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## Draw ER Diagram: Example 1

- ❑ A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books, but one book can be bought by one shop owner only. Books are uniquely identified by book id.

✓ Identify the entities, attributes and relationship.

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## Identifying Entities

- A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books, but one book can be bought by one shop owner only. Books are uniquely identified by book id.

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## Identifying Entities

- Identify the Entities:
- ✓ Publishing Company / Publisher
  - ✓ Book
  - ✓ Subject
  - ✓ Author
  - ✓ Editor
  - ✓ Item
  - ✓ Supplier
  - ✓ Shop Owner

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## Identifying Attributes for Entities

### □ Identify the Entities:

- ✓ Publishing Company / Publisher: Name, Address, Phone, Established\_date, etc.
- ✓ Book: Book\_Id, Book\_Name, Book\_Price, Print\_Date, etc;
- ✓ Subject: Subject\_Code, Subject\_Name;
- ✓ Author: Author\_Id, Author\_Name, Author\_Details, etc.
- ✓ Editor: Editor\_Id, Editor\_Name, No\_of\_BooksEdited, etc.
- ✓ Item: Item\_No, Item\_Name, Manufactured\_Date, Expiry\_Date, etc.
- ✓ Supplier: Supplier\_id, Supplier\_Name, No\_of\_items, Date, Phone, etc.
- ✓ Shop Owner: Name, Address, Phone, etc.

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## Identifying Relationships

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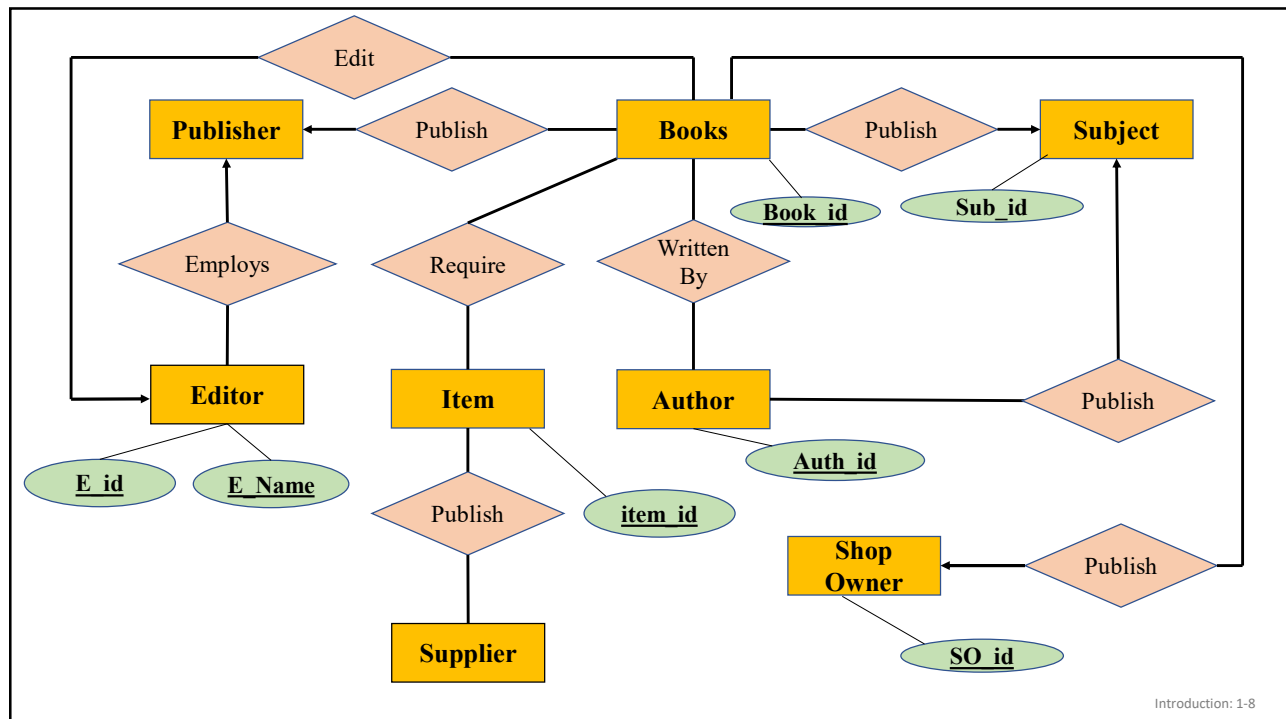
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## Identify the Relationship

- ✓ Publisher – Book : Produces
- ✓ Book – Subject : On / About
- ✓ Book – Author : Written by
- ✓ Subject – Author: Specialize in
- ✓ Publisher – Editor: Employs
- ✓ Editor – Book: Edit
- ✓ Item – Book: Require
- ✓ Supplier – Item: Supplied by
- ✓ Shop Owner – Book: Buy

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## Degree of Relationship Set

- The total number of entity sets participating in a relationship set is known as degree of relationship set.
- Types of Relationship Set
  - Unary Relationship Set
    - ✓ When there is only one entity set participating in a relationship then such type of relationship is called unary relationship.
  - Binary Relationship Set
    - ✓ When there are exactly two entity sets participating in a relationship then such type of relationship is called binary relationship.

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## Degree of Relationship Set

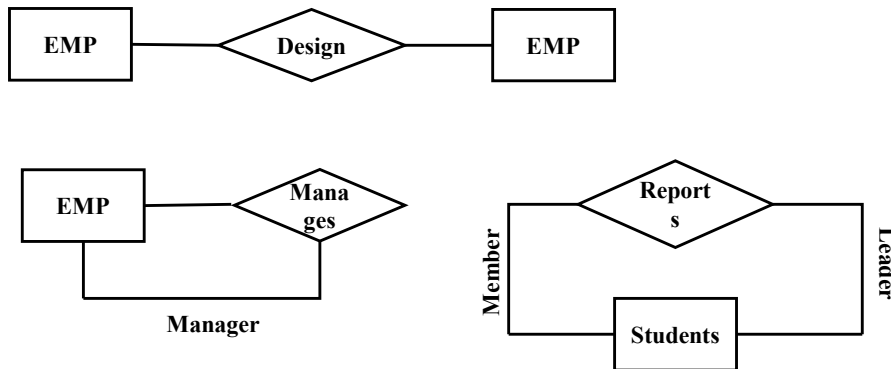
- Ternary Relationship Set
  - ✓ When there are exactly three entity sets participating in a relationship then such type of relationship is called ternary relationship.
- N-Ary Relationship Set
  - ✓ When a large number of entity sets are participating in a relationship, then such type of relationship is called an n-ary relationship.

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## Unary Relationship Set

- When there is only one entity set participating in a relationship then such type of relationship is called unary relationship.

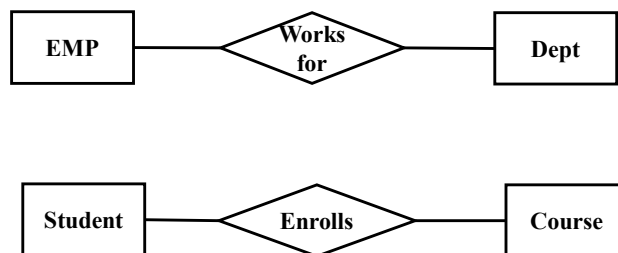


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## Binary Relationship Set

- When there are exactly two entity sets participating in a relationship then such type of relationship is called binary relationship.

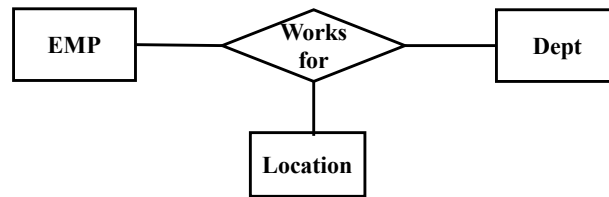


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## Ternary Relationship Set

- When there are exactly three entity sets participating in a relationship then such type of relationship is called binary relationship.

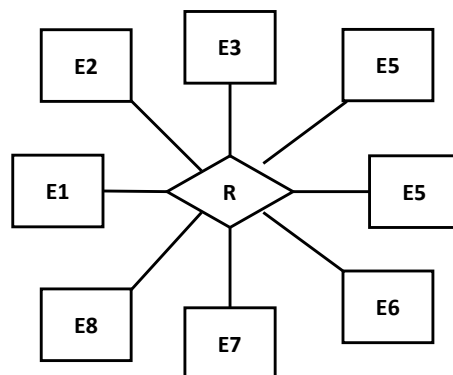


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## N-Ary Relationship Set

- When a large number of entity sets are participating in a relationship, then such type of relationship is called an n-ary relationship.



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## Mapping Cardinalities / Cardinality Ratio

- Cardinality defines the number of entity (maximum) of an entity set participates in a relationship set.

Or

It specify the number of entities of an entity set that are associated with entities of another entity set through relationship set

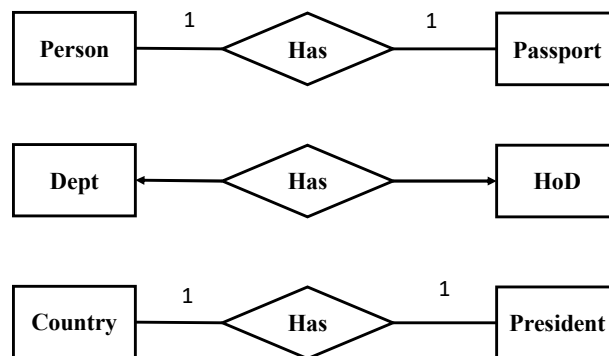
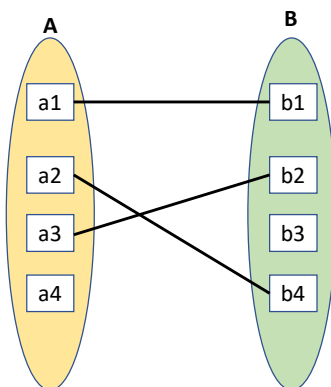
- Most useful in binary relationship.
- Cardinality can be different types
  - One to One (1-1)
  - One to Many (1-m)
  - Many to One (m-1)
  - Many to Many (m-n)

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## One to One (1-1)

- One entity of entity set A can be associated with at most one entity of entity set B and vice versa.
- E.g., A department has one HoD and A HoD belongs to One department.



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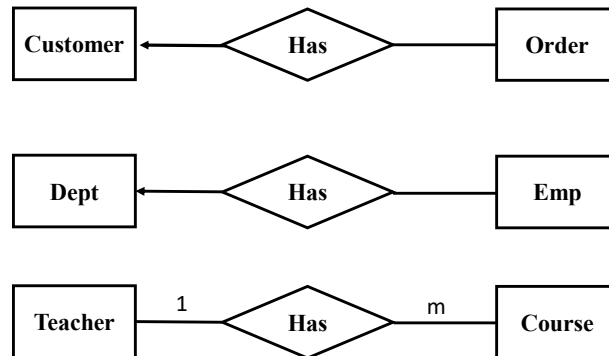
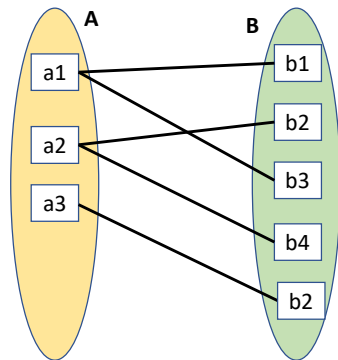


## One to Many (1-m)

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- One entity from entity set A can be associated with more than one entity of entity set B, however an entity of entity set B, can be associated with at most one entity of entity set A.

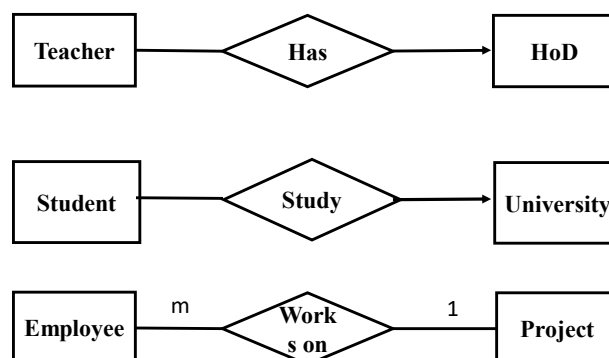
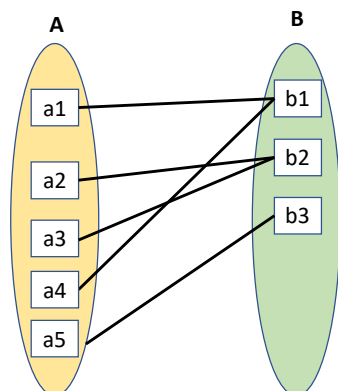


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## Many to One (m-1)

- More than one entities from entity set A can be associated with at most one entity of entity set B, however an entity of entity set B, can be associated with at most one entity of entity set A.

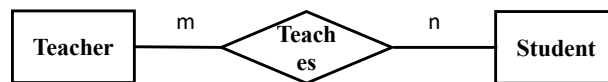
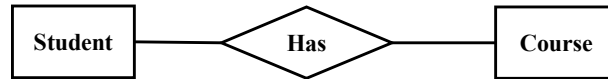
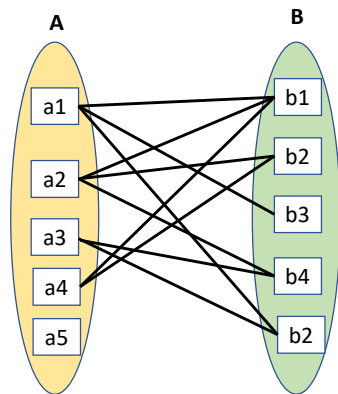


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## Many to Many (m-n)

- One entity of entity set A can be associated with more than one entity of entity set B, and vice versa.
  - E.g., One student can study multiple courses and many students can be registered in one course.



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## How to Choose Relationship?

- The appropriate mapping cardinality for a particular relationship set depends on the real-world situation being modeled.
- Consider Borrower relationship set in bank:
  - If a particular bank, a loan can belong to one customer and a customer can have only one loan then relationship set from customer to loan 1:1.



- If a loan can belong to only one customer and a customer can have several loans then relationship set from customer to loan 1:m.



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## How to Choose Relationship?

- Continued...
- Consider **Borrower** relationship set in bank:
  - If a loan can belongs to several customers and a customer can have only one loan then relationship set from customer to loan m:1.



- If a loan can belongs to several customers and a customer can have several loans then relationship set from customer to loan m:n.



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## Participation Constraints

- Participation Constraints is applied on the entity participating in the relationship set.

Or

- Participation constraint specifies the existence of an entity when it is related to another entity in a relationship type.
- It is also called **minimum cardinality** constraint.
- Types of participation constraints
  - **Total** Participation
  - **Partial** Participation

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## Participation Constraints

### ■ Total Participation

- Each entity is involved in the relationship.
- It is denoted by **double lines**.
- E.g., participation of loan in borrower is total.
  - Every loan must have a customer associated to it via borrower.

### ■ Partial Participation

- Not all entities are involved in the relationship.
- It is denoted by **single lines**.
- E.g., participation of customer in borrower is partial.
  - A customer may have no loan.



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- ✓ Identify the cardinality mappings, participation constraints .

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## Identifying Cardinality

- ❑ A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by book id.

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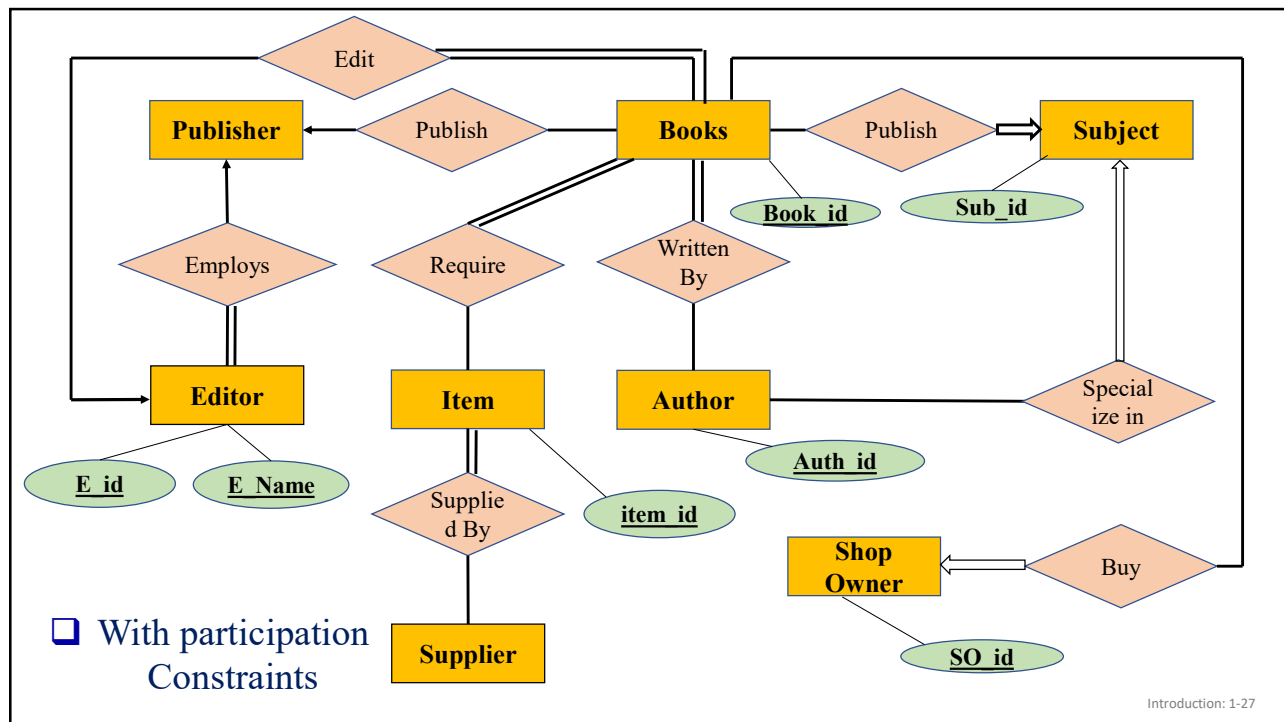
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## Draw ER Diagram: Example 1

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>❑ Identify the Relationship:</li> <li>✓ Publisher – Book : Produces</li> <li>✓ Book – Subject : On / About</li> <li>✓ Book – Author : Written by</li> <li>✓ Subject – Author: Specialize in</li> <li>✓ Publisher – Editor: Employs</li> <li>✓ Editor – Book: Edit</li> <li>✓ Item – Book: Require</li> <li>✓ Supplier – Item: Supplied by</li> <li>✓ Shop Owner – Book: Buy</li> </ul> | <ul style="list-style-type: none"> <li>❑ Identify the Cardinality:</li> <li>✓ Publisher – Book : One to Many</li> <li>✓ Book – Subject : Many to One</li> <li>✓ Book – Author : Many to Many</li> <li>✓ Subject – Author: One to Many</li> <li>✓ Publisher – Editor: One to Many</li> <li>✓ Book – Editor: Many to One</li> <li>✓ Book – Item: Many to Many</li> <li>✓ Supplier – Item: Many to Many</li> <li>✓ Book – Shop Owner: Many to One</li> </ul> |
|---|---|

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## Keys in DBMS

- Definition: A key is **an attribute or set of attributes** that **uniquely identifies** any **record or tuple or entity** from a table/entity set /relation.
- Purpose:
  - Key is used to **uniquely identify** any record or row of data from the table.
  - It is also used to **establish and identify relationships** between tables.

Emp_Id	Emp_Name	Department	Phone	City	Email
101	Khánh	SE	9023453123	HCM	khanh@gmail.com
102	Đạt	SE	8048125672	Hanoi	dat02@gmail.com
103	Đạt	SE	8231596142	Hanoi	dat03@gmail.com
104	Kiệt	CNDC	9023185962	TDM	kiet@gmail.com

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## Types of Keys in DBMS

- ✓ Super key
- ✓ Candidate Key
- ✓ Primary Key
- ✓ Alternate Key
- ✓ Foreign Key
- ✓ Composite Key

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## Super key

- It is a combination of all possible attributes that can uniquely identify the rows or tuples in the given relation.
  - Super key is a super set of a candidate key.
  - A table can have many super keys.
  - A super key may have additional attributes that are not needed for unique identity.

Emp_Id	Name	Aadhar_No	Email_Id	Dept_Id
01	Aman	775762540011	aa@gmail.com	1
02	Neha	876834788522	nn@gmail.com	2
03	Neha	996677898677	ss@gmail.com	2
04	Vimal	796454638800	vv@gmail.com	3

### Super Keys:

1. {Emp\_Id}
2. {Aadhar\_No}
3. {Email\_Id}
4. {Emp\_Id, Aadhar\_No}
5. {Aadhar\_No, Email\_Id}
6. {Emp\_Id, Email\_Id}
7. {Emp\_Id, Aadhar\_No, Email\_Id}
8. {Emp\_Id, Name}
9. {Emp\_Id, Name, Dept\_Id}
10. {Emp\_Id, Name, Aadhar\_No, Email\_Id, Dept\_Id}, etc....

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## Candidate key

- It is a attribute or set of attributes that uniquely identifies a record or tuple or entity from a table/entity set/relation.
- **Minimal of a Super key is a candidate key** or super key with no redundant attributes.
  - It is called a minimal super key because we select a candidate key from a set of super key such that selected candidate key is the minimum attribute required to uniquely identify the tuple or row in a table.
  - Candidate keys are defined as distinct set of attributes from which primary key can be selected.
  - Candidate keys are not allowed to have null values.

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## Candidate key

- **Minimal of Super key is candidate key. Find candidate key.**

Emp_Id	Name	Aadhar_No	Email_Id	Dept_Id
01	Aman	775762540011	aa@gmail.com	1
02	Neha	876834788522	nn@gmail.com	2
03	Neha	996677898677	ss@gmail.com	2
04	Vimal	796454638800	vv@gmail.com	3

### Super Keys:

1. {Emp\_Id}
2. {Aadhar\_No}
3. {Email\_Id}
4. {Emp\_Id, Aadhar\_No}
5. {Aadhar\_No, Email\_Id}
6. {Emp\_Id, Email\_Id}
7. {Emp\_Id, Aadhar\_No, Email\_Id}
8. {Emp\_Id, Name}
9. {Emp\_Id, Name, Dept\_Id}
10. {Emp\_Id, Name, Aadhar\_No, Email\_Id, Dept\_Id}, etc....

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## Candidate key

- Minimal of Super key is candidate key. Find candidate key.

Emp_Id	Name	Aadhar_No	Email_Id	Dept_Id
01	Aman	775762540011	aa@gmail.com	1
02	Neha	876834788522	nn@gmail.com	2
03	Neha	996677898677	ss@gmail.com	2
04	Vimal	796454638800	vv@gmail.com	3

### Super Keys:

1. ✓ {Emp\_Id}      4. ✗ {Emp\_Id, Aadhar\_No}      7. ✗ {Emp\_Id, Aadhar\_No, Email\_Id}  
 2. ✓ {Aadhar\_No}      6. ✗ {Aadhar\_No, Email\_Id}      8. ✗ {Emp\_Id, Name}  
 3. ✓ {Email\_Id}      9. ✗ {Emp\_Id, Email\_Id}      9. ✗ {Emp\_Id, Name, Dept\_Id}  
 10. ✗ {Emp\_Id, Name, Aadhar\_No, Email\_Id, Dept\_Id},  
 etc....

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## Candidate key

- Minimal of Super key.

Emp_Id	Name	Aadhar_No	Email_Id	Dept_Id
01	Aman	775762540011	aa@gmail.com	1
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03	Neha	996677898677	ss@gmail.com	2
04	Vimal	796454638800	vv@gmail.com	3

### Candidate Keys

1. {Emp\_Id}
2. {Aadhar\_No}
3. {Email\_Id}

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## Primary key


- It is **one of the candidate key** chosen database designer like DBA to uniquely identify the tuple in the table or relation.
- Features of Primary Key:
  - ❖ The value of primary key can never be null.
  - ❖ The value of primary key must be unique (not duplicate).
  - ❖ The value of primary key can never be changed (i.e. no updation possible).
  - ❖ The value of primary key must be assigned when inserting a record.
  - ❖ A relation or table is allowed to have only one primary key.

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## Primary key

**Primary Key**



Emp_Id	Name	Aadhar_No	Email_Id	Dept_Id
01	Aman	775762540011	aa@gmail.com	1
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03	Neha	996677898677	ss@gmail.com	2
04	Vimal	796454638800	vv@gmail.com	3

- **Primary Key**
1. {Emp\_Id}

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## Alternate key

- Out of all candidate keys, only one gets selected as primary key and **remaining keys** are known as alternate keys.
- In the Previous example “**Emp\_Id**” is best suitable for primary key. So, rest of the candidate keys like *Aadhar\_No*, *Email\_Id* are considered as a alternate key.

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## Foreign key

- A Foreign key is
  - ❖ A key is used to **link two tables** together.
  - ❖ **An attribute or set of attributes** in one table that refers to the primary in the another table.

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## Foreign key

- The purpose of the foreign key is to ensure referential integrity of the data.
- Foreign key references the primary key of the table.
- Foreign key can take only those values which are present in the primary key of the referenced relation or table.
- There is no restriction on a foreign to be unique.
- Referenced relation or table may also be called as master table or primary table.
- Referencing relation or table is called as the foreign table.

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## Foreign key



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## Composite key

- A key that has more than one attributes then it is known as composite key. It is also known as compound key.

Cust_Id	Order_Id	Product_Code	Product_Count
C01	001	P111	5
C02	012	P111	8
C02	012	P222	6
C01	001	P333	9

### Composite Key:

{Cust\_Id, Product\_Code}

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- ✓ Identify the keys .

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## Identifying Primary Key

- A publishing company produces books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books, but one book can be bought by one shop owner only. Books are uniquely identified by **book id**.

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## Chapter 1: Exercises 1

- **Question 1:** In the relational modes, cardinality is termed as \_\_\_\_\_.
  - (A) Number of tuples.
  - (B) Number of attributes.
  - (C) Number of tables.
  - (D) Number of constraints.
- **Question 2:** DML is provided for \_\_\_\_\_.
  - (A) Description of logical structure of database.
  - (B) Addition of new structures in the database system.
  - (C) Manipulation & processing of database.
  - (D) Definition of physical structure of database system.

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## Chapter 1: Exercises 1

- **Question 3:** An entity set that does not have sufficient attributes to form a primary key is a \_\_\_\_\_.
  - (A) Strong entity set.
  - (B) Weak entity set.
  - (C) Simple entity set.
  - (D) Primary entity set.
  
- **Question 4:** In a Hierarchical model, records are organized as \_\_\_\_\_.
  - (A) Graph.
  - (B) List.
  - (C) Links.
  - (D) Tree.

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## Chapter 1: Exercises 1

- **Question 5:** Which one of the following statements is false?
  - (A) The data dictionary is normally maintained by the database administrator.
  - (B) Data elements in the database can be modified by changing the data dictionary.
  - (C) The data dictionary contains the name and description of each data element.
  - (D) The data dictionary is a tool used exclusively by the database administrator.
  
- **Question 6:** E-R model uses \_\_\_\_\_ symbol to represent weak entity set.
  - (A) Dotted rectangle.
  - (B) Diamond
  - (C) Doubly outlined rectangle
  - (D) None of these

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