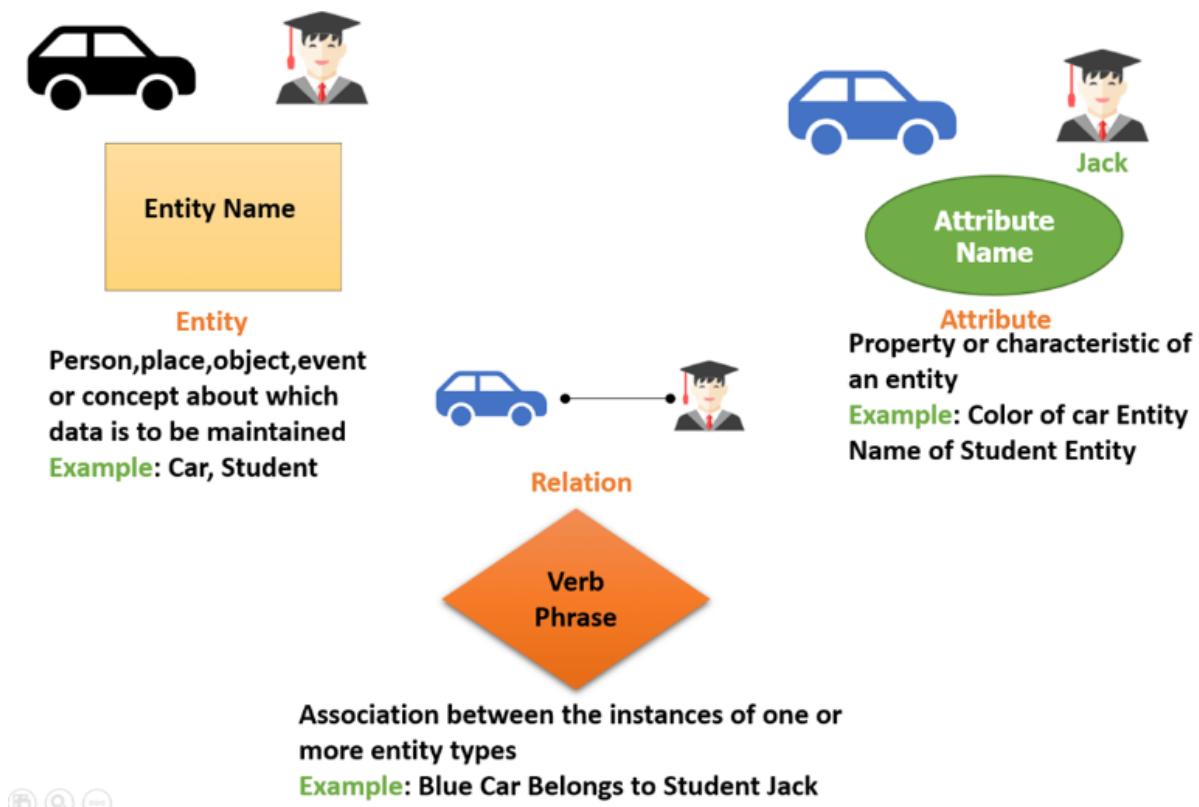
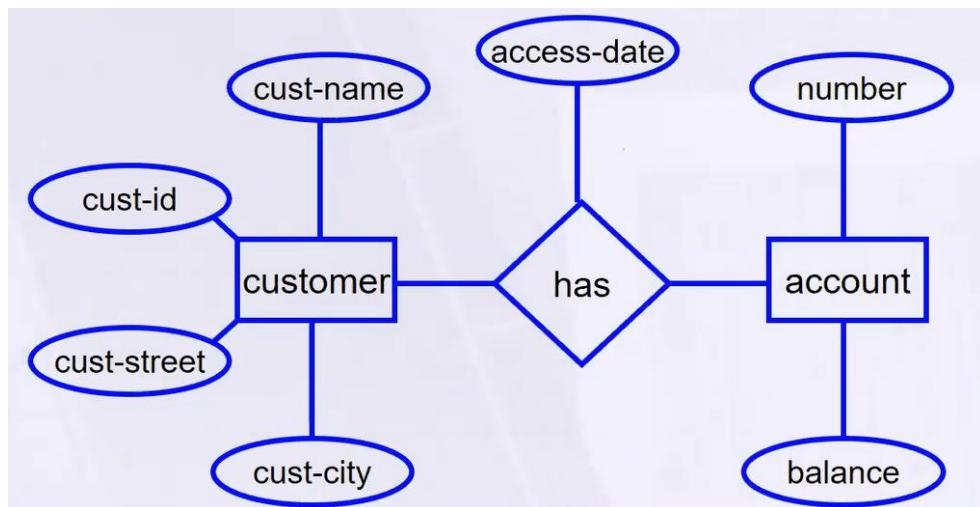
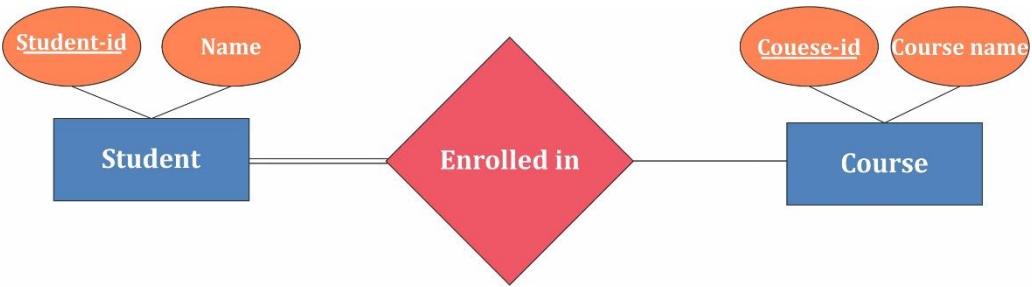


❖ What is an Entity Relationship Diagram (ERD)?

- After gathering the requirements, we start converting these lines into a diagram.
- While you read the requirement lines, try to identify the main components.
- ✓ **Entities:** Any important objects inside the system, it could be:
 - **person/role:** (e.g. Student, employee, Doctor, Teacher)
 - **object:** (e.g. Invoice, Product, Vehicle, Book)
 - **concept:** abstract ideas or categories important to a system (e.g. Profile or account)-> (username, password). (e.g. Permission)-> Represents access rights or privileges granted to users in a system (Attributes could include permission type (read, write, delete), description, and associated roles).
 - **Event:** (e.g. Transaction)-> transaction ID, amount, date. (e.g. Appointment, Login Attempt, Payment, booking, Registration, sale)
- ✓ **Attributes:** column, an attribute is a property or characteristic of the entity that holds it
- ✓ **Relationship:** Links between the entities





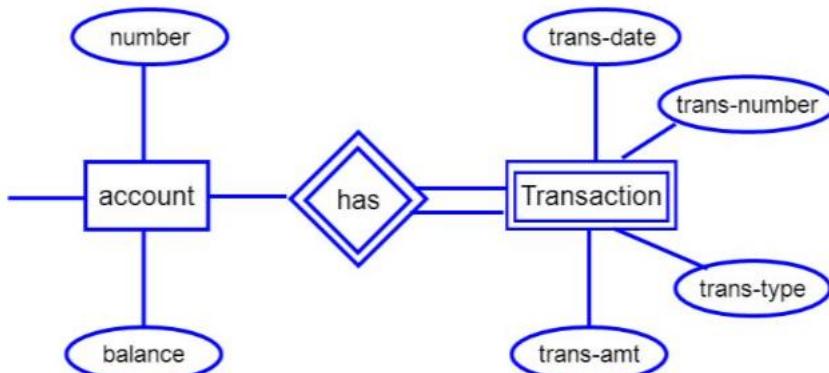
We say that **attribute** is a property or characteristic of the entity, I can see in this diagram that we have attribute on the relationship!!

- This attribute is shared among them.
- Same as (Student and Course)-> where can I put the grade of the student? its shared between them so we will write it on the relationship.
- Number of hours the employee worked on a specific project (Employee and Project)-> number of hours is attribute on the relationship.

❖ Let's learn more about a Strong entity VS Weak Entity 😊



- ✓ we have this example here, "If an employee is dismissed from a specific department, will that department be closed?" No !
- ✓ "Or vice versa, if I close a specific department, does that mean I am dismissing the employees?" No !
- ✓ **Yes, there is a relationship, but it hasn't reached the level where deleting a row from one table would affect the other table. So this is Strong entity (Employee, Department).**



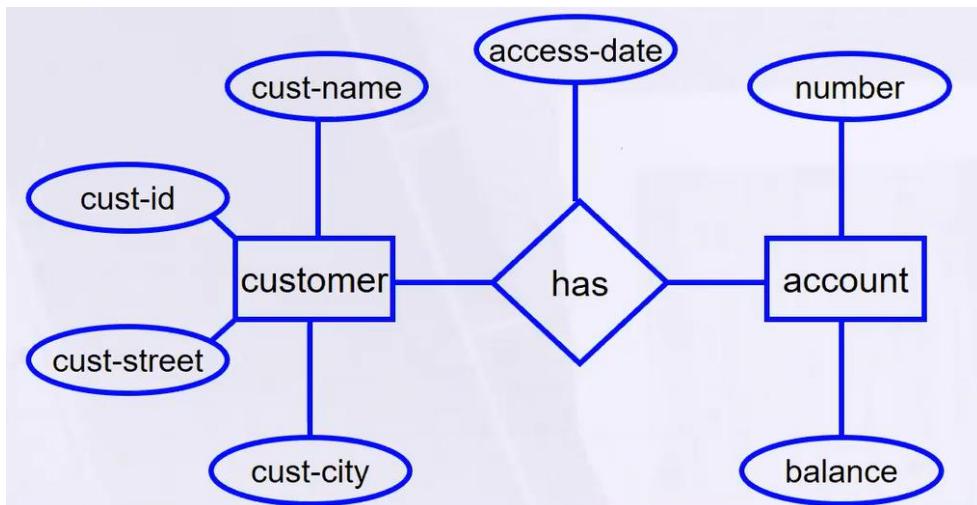
- ✓ **Weak Entities:** It is the Entity which existence in the system can disappear with the disappearance of another entity.
- ✓ **For example:** A person with their credit card uses it to withdraw and deposit money. If they go to the bank to cancel the credit card, is there a need to store the transactions that were made with the credit card? No! So, Transaction is weak entity
- ✓ **If the account disappears -> Transaction will disappear also.**
- ✓ **Another example:** Courses and the labs, if the courses disappeared the labs will automatically disappear.
- ✓ **Another example:** The employee's insurance is cancelled if the employee resigns

Strong entity	Weak Entity
Strong entity set always has a primary key.	It does not have enough attributes to build a primary key.
It is represented by a rectangle symbol.	It is represented by a double rectangle symbol.
It contains a Primary key represented by the underline symbol.	It contains a Partial Key which is represented by a dashed underline symbol.
	In a weak entity set, it is a combination of primary key (account number) and partial key (transaction number).

❖ Types of Attributes 😊

There are different types of attributes as discussed below:

- **Composite Attribute**
- **Multi-Valued Attribute**
- **Derived Attribute**
- **Complex Attribute**
- **Simple Attribute**

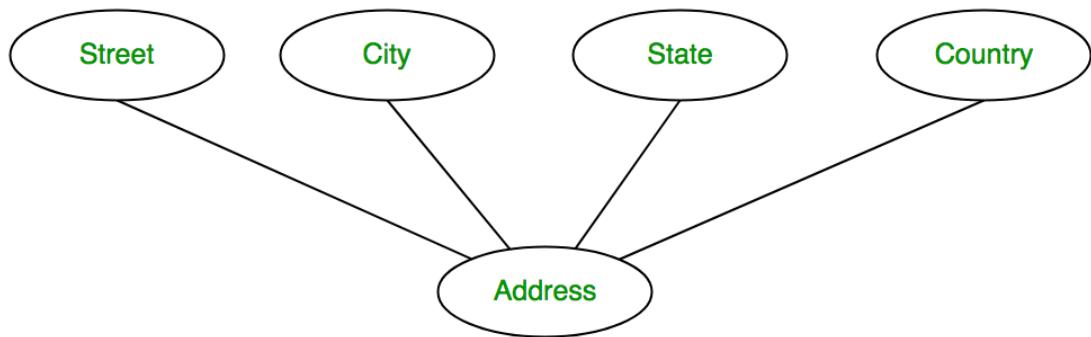


- **Simple Attribute**

If this attribute is not divisible, not calculated at runtime, not repeated for the same person.

- **Example:** City, roll number of a student, the ID number of an employee, gender, name (Is it possible to create an equation to calculate the name?), but if mention (First, Last name)-> **Composite Attribute**

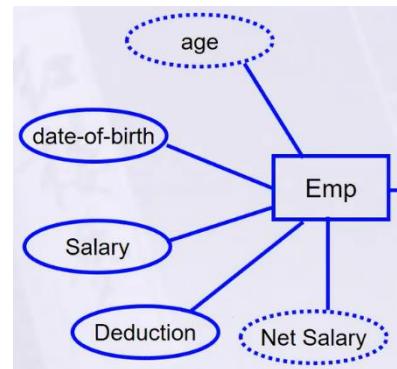




- **Derived Attribute**

Something calculated at runtime, something I can derive from another thing. And it is represented by dotted oval shape.

Example: We have birthday-> I can calculate age, Total and average marks of a student, age of an employee that is derived from date of birth.

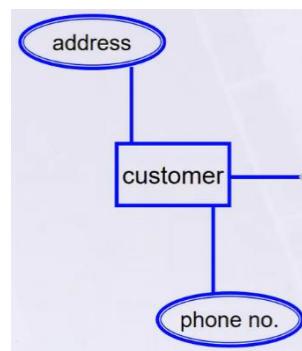


- **Multi-Valued Attribute**

Something that is repeated for the same person.

And it is represented by double oval shape.

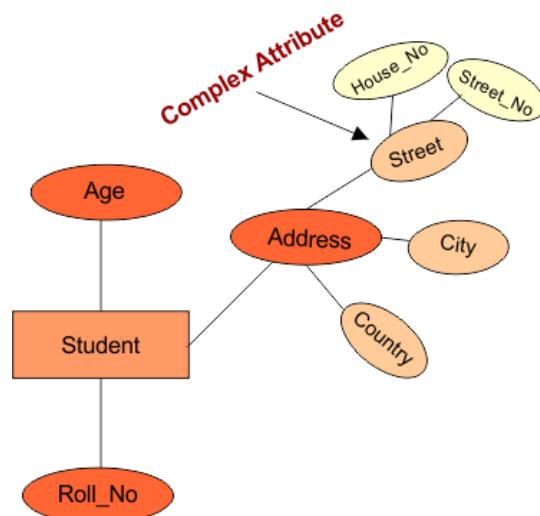
Example: Phone number (more than one)



- **Complex Attribute**

Multi-Valued + Composite

Example: Address because address contain composite value like street, city, state, PIN code and also multivalued because one people has more than one house address.

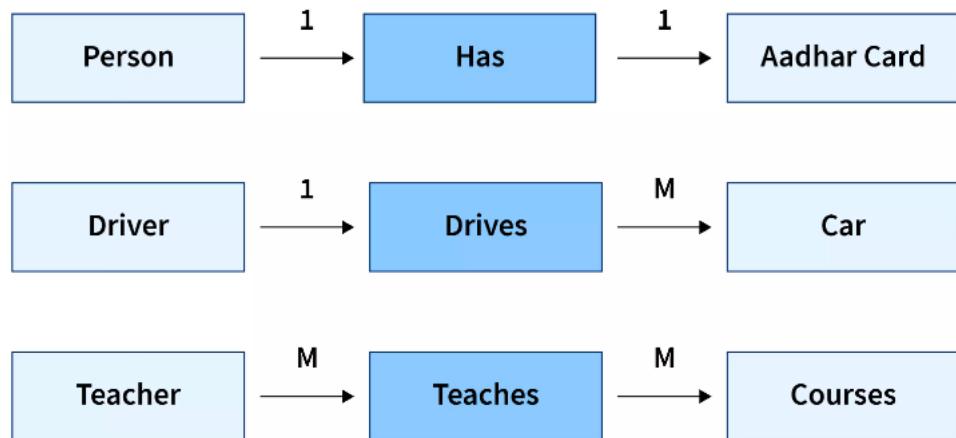


❖ What Is Relationship?

When we read the requirements document, we find nouns and verbs

Nouns: could be entity or attribute.

Verbs: Relationship.



❖ What is the types Of Relationships? 😊

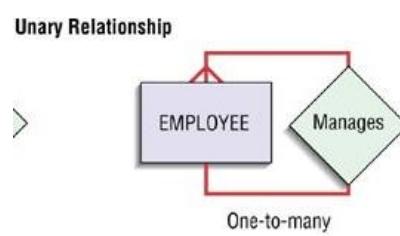
- ✓ Degree of relationship
- ✓ Cardinality constraint
- ✓ Participation constraint

Degree of relationship:

Degree: number of entity types that participate in relationship.

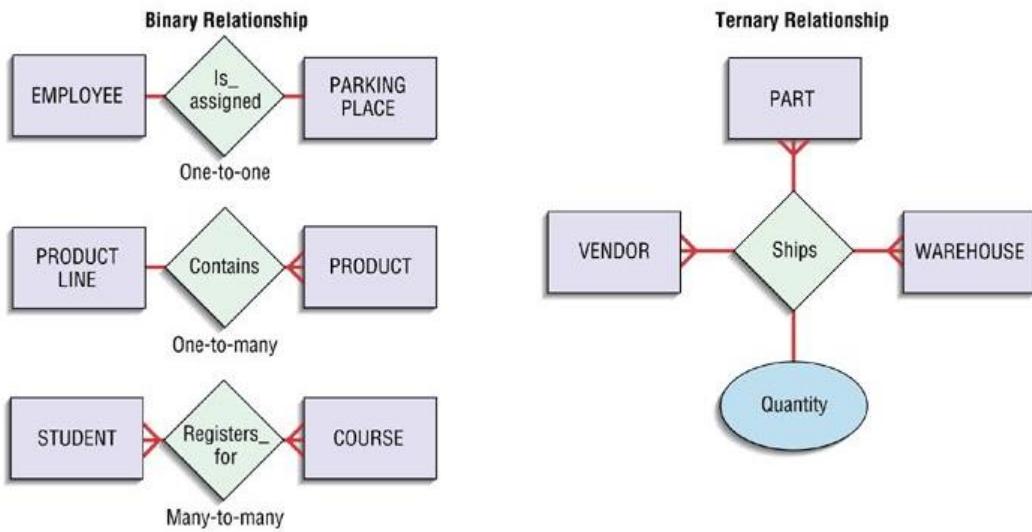
Three cases:

- **Unary:** between 2 instance of one entity type (e.g. shared attribute Employee(id,name) mange Manger (id,name))=> employee could be manger also! So later on we can have one entity. Called (Employee).
- **Binary:** between the instance of 2 entity type(The most common in databases), no attribute is shared.(e.g. Employee and department).



- **Ternary:** among the instance of 3 entity type.

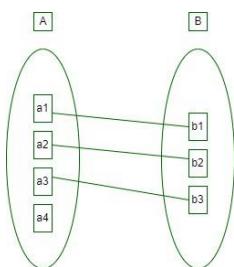
There is a specific attribute that combine three entities. (e.g. Course teaches by number of teacher (Fatma and Karim ☺), Teacher, Student)=>here Grade will appear but if we said that the course is teach by one teacher => this will be binary.



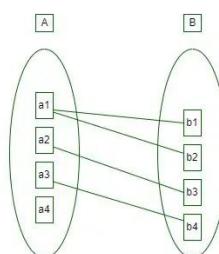
Cardinality constraint:

Each row in the first entity is linked to how many rows in the second entity.

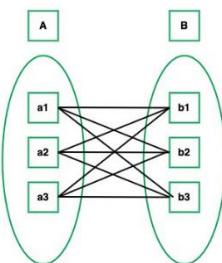
One-to-One



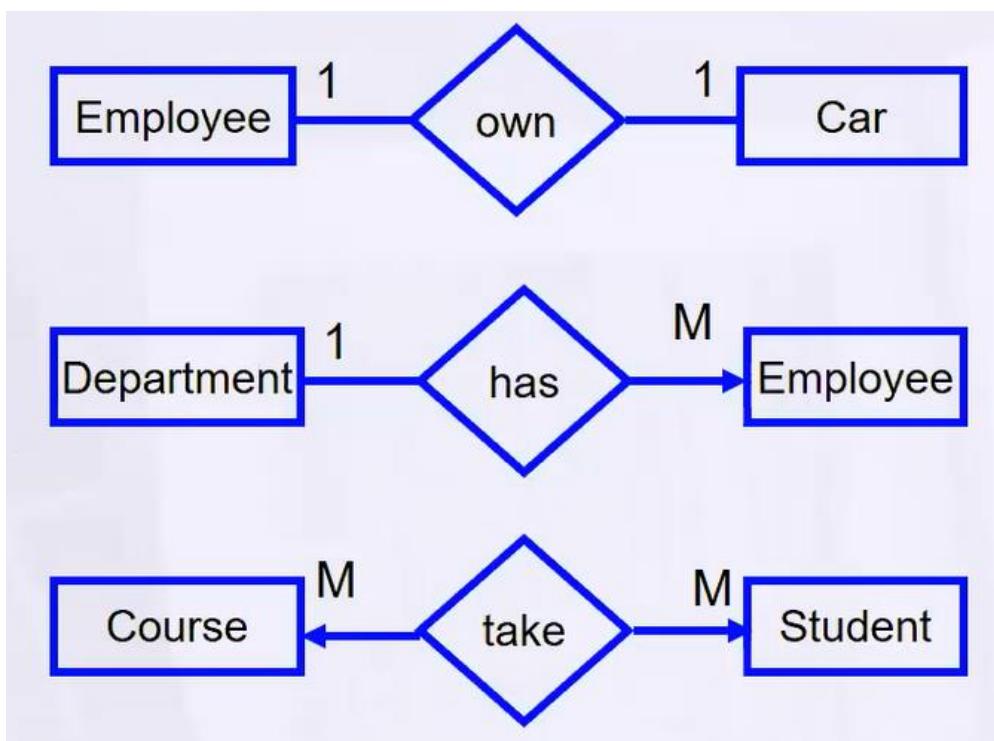
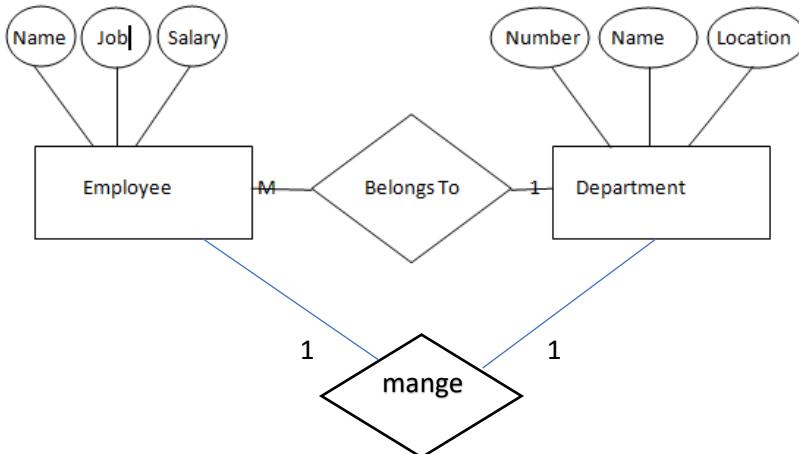
One-to-Many



Many-to-Many



- **One-to-One**
- **One-to-Many**
- **Many-to-Many**

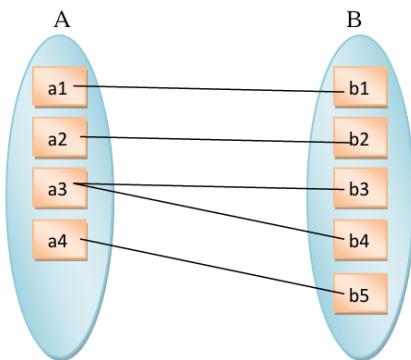


Note: All the cardinality depends on the business requirement. If its not appear in the requirement, ask the system analyst => ***we can ask our specialist Kaim 😊*** Do not assume the logic by yourself!

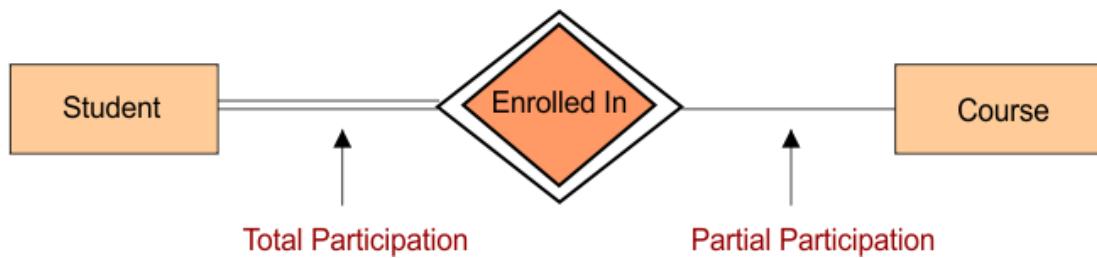
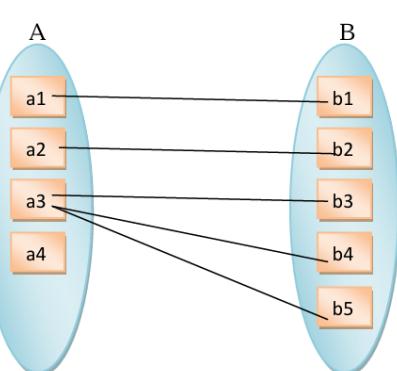
Participation constraint:

- ✓ Are all the rows involved in the relationship or not?
- ✓ **For example:** Do all employees must to have a department?
- ✓ Optional (may, some)= one line
- ✓ Mandatory (must) = 2 lines

Total Participation



Partial Participation



❖ Keys:

- ✓ Primary Key
- ✓ Candidate Key
- ✓ Foreign Key (Tomorrow, we will explain it 😊)
- ✓ Composite Key
- ✓ Partial Key => for the weak entity
- ✓ Super Key
- ✓ Alternate Key
- ✓ Artificial Key ... your job is to search about it there are more than this ! 😊

- There are many attributes, and you want to chose the PK, before you choose the PK you must first **determine candidate Key**.
- **What is candidate key?** the one that could be PK you choose the suitable one.
- **ID => PK with underline.**
- Assume that I don't have ID , so we will go with composite PK (name, address together) اعمل تبادل وتوافق بينهم للاختيار (😊)
- If all the composite is not suitable then we set one PK.

SUMMARY OF ER-DIAGRAM NOTATION FOR ER SCHEMAS

Symbol	<u>Meaning</u>
	ENTITY TYPE
	WEAK ENTITY TYPE
	RELATIONSHIP TYPE
	IDENTIFYING RELATIONSHIP TYPE
	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
	STRUCTURAL CONSTRAINT (min, max) ON PARTICIPATION OF E IN R