Database System Concepts

Chapter No 03 ERD/M

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Entity Relationship Model

- Introduced by Peter Chen in 1976

- It is conceptual representation of the data for an organization

- E-R Model is expressed in the term of **entities**, **attributes** and **relationships**.

- Graphical representation of an entity relationship model is called Entity Relationship Diagram (ERD).

- It is a **semantic data model**

Entity Relationship Model(cont...)

- A semantic data model, used for the graphical representation of the conceptual database design.

Entity Relationship Model(cont...)

Component of E-R Model

➡ **Entity**

➡ **Attribute**

➡ **Relationship**

Entity Relationship Model

Entity

- An entity is a person, place, object, event, or concept in the user environment about which organization wish to maintain the data.

- Entity is used in three different meaning

    - Entity type

    - Entity Instance

    - Entity set

Entity Relationship Model

Entity Type

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

- A label assign to object that exist in a environment and that have similar properties.

- Entity type are distinguishable from other entity types on the base of properties

Entity Relationship Model

Entity Type

- Entity type in E-R model has a singular name, placed inside the box

- Capital letters are use for name of entity type
- Entity type is indicated by Rectangle

CUSTOMER	ORDER

Entity Relationship Model(cont...)

Entity Instance

➡ A single occurrence of an entity type

➡ A particular object belonging to a particular entity type is called entity instance

➡ **Example:**
- ➡ Entity Type: Student

- ➡ Entity Instance: Habib record in the student entity type

Entity Relationship Model(cont...)

Entity Type

Entity Instance

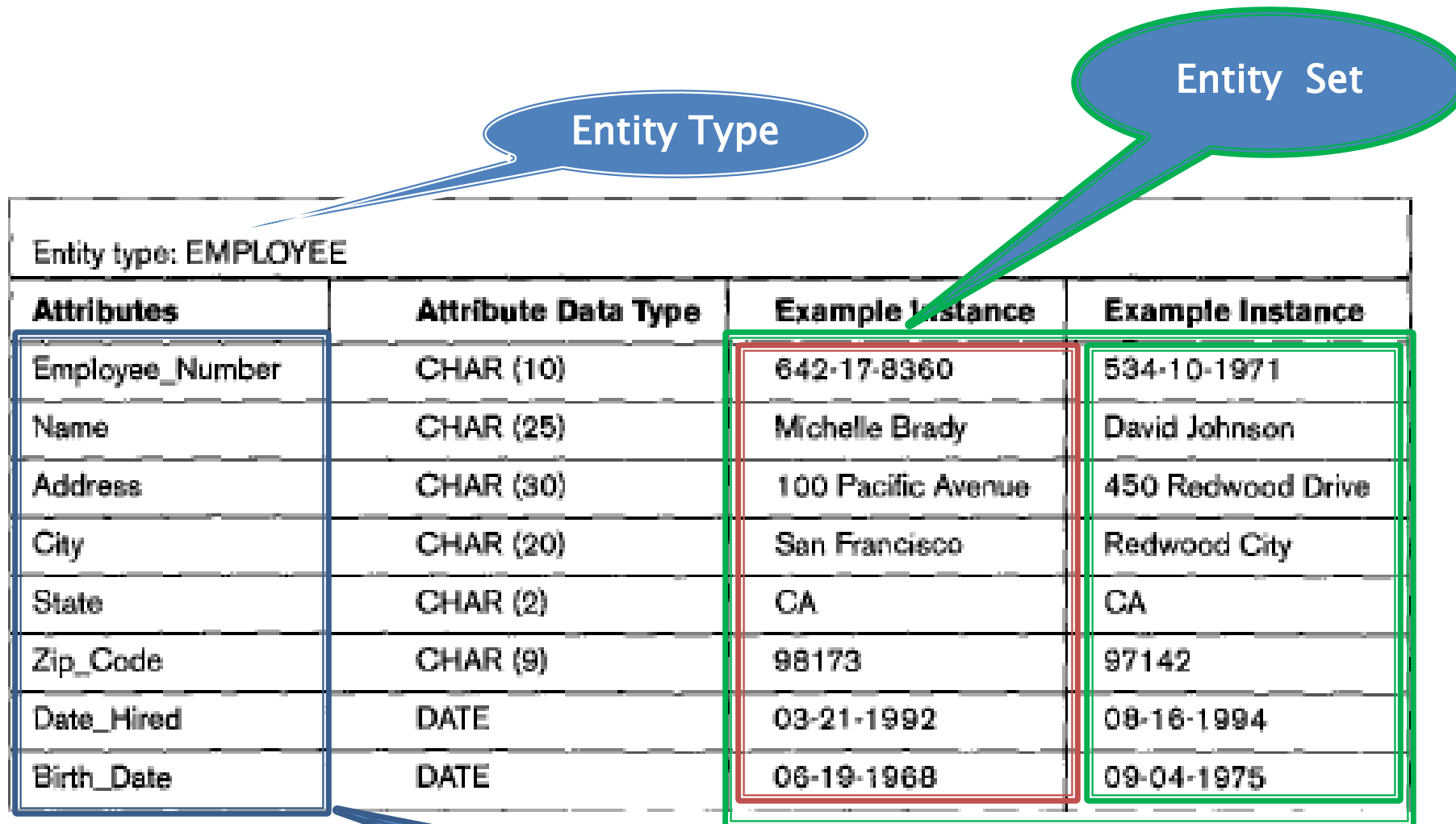| Entity type: EMPLOYEE			
Attributes	**Attribute Data Type**	**Example Instance**	**Example Instance**
Employee_Number	CHAR (10)	642-17-8360	534-10-1971
Name	CHAR (25)	Michelle Brady	David Johnson
Address	CHAR (30)	100 Pacific Avenue	450 Redwood Drive
City	CHAR (20)	San Francisco	Redwood City
State	CHAR (2)	CA	CA
Zip_Code	CHAR (9)	98173	97142
Date_Hired	DATE	03-21-1992	08-16-1994
Birth_Date	DATE	06-19-1968	09-04-1975

Properties of Entity Type

Entity Instance

Entity Relationship Model (cont…)

Entity Set

- All instance belonging to any entity type are called entity set.

- For example:
  - Entity Type: Student

  - Entity Instance: Habib record in entity type student
  - Entity Instance: Asad record in entity type student

  - Entity Set: collection of all the student Records

Entity Relationship Model(cont...)

Entity Set

Entity Type

Entity type: EMPLOYEE			
Attributes	**Attribute Data Type**	**Example Instance**	**Example Instance**
Employee_Number	CHAR (10)	642-17-8360	534-10-1971
Name	CHAR (25)	Michelle Brady	David Johnson
Address	CHAR (30)	100 Pacific Avenue	450 Redwood Drive
City	CHAR (20)	San Francisco	Redwood City
State	CHAR (2)	CA	CA
Zip_Code	CHAR (9)	98173	97142
Date_Hired	DATE	03-21-1992	08-16-1994
Birth_Date	DATE	06-19-1968	09-04-1975

Properties of Entity Type

Entity Relationship Model (cont...)

Type of Entity Type

➡ **Strong Entity Type**

➡ **Weak Entity Type**

Entity Relationship Model (cont...)

Type of Entity Type

➡ **Weak Entity Type**

> Weak entity type is represented by double line Rectangle
>
> DEPENDENT

➤ An entity type whose existence depends on some other entity type.

➤ An entity type whose instances cannot exist without being linked with the instances of some other entity types.

➤ They cannot exist independently

➤ It has a **partial identifiers**.

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Entity Relationship Model

Type of Entity Type

➡ **Strong Entity Type**

➤ An entity type that exists independently of other entity types.

➤ An entity type whose instances can exist independently

➤ The entity type have there own identity

➤ It always have a **identifier**

➤ It is also called **Identifying owner**

Entity Relationship Model

Type of Entity Type

- **Identifying Relationship**

  - The relationship between the weak entity type and its owner is called identifying relationship.

Entity Relationship Model

Type of Entity Type

Identifier

Identifying Relationship

Partial Identifier

EMPLOYEE
Employee_ID
Employee_Name

Carries

DEPENDENT
Dependent_Name
(First_Name,
Middle_Initial,
Last_Name)
Date_of_Birth

Strong Entity Type
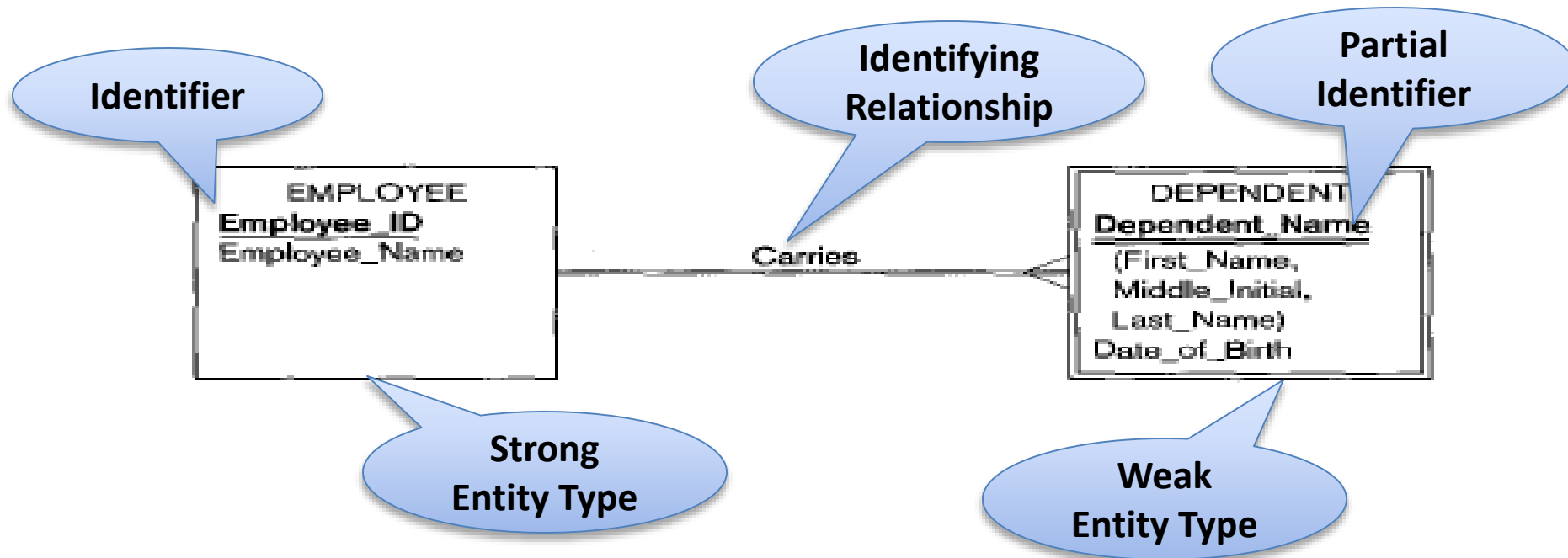
Weak Entity Type

Entity Relationship Model(cont…)

Naming Entity Type

- Singular Name

- Specific to organization

- Name should be Capital

- Abbreviation can be used

Entity Relationship Model(cont...)

Type of Entity Type

- **Term Used**
- **Identifying owner:**
- The entity type on which weak entity type depends is called identifying owner
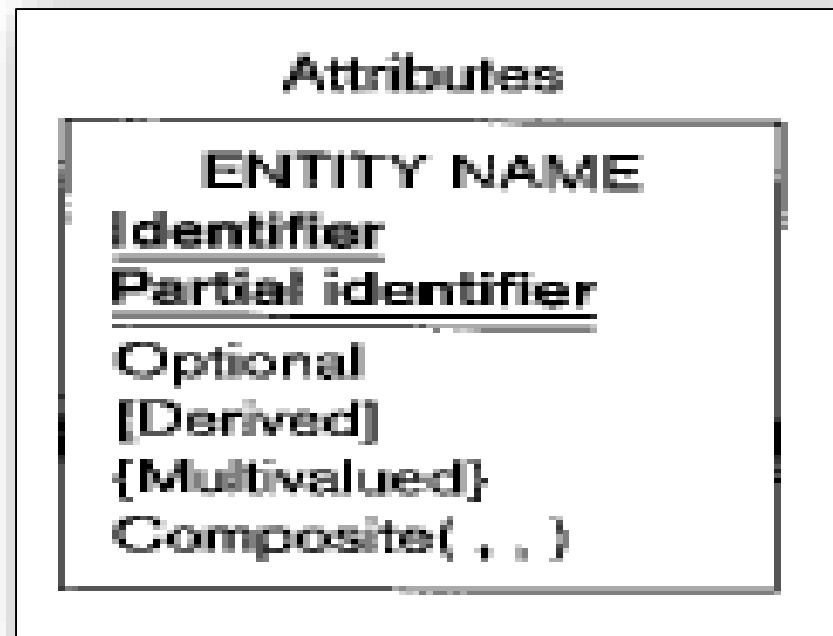
Entity Relationship Model

Attribute

- A properties associated with entity type

- A property or characteristic of an entity type or relationship that is of interest to the organization.

- Attribute may be associated with relationship

- **Example**
  - STUDENT   Student_ID, Student_Name, Phone_Number, Email
  - EMPLOYEE   Employee_ID, Ename, Job, Hiredate

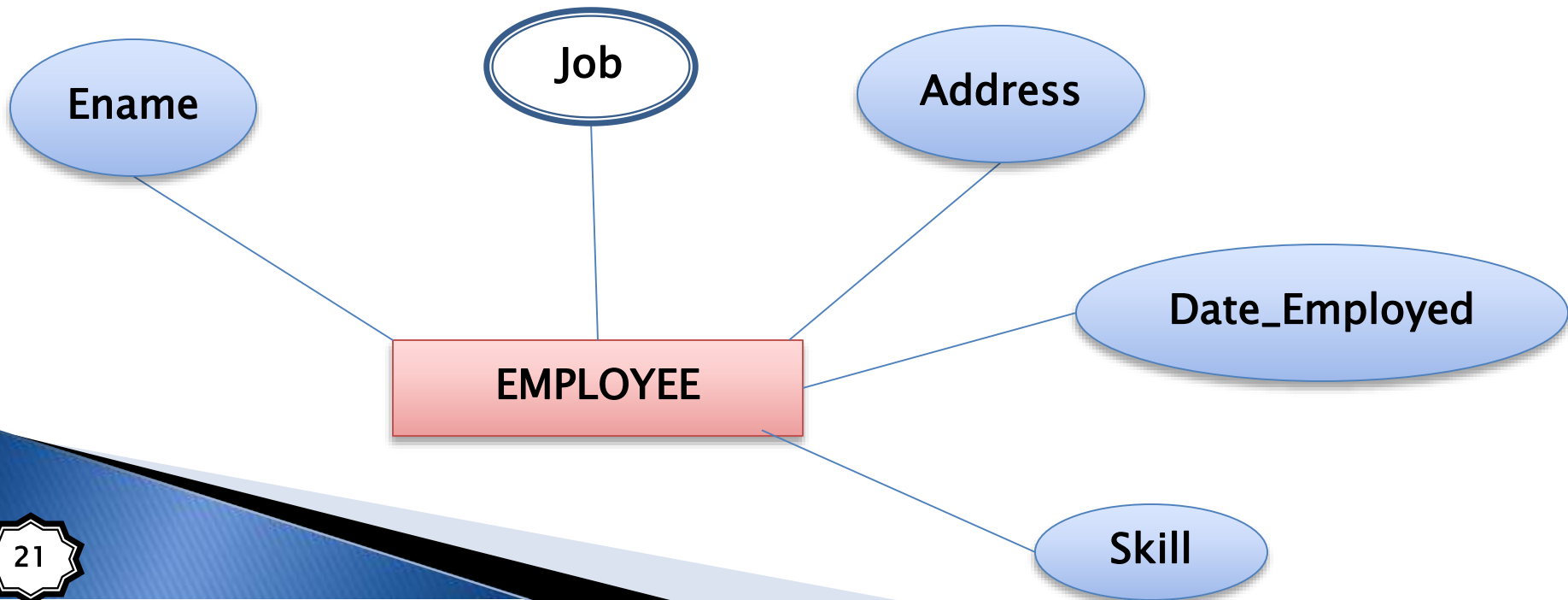# Entity Relationship Model

Attribute

- **Graphical representation**

Attributes

ENTITY NAME
Identifier
Partial identifier
Optional
[Derived]
{Multivalued}
Composite(, ,)

Entity Relationship Model

Attribute

- **Graphical representation**
- **Old Method:** Represented by Oval

Entity Relationship Model

Naming Attribute

➡ Initial capital letter followed by lowercase letters e.g. Ename

➡ If attribute consist of two word then use the underscore character to connect the words and start each word with capital letter e.g. Student_Name

Entity Relationship Model

Domain of an Attribute

- Set of possible value for an attribute is called domain

- Domain can be used for the boundaries check

- Attribute in an entity set get the value from the same domain

Entity Relationship Model

Types of Attribute

➡ Required Attribute

➡ The attribute that must have a value for every instance

➡ Optional Attribute

➡ The attribute that may not have a value for every entity instance

➡ The attribute without a value is said to be null.

Entity Relationship Model

Attribute

- **Required Versus Optional Attribute**

Entity type: STUDENT

Attributes	Attribute Data Type	Required or Optional	Example Instance	Example Instance
Student_ID	CHAR (10)	Required	876-24-8217	822-24-4456
Student_Name	CHAR (40)	Required	Michael Grant	Melissa Kraft
Home_Address	CHAR (30)	Required	314 Baker St.	1422 Heft Ave
Home_City	CHAR (20)	Required	Centerville	Miami
Home_State	CHAR (2)	Required	OH	FL
Home_Zip_Code	CHAR (9)	Required	45459	33321
Major	CHAR (3)	Optional	MIS	

Optional Attribute

Entity Relationship Model

- **Attribute**

- **Simple Attribute**
  - The attribute that can not be broken down into smaller parts or component

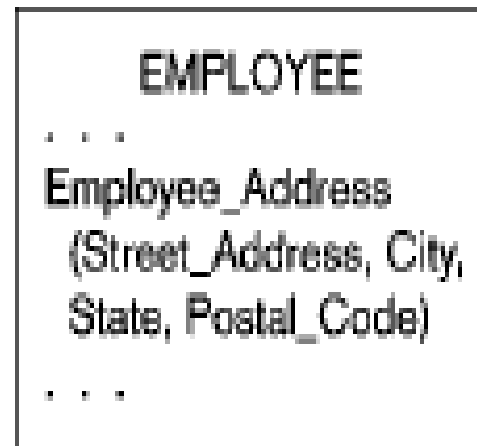 - The attribute having a single value

  - Example: Roll_No, Marks etc.

- **Composite Attribute**
  - The attribute that can be broken down into meaningful component
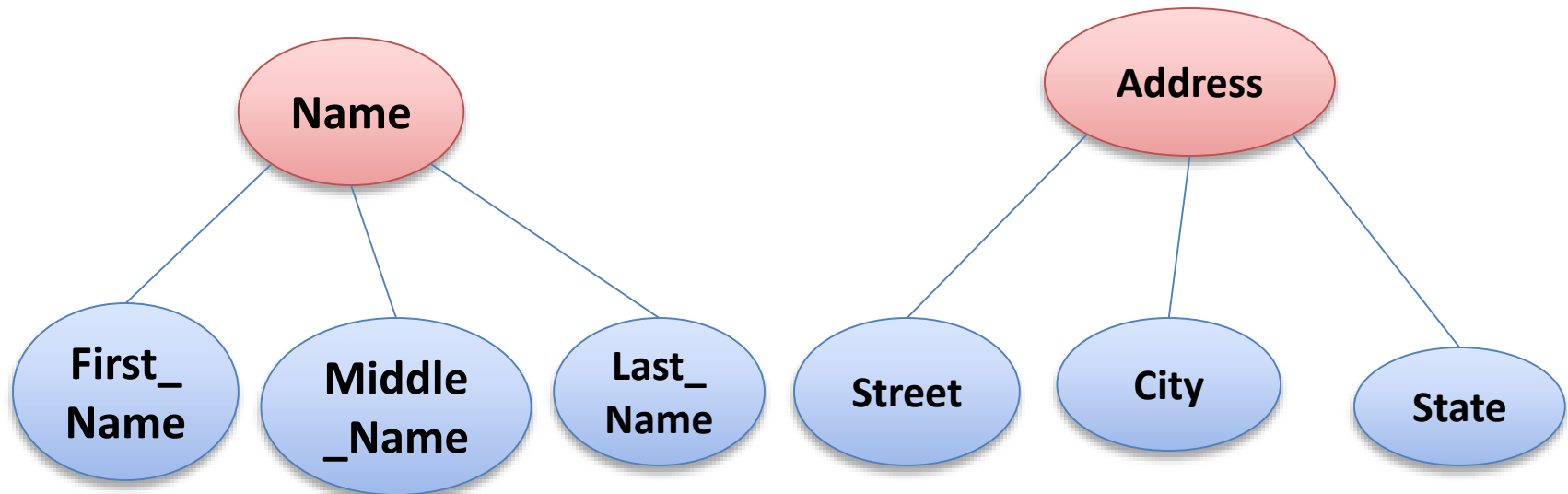
Entity Relationship Model

Attribute

➡ **Graphical representation of Composite Attribute**

```
          EMPLOYEE
. . .
Employee_Address
    (Street_Address, City,
    State, Postal_Code)

. . .
```

Entity Relationship Model

Attribute

- **Graphical representation of Composite Attribute**
- **Old Method**

Entity Relationship Model

Attribute

➥ Single Valued Attribute

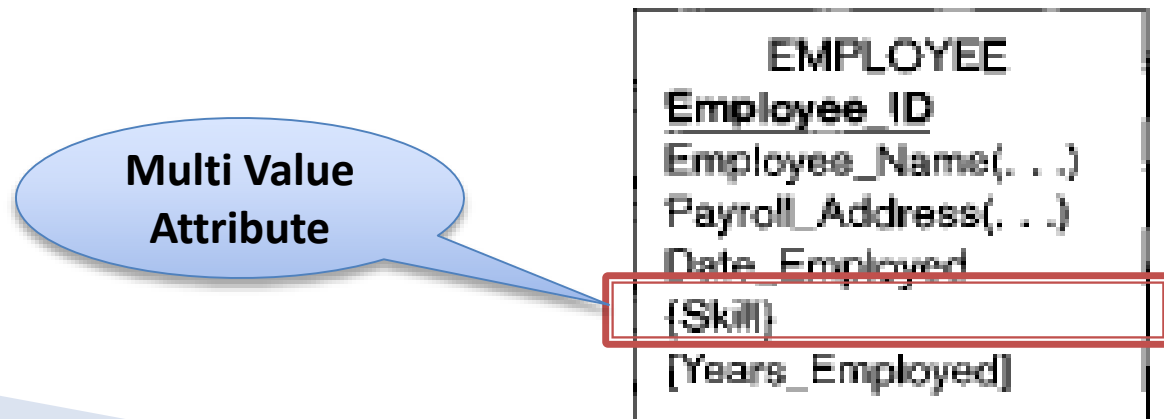➡ The attribute that may take a single value for a given entity instance. For Example CNIC_No

➥ Multi-Valued Attribute

➡ The attribute that may take more then one value for a given instance. For Example Skill, Subject etc
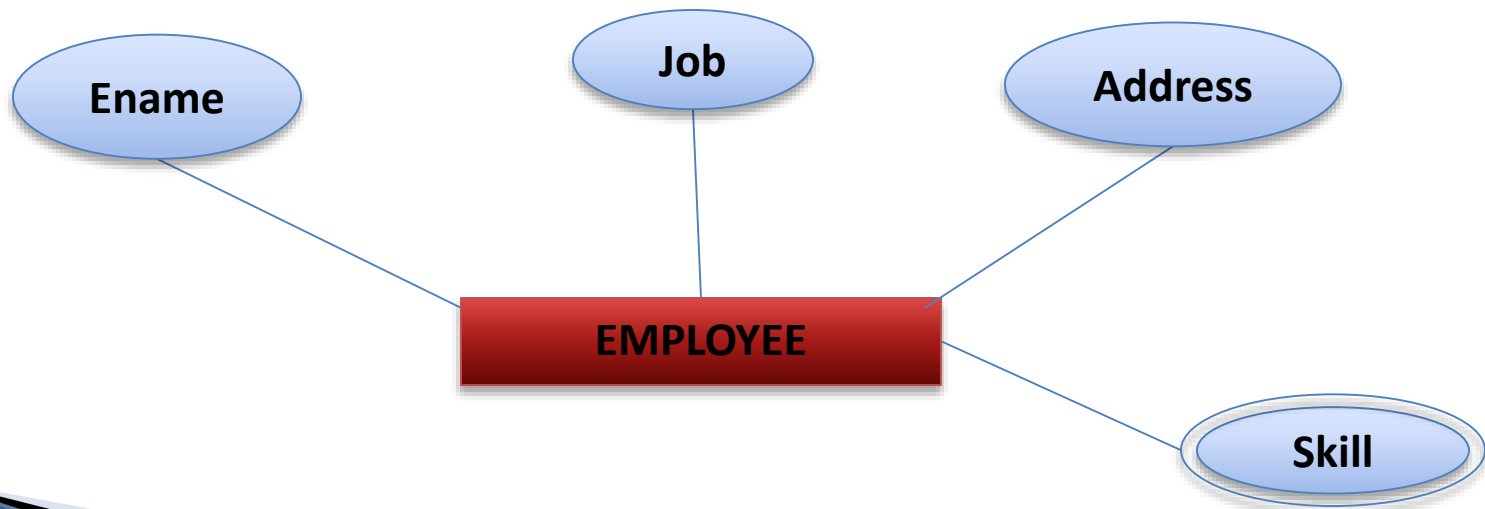
Entity Relationship Model

Attribute

- **Single Valued Versus Multi-valued Attribute**
- Graphical representation of Multi-Valued Attributed

  - To represent the Multi-valued attribute **curly brackets** are used around the attribute name but some ER diagramming tools may use an * after the attribute name.

Multi Value Attribute

EMPLOYEE
Employee_ID
Employee_Name(. . .)
Payroll_Address(. . .)
Date_Employed
{Skill}
[Years_Employed]

Entity Relationship Model

Attribute

- **Single Valued Versus Multi-Valued Attribute**

- Old Graphical representation of Multi-Valued Attributed: **Double line oval / Ellipse**

Entity Relationship Model

Attribute

- **Derived Attribute**

  - The attribute whose value can be calculated from related attribute value.

  - The data not actually store in database but derived from other related attribute that are store in database.
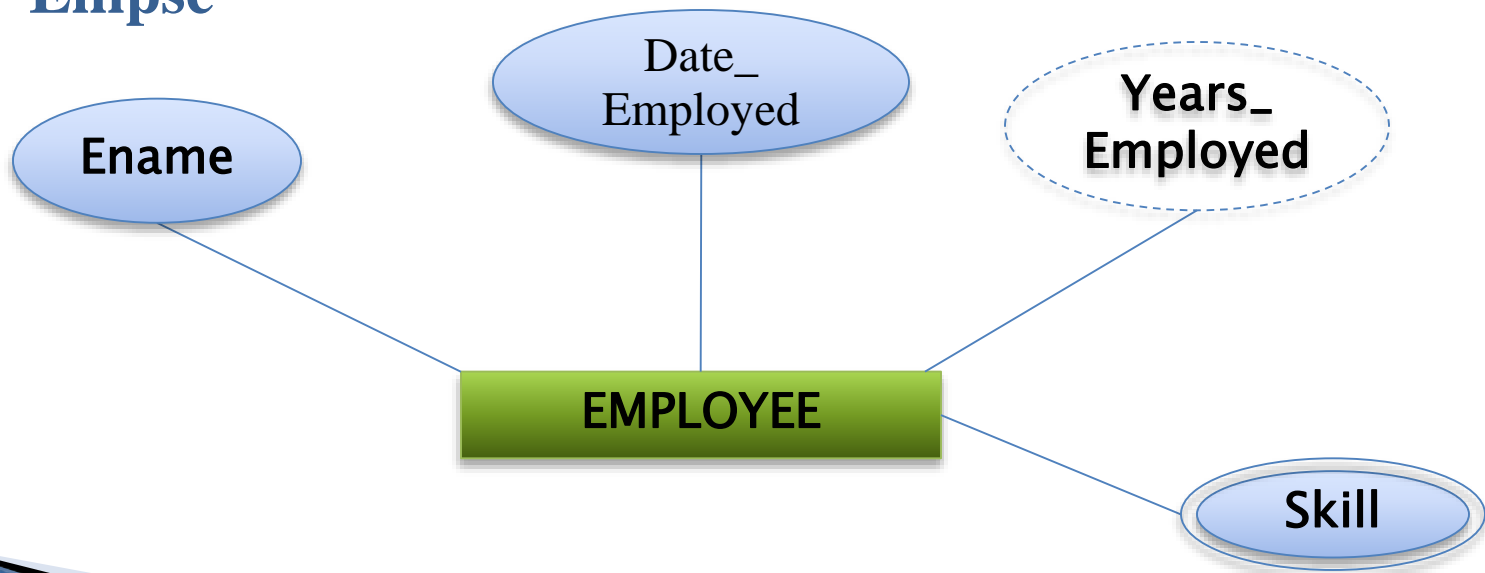
- **Example**

  - Date_Employed attribute used in EMPLOYEE entity type used to calculate Years_Employed

Entity Relationship Model

Attribute

- **Derived Attribute**
- Old Graphical representation of Derived Attributed: **Dashed Ellipse**

Entity Relationship Model

Attribute

- **Derived Attribute**

- Graphical representation of Derived Attributed: **Square Brackets** around the attribute name, e.g. [Years_Employed] but some ER diagramming tools may use forward slash **'/'**.

Derived Attribute

EMPLOYEE
Employee_ID
Employee_Name(. . .)
Payroll_Address(. . .)
Date_Employed
[Skill]
[Years_Employed]

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Entity Relationship Model

Attribute

➥ Identifier Attribute

➥ The attribute or set of attribute that uniquely distinguish each occurrence of entity. Identifier attribute is represented by underline
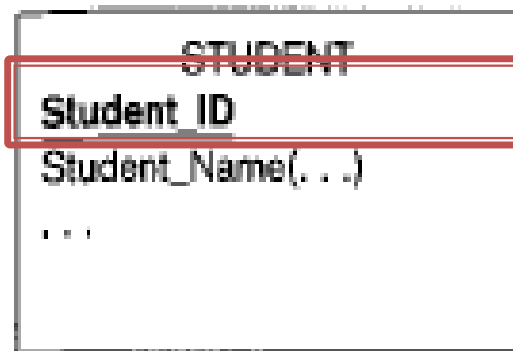
➥ Partial Identifier
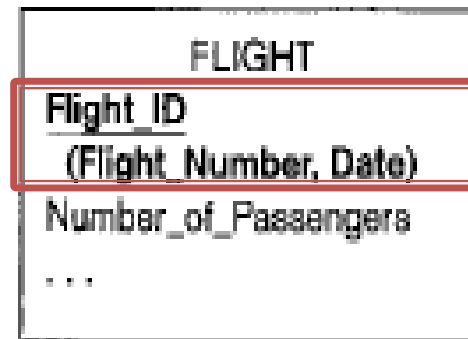
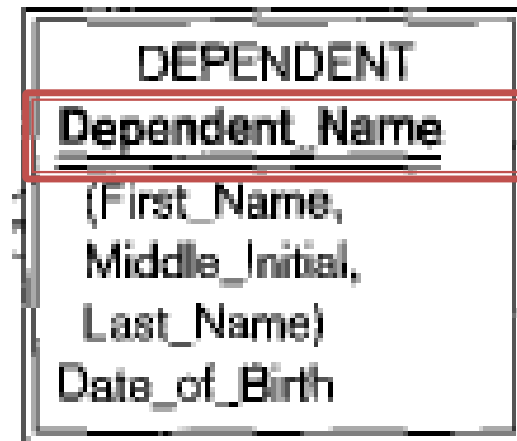➥ Represented by double under line

Entity Relationship Model

Attribute

- **Identifier**

- Graphical representation

STUDENT
Student_ID
Student_Name(. . .)
. . .

Simple identifier attribute

FLIGHT
Flight_ID
  (Flight_Number, Date)
Number_of_Passengers
. . .

(b) Composite identifier attribute

DEPENDENT
Dependent_Name
(First_Name,
Middle_Initial,
Last_Name)
Date_of_Birth

Partial Identifier

Thanks

Questions?