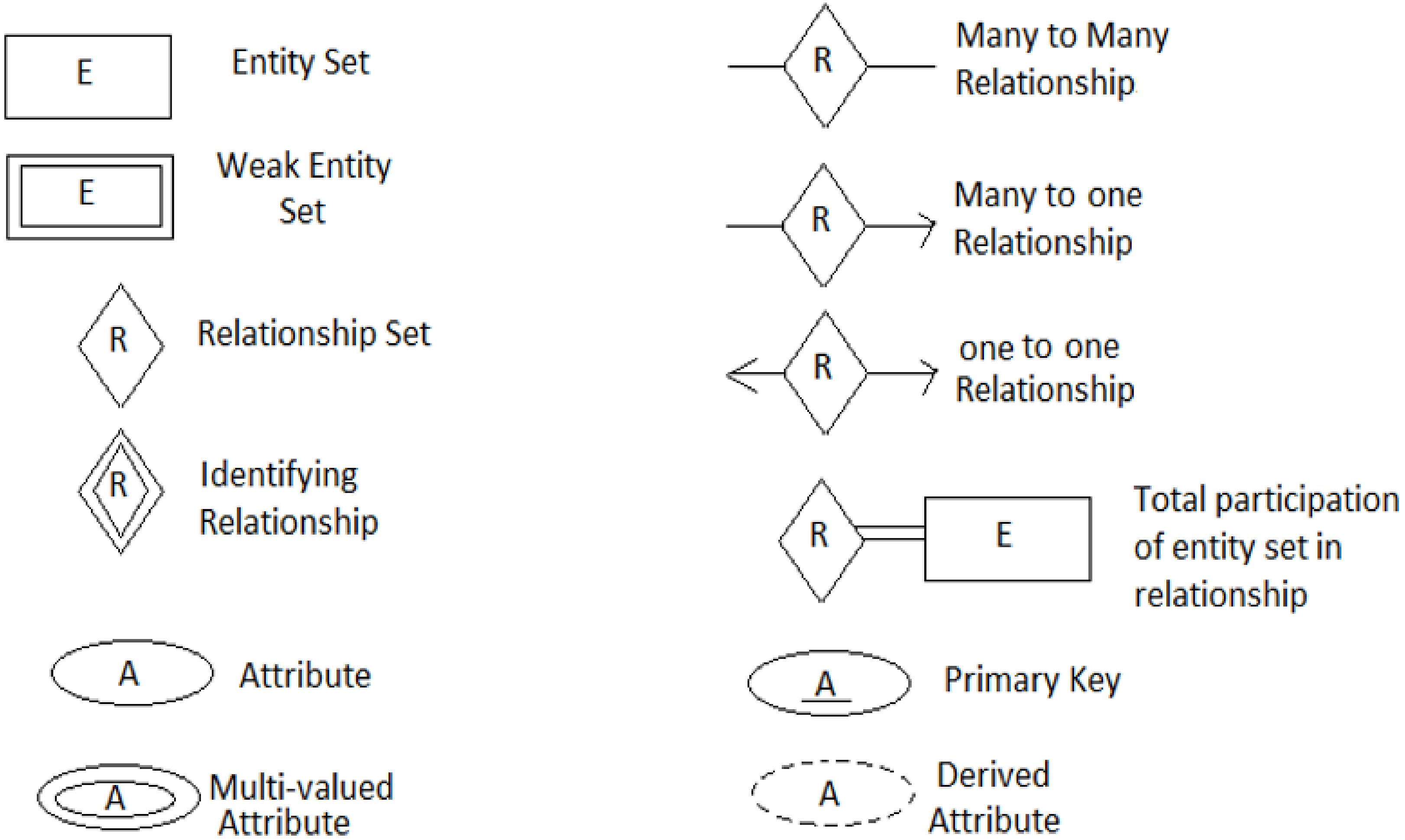
- What are the entities and relationships in the enterprise?
- What information about these entities and relationships should we store in the database?
- What are the integrity constraints or business rules that hold?
- A database `schema’ in the ER Model can be represented pictorially (ER diagrams).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

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





Entity Set

Weak Entity Set

Relationship Set

Identifying Relationship

Attribute

Multi-valued Attribute

Many to Many Relationship

Many to one Relationship

one to one Relationship

Total participation of entity set in relationship

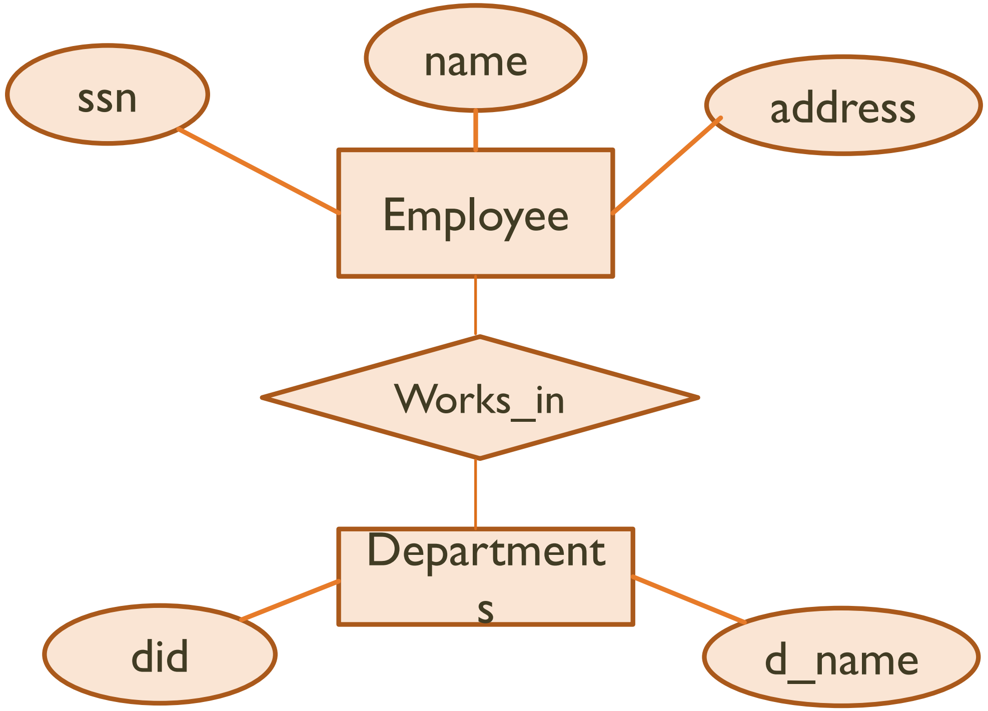
Primary Key

Derived Attribute

Notations in Entity Relationship Diagram

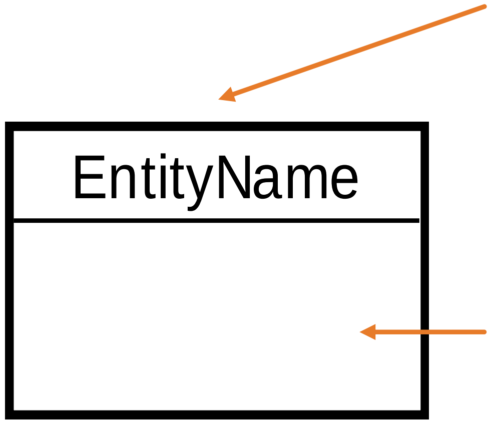
ER MODEL BASICS

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



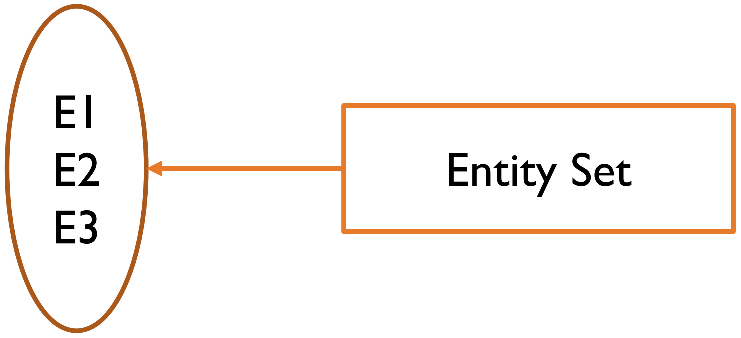
ENTITY AND ENTITY SET

- 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*.



Entity type name (singular, no spaces, capital letter at start of each word)

space for attributes



ATTRIBUTES

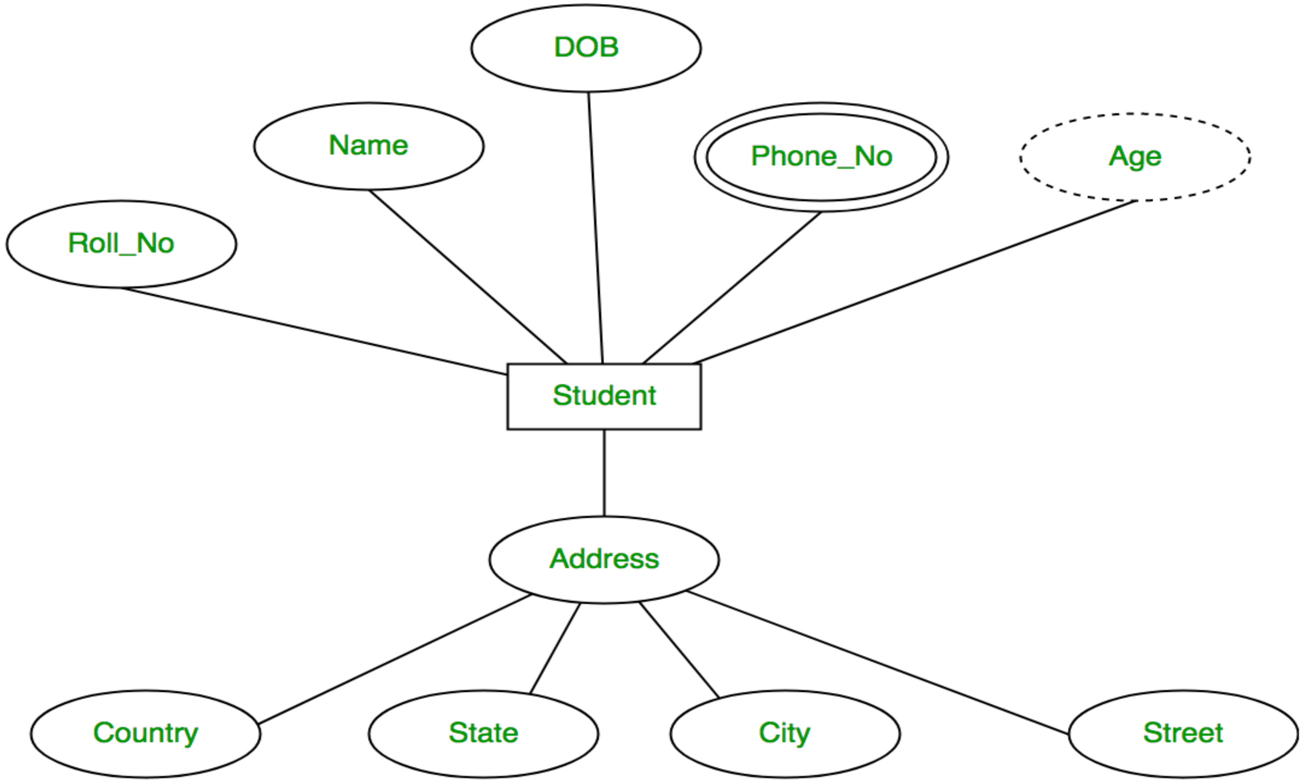
Properties associated each entity with a value from a domain of values.

- *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.

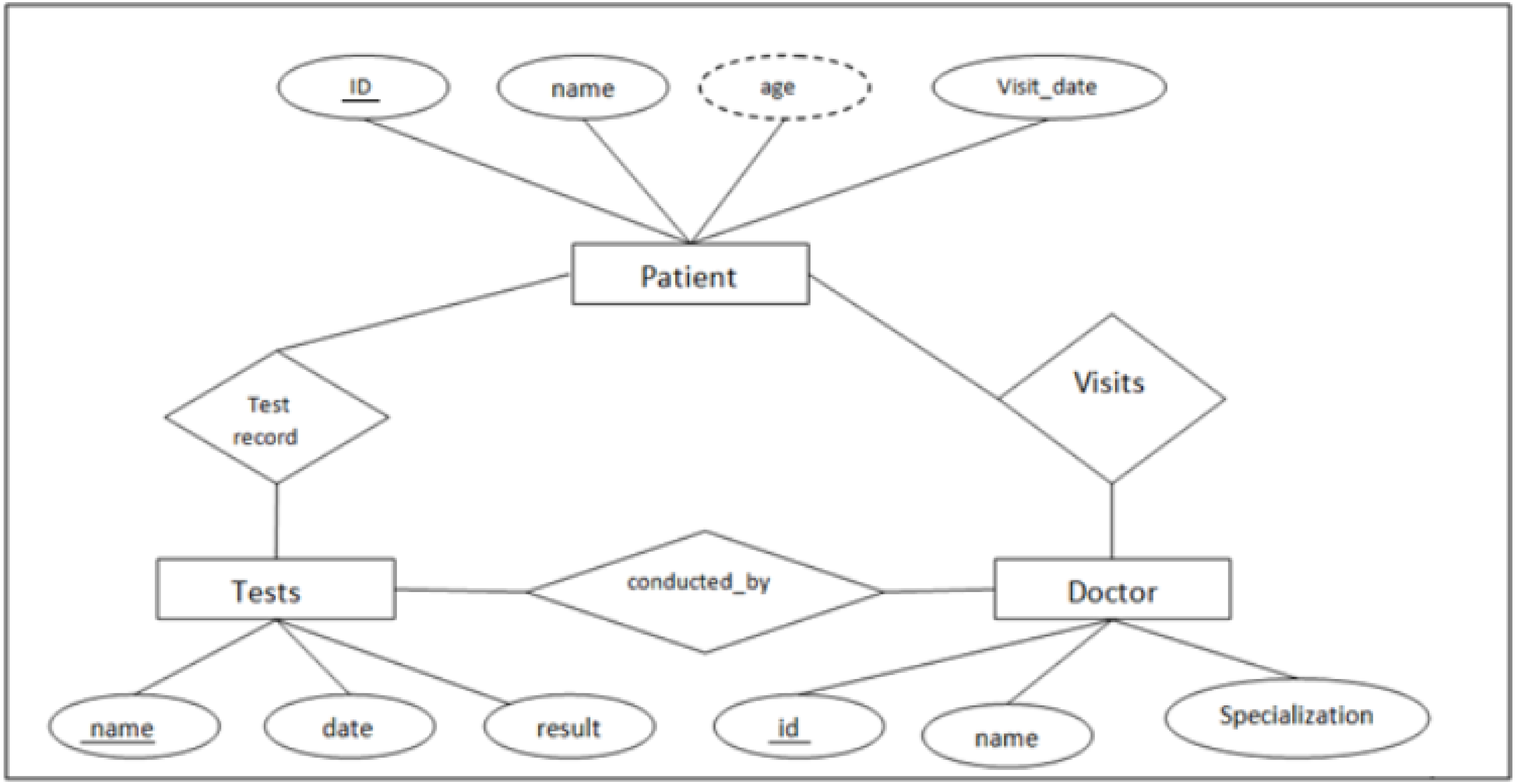
ATTRIBUTES CONTD.

Geometric shapes and their meaning:

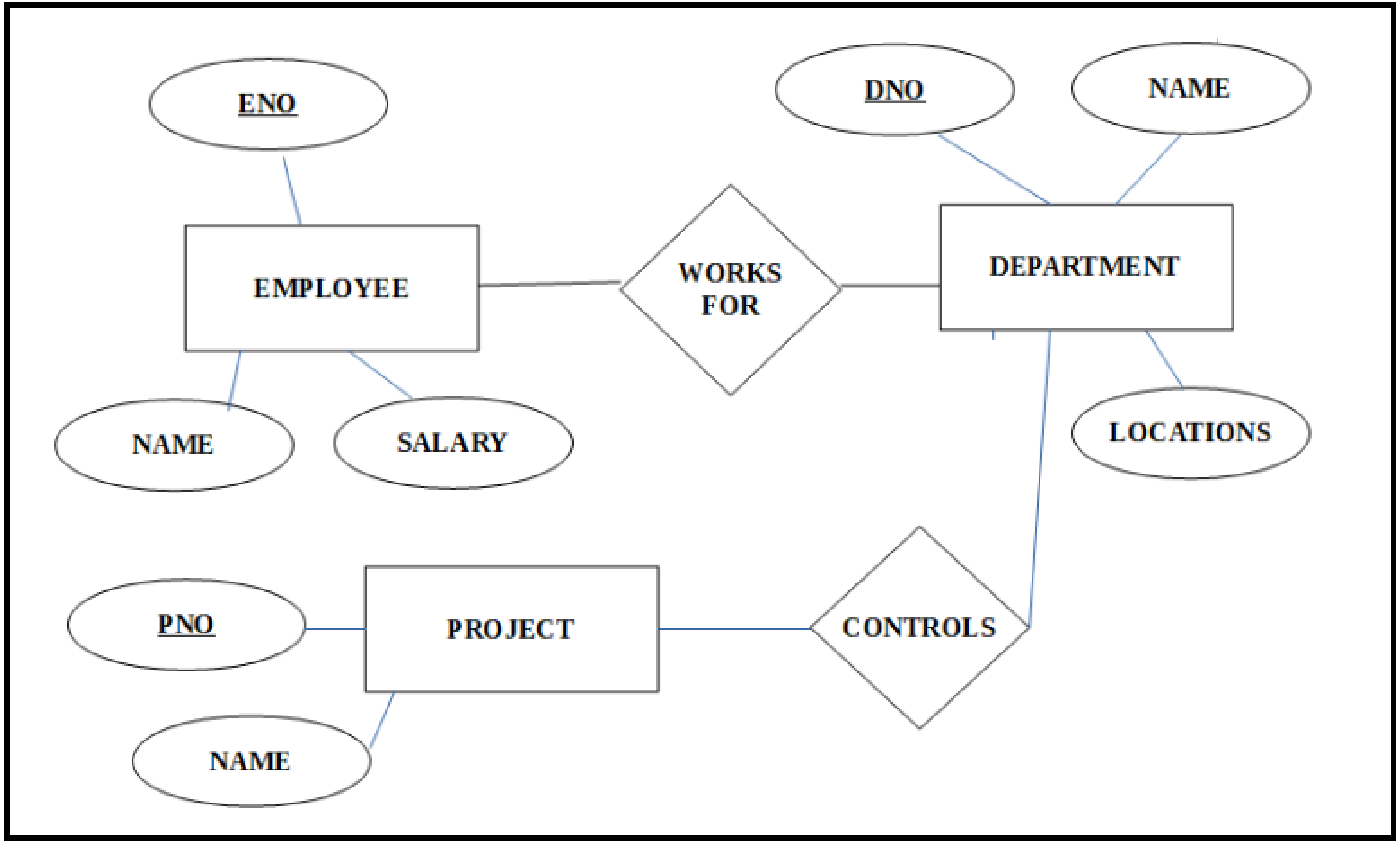
- **Rectangle**: Represents Entity sets.
- **Ellipses**: Attributes
- **Diamonds**: Relationship Set
- **Lines**: They link attributes to Entity Sets and Entity sets to Relationship Set
- **Double Ellipses:** Multivalued Attributes
- **Dashed Ellipses**: Derived Attributes



- Entity type Student with its attributes



Hospital ER Model



Company ER Model

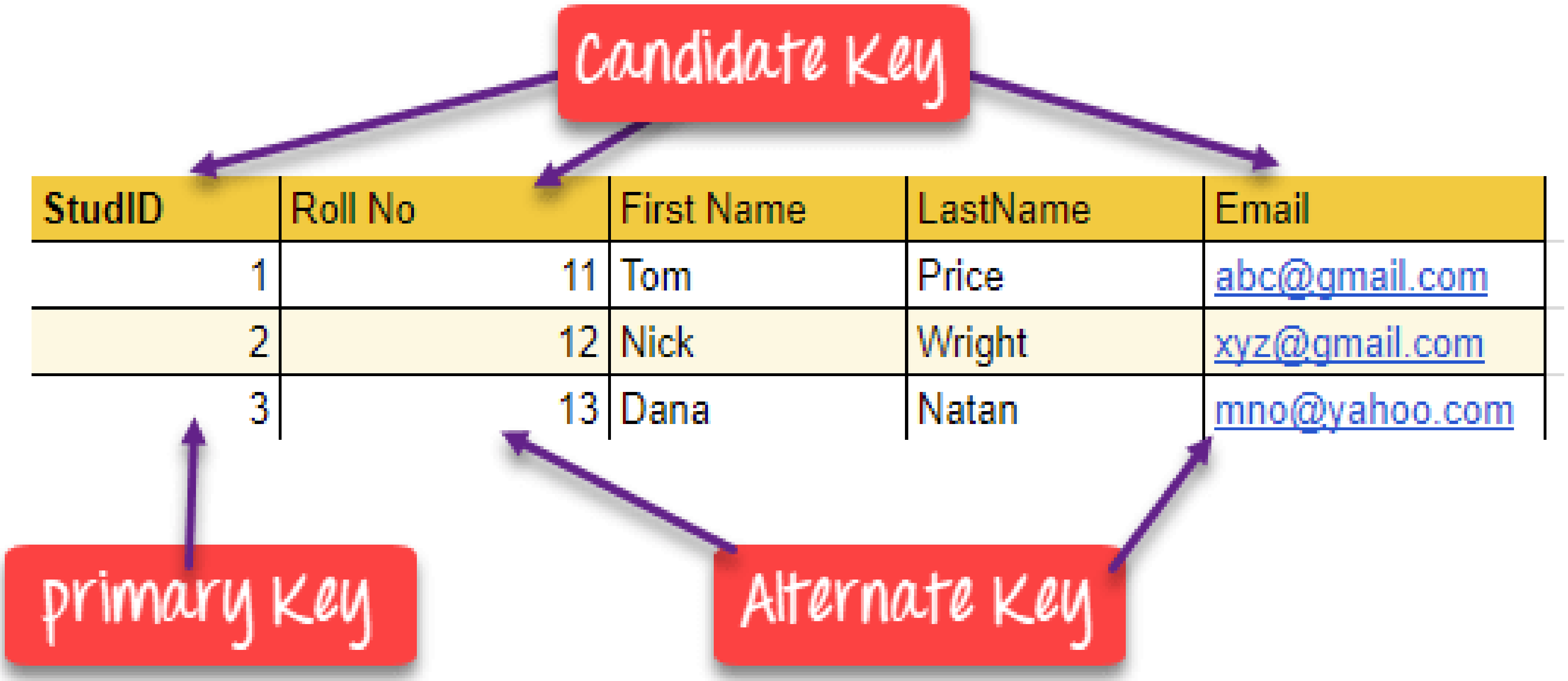
ENTITY SET AND KEYS

- *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

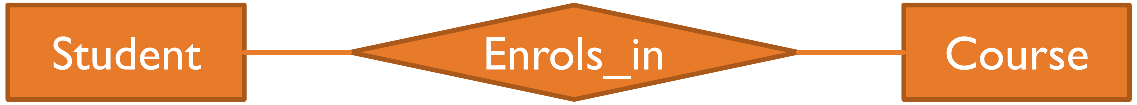


StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Candidate Key
primary Key
Alternate Key

RELATIONSHIP AND RELATIONSHIP SET

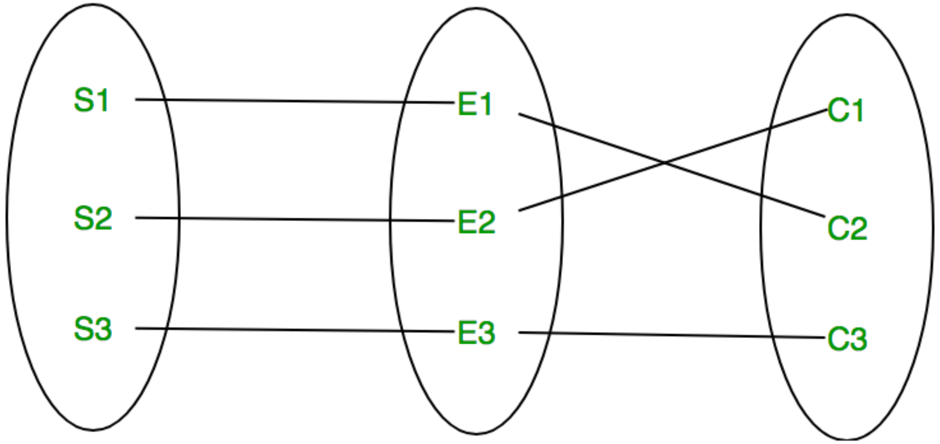
- *Relationship:* Association among two or more entities.
- *Relationship Set:* Collection of similar relationships. Same entity set could participate in different relationship sets, or in different "roles" in same set.
- *Ex.* A set of relationships of same type is known as relationship set. The following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



Student

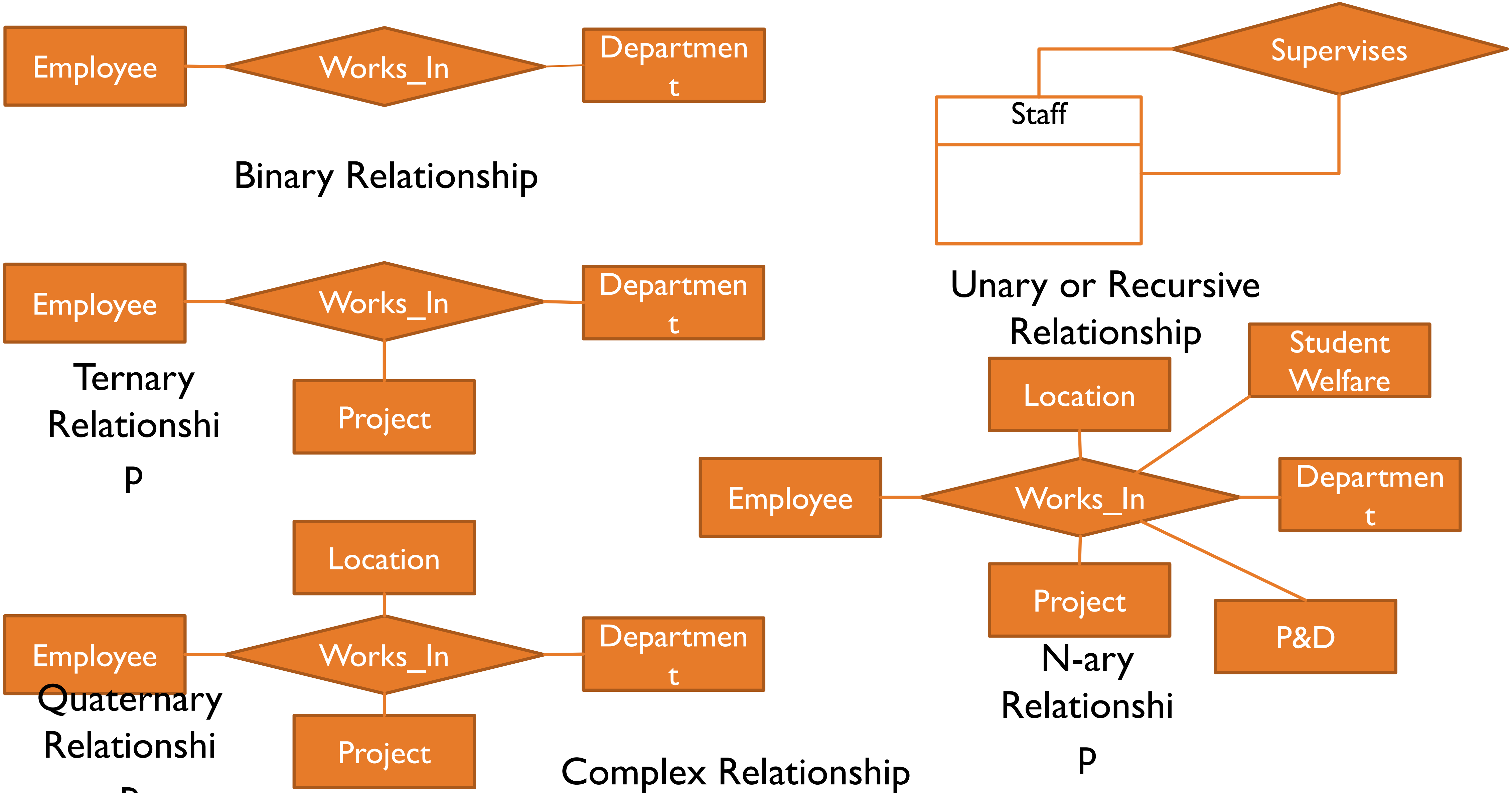
Enrols_in

Course



RELATIONSHIP: CONSTRAINTS

degree of a relationship type	• binary (connects 2 entity types) • unary/ recursive (connects 1 entity type with itself) • complex (connects 3 or more entity types) • Ternary (connects 3)
cardinality	• one to one (1:1) • one to many (1:m) • many to many (m:n)
participation	• full/mandatory • or partial/optional



Binary Relationship

Unary or Recursive
Relationship

Ternary
Relationshi
p

Quaternary
Relationshi
p

Complex Relationship

N-ary
Relationshi
p

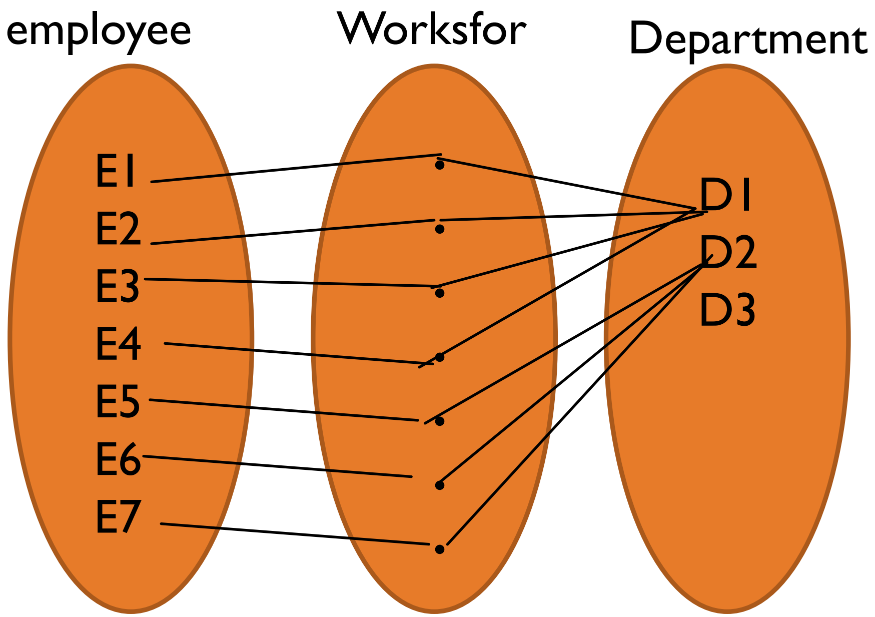
FIND ENTITIES?
LIST OUT ENTITY'S ATTRIBUTES?

- Problem Description
- Hospital has doctors and patients. Patients visit the hospital to get a consultation from the doctor. Doctor may suggest tests to examine the condition of the patient.

EXAMPLE:

Every employee works for exactly *one* department and a department can have *many* employees.

New department may not have any employee.



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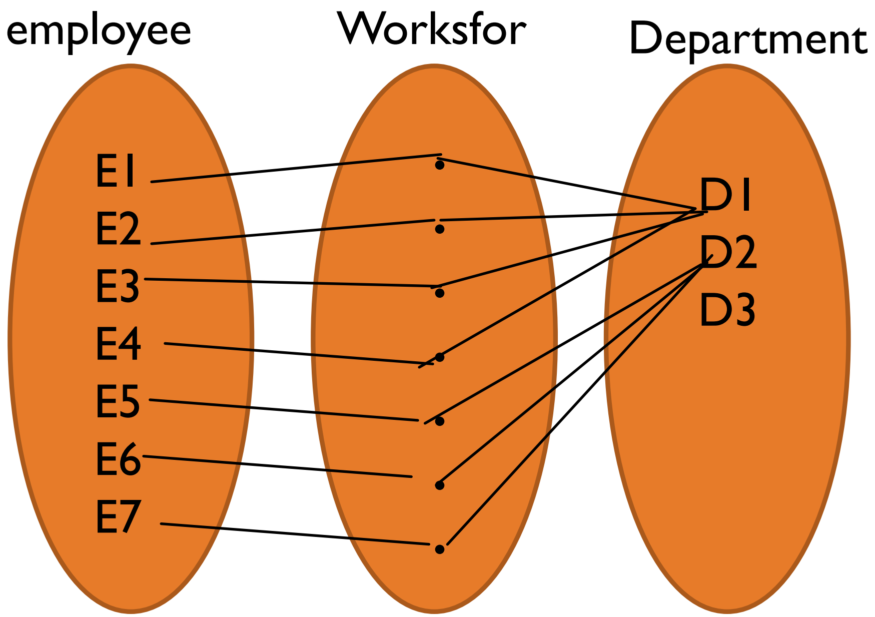
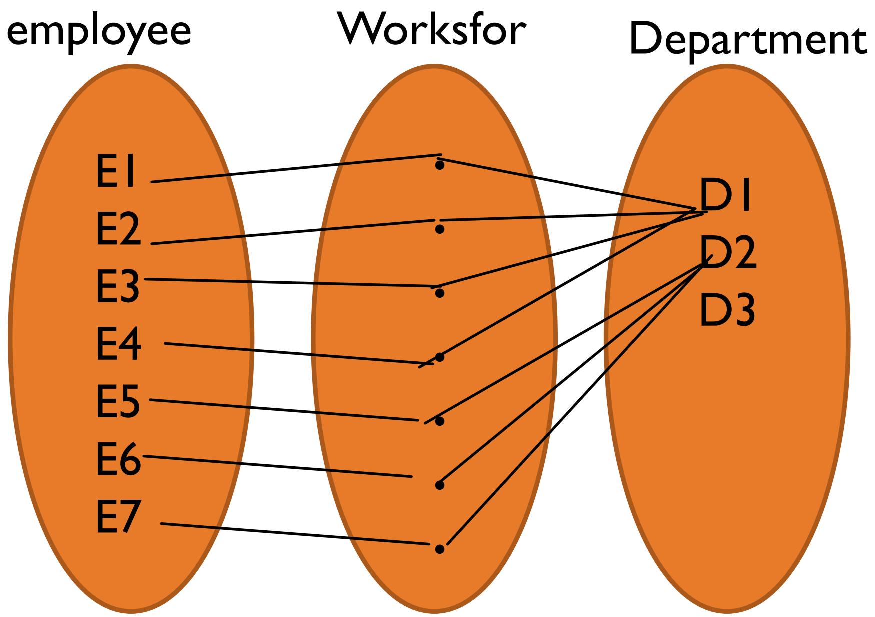


DEGREE=2

EXAMPLE:

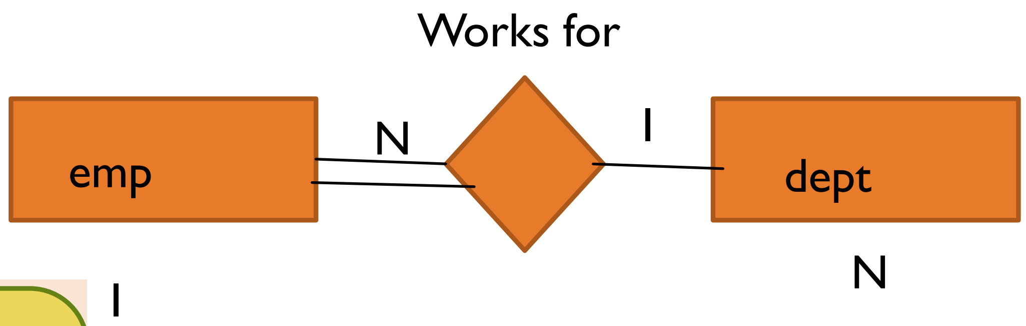
Every employee works for exactly *one* department and a department can have *many* employees.

New department may not have any employee.



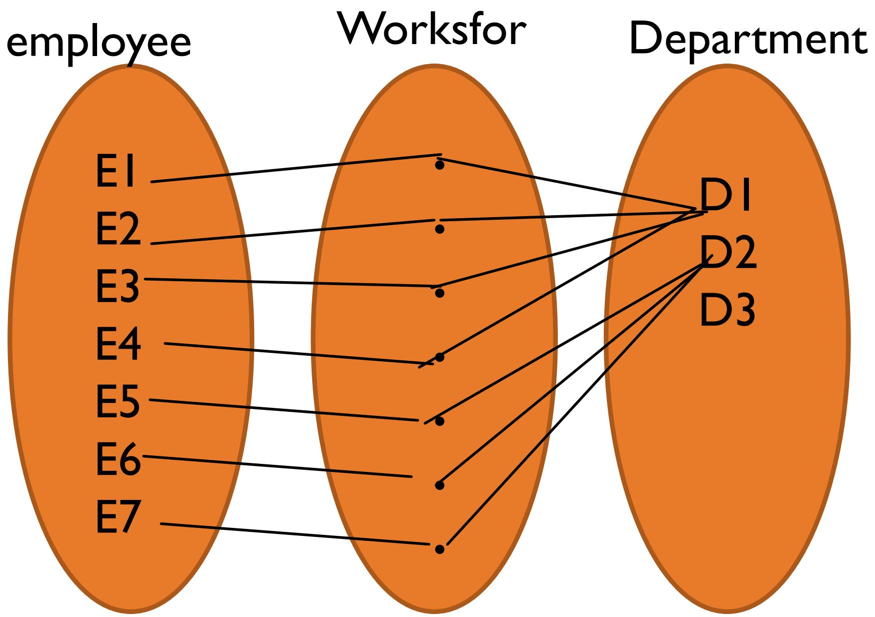
DEGREE=2
CARDINALITY RATIO = MAX (1,N)
PARTICIPATION/EXISTENCE = MIN (1,0)

EXAMPLE:



Every employee works for exactly *one* department and a department can have *many* employees.

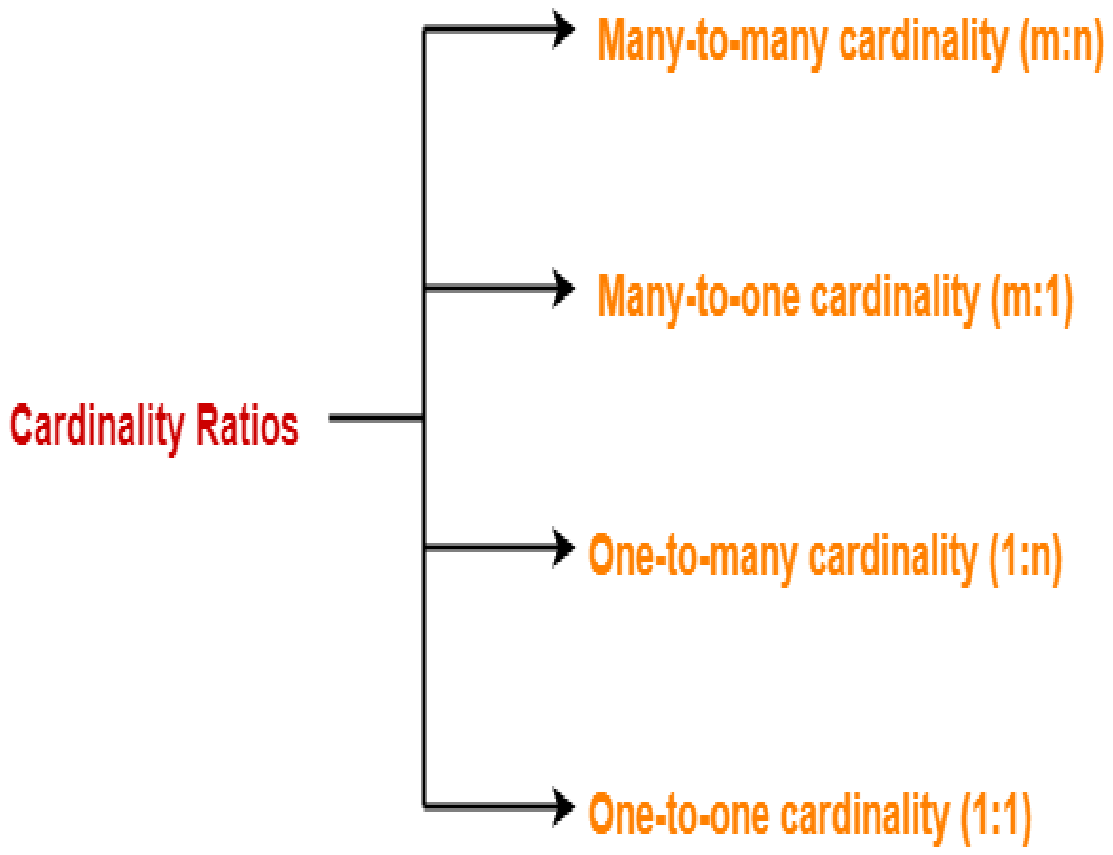
New department may not have any employee.



DEGREE=2
CARDINALITY RATIO = MAX (1,N)
PARTICIPATION/EXISTENCE = MIN (1,0)

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



Cardinality Ratios

Many-to-many cardinality (m:n)

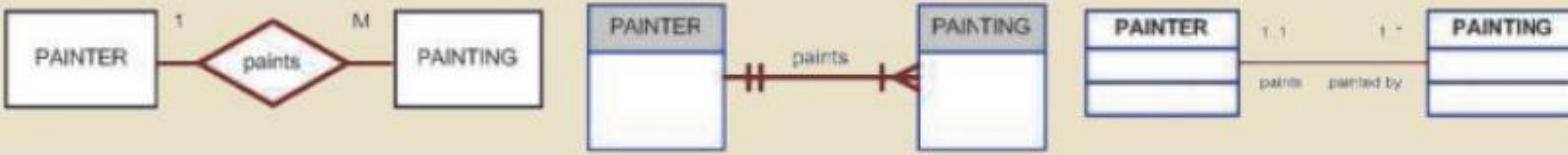
Many-to-one cardinality (m:1)

One-to-many cardinality (1:n)

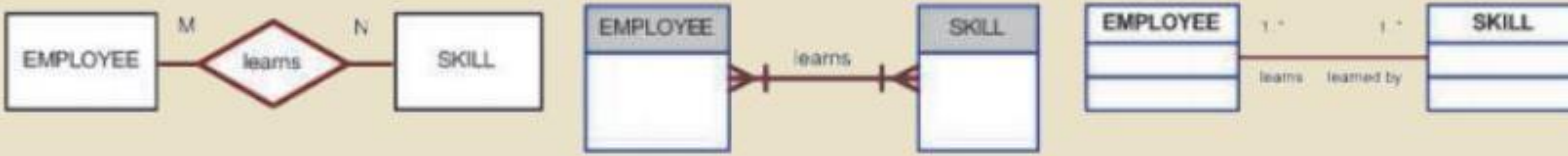
One-to-one cardinality (1:1)

Chen Notation ***Crow's Foot Notation*** *UML Class Diagram Notation*

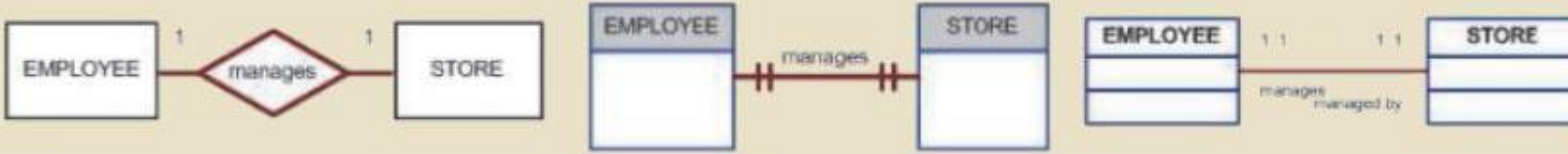
A One-to-Many (1:M) Relationship: a PAINTER can paint many PAINTINGs; each PAINTING is painted by one PAINTER.



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

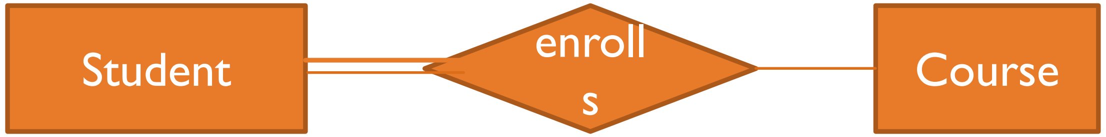
- **Participation Constraint** is applied on the entity participating in the relationship set.
- It specifies the number of instances of an entity that are participating in the relationship type.
- It is also called the *minimum cardinality* constraint.

There are two types of participation constraint:

- *Total participation*
- *Partial participation*

TOTAL PARTICIPATION

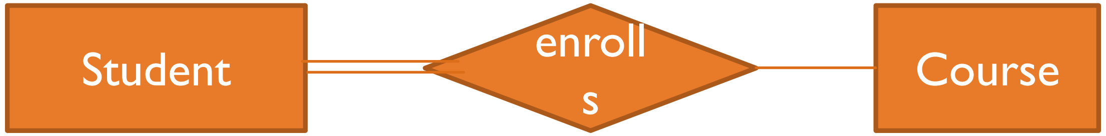
- Each entity present in the entity set must mandatorily participate in at least one relationship instance of that relationship set
- It is represented using a double line between the entity set and relationship set



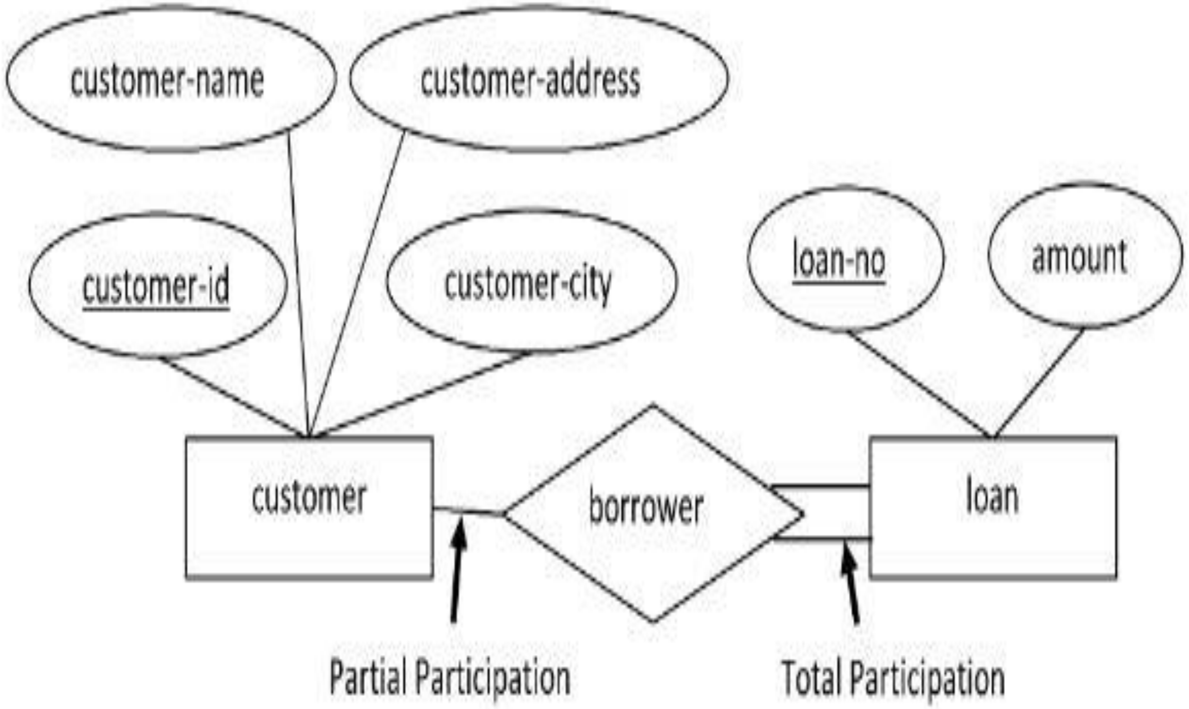
- It specifies that each student must be enrolled in at least one course where the "student" is the entity set and relationship "enrolls" signifies total participation
- It means that every student must have enrolled at least in one course

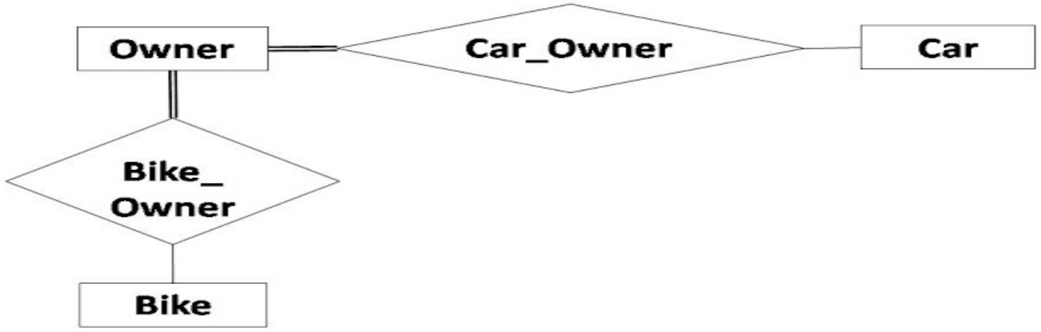
PARTIAL PARTICIPATION

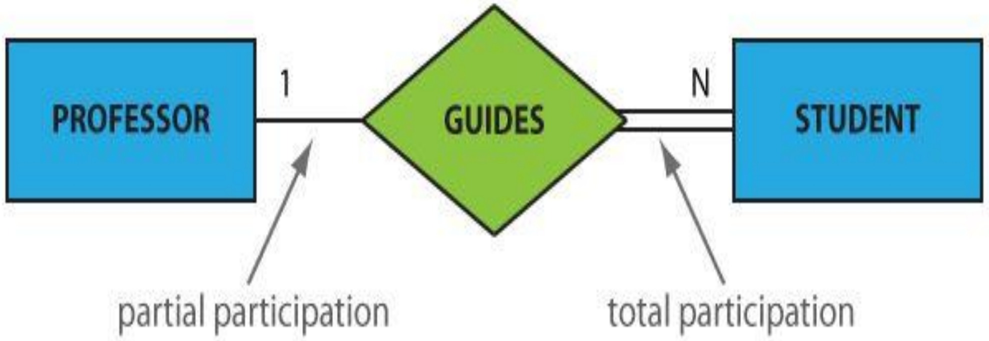
- It specifies that each entity in the entity set may or may not participate in the relationship instance of the relationship set, is also called as optional participation
- It is represented using a single line between the entity set and relationship set in the ER diagram

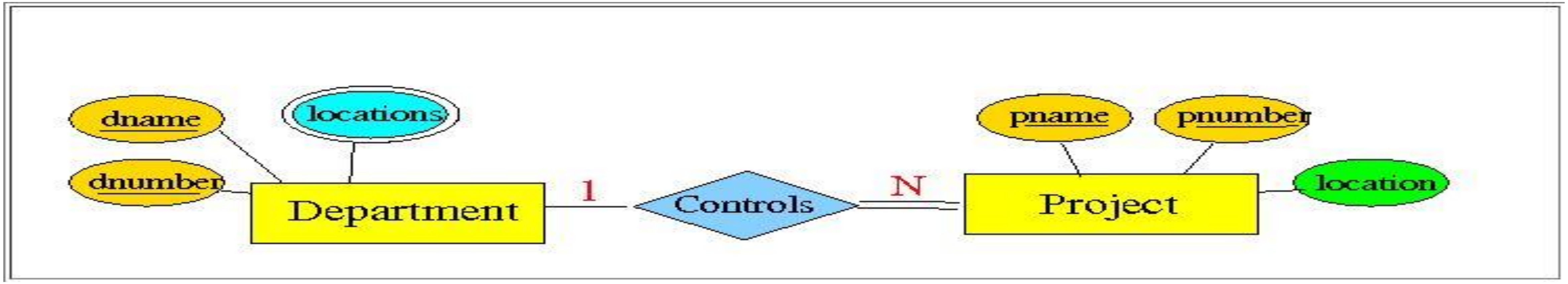


- A **single line between the entity** i.e courses and enrolls a relationship signifies the partial participation, which means there might be some courses where enrollments are not made i.e enrollments are optional in that case


customer-name
customer-address
customer-id
customer-city
loan-no
amount
customer
borrower
loan
Partial Participation
Total Participation


Owner
Car_Owner
Car
Bike_
Owner
Bike


PROFESSOR
1
GUIDES
N
STUDENT
partial participation
total participation


dname
locations
dnumber
Department
1
Controls
N
Project
pname
pnumber
location

REFERENCES

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- https://www.studytonight.com/dbms/
- https://www.youtube.com/watch?v=QpdhBUYk7Kk
- https://www.youtube.com/watch?v=-CuY5ADwn24&t=110s
- https://www.youtube.com/watch?v=XUdNVaSikqY