



# COMPUTER SCIENCE

## Database Management System

ER Model



Lecture\_3



Vijay Agarwal sir



TOPICS  
TO BE  
COVERED

01

Foreign Key Concepts

02

ER to RDBMS Conversions



# Foreign key

(Contain F.K) Referencing Reln

(Referenced by FK) Referenced Reln

Foreign key Constraints

Primary key (unique + Not Null)

- ① ON DELETE NO ACTION
- ② ON DELETE CASCADE
- ③ ON DELETE SET NULL.

- The Value Present in the foreign key must be Present in Primary key.
- Foreign key may contain Duplicates & NULL value.

### Referenced Reln

✓ Insertion

✗ Deletion (May Cause Violation)

### Referencing Reln (which contains F.K)

✓ Deletion

✗ Insertion (may cause Violation)

# ER MODEL

- Entity & Entity Set
- Relationship & Relationship Set
- Attribute & its type.
- Degree of Relationship Set  
*(How Many Number of Entity set Participating)*
- Participation Constraints

Cardinality Ratio  
(Entity participate)

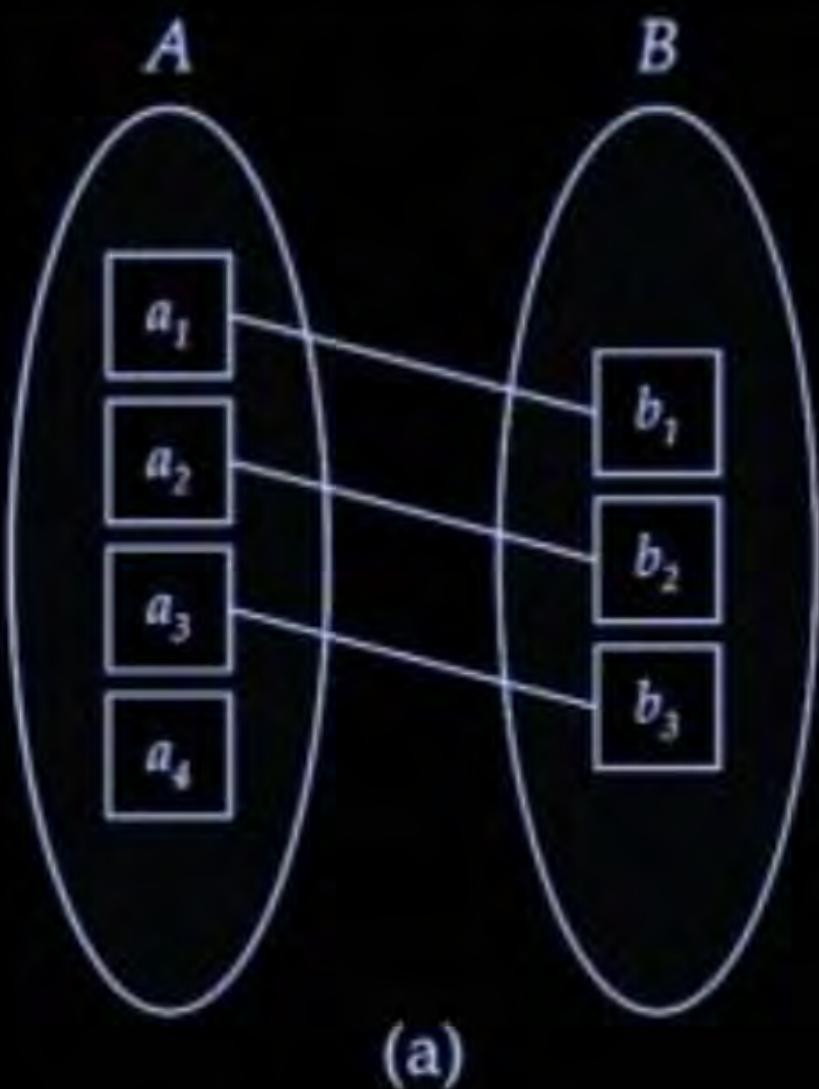
- ① 1 : 1
- ② 1 : M
- ③ M : 1
- ④ M : N

Total/Full Participation (=)  
Partial Participation (-)

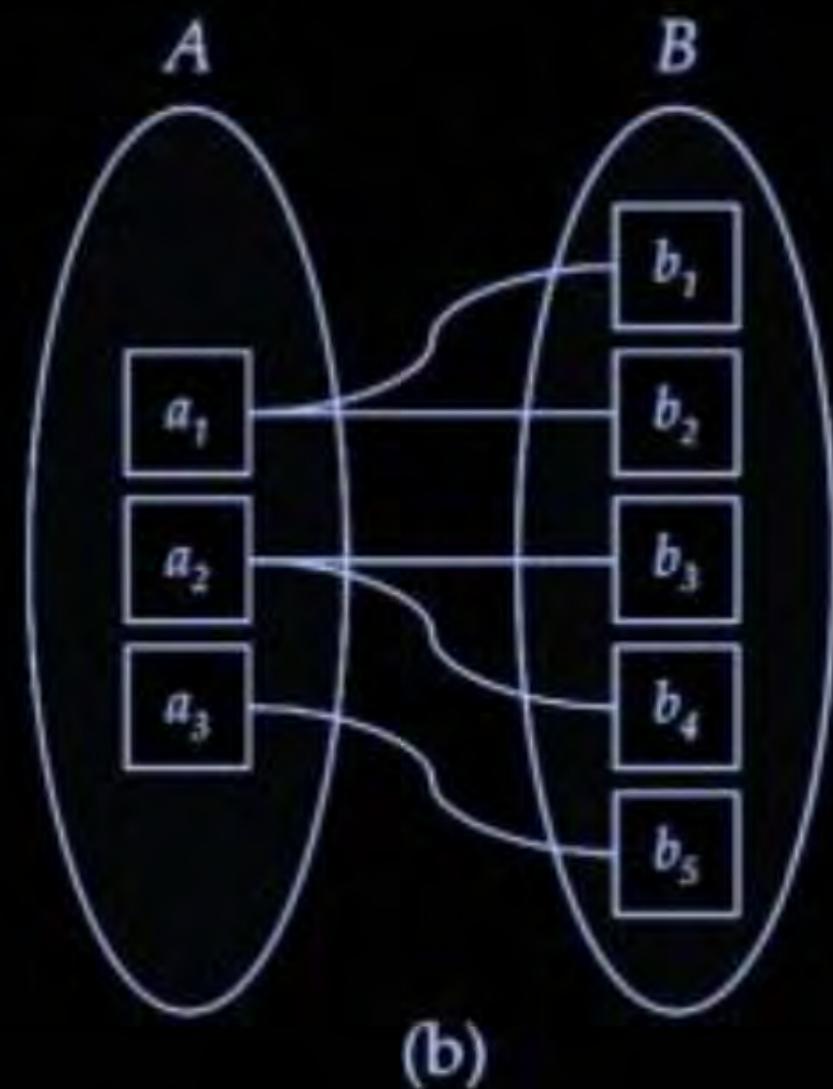
# Mapping Cardinality Constraints

- Express the number of entities to which another entity can be associated via a relationship set.
- Most useful in describing binary relationship sets.
- For a binary relationship set the mapping cardinality must be one of the following types:
  - ❖ One to one
  - ❖ One to many
  - ❖ Many to one
  - ❖ Many to many

# Mapping Cardinalities



(a)



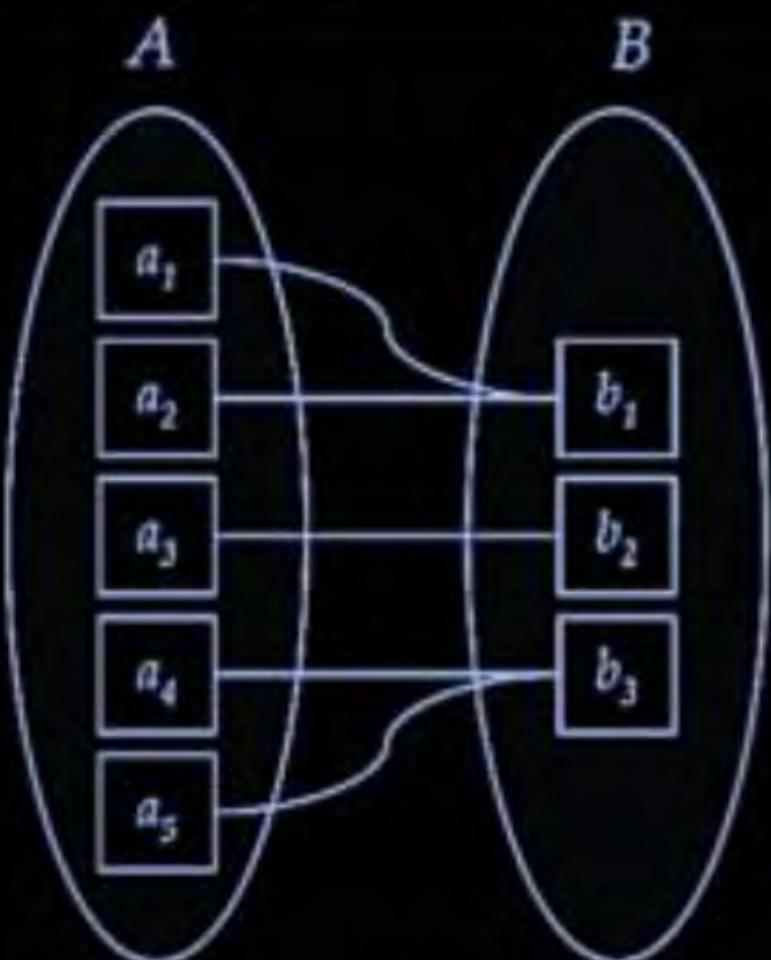
(b)

One to one

Note: Some elements in  $A$  and  $B$  may not be mapped to any elements in the other set

One to many

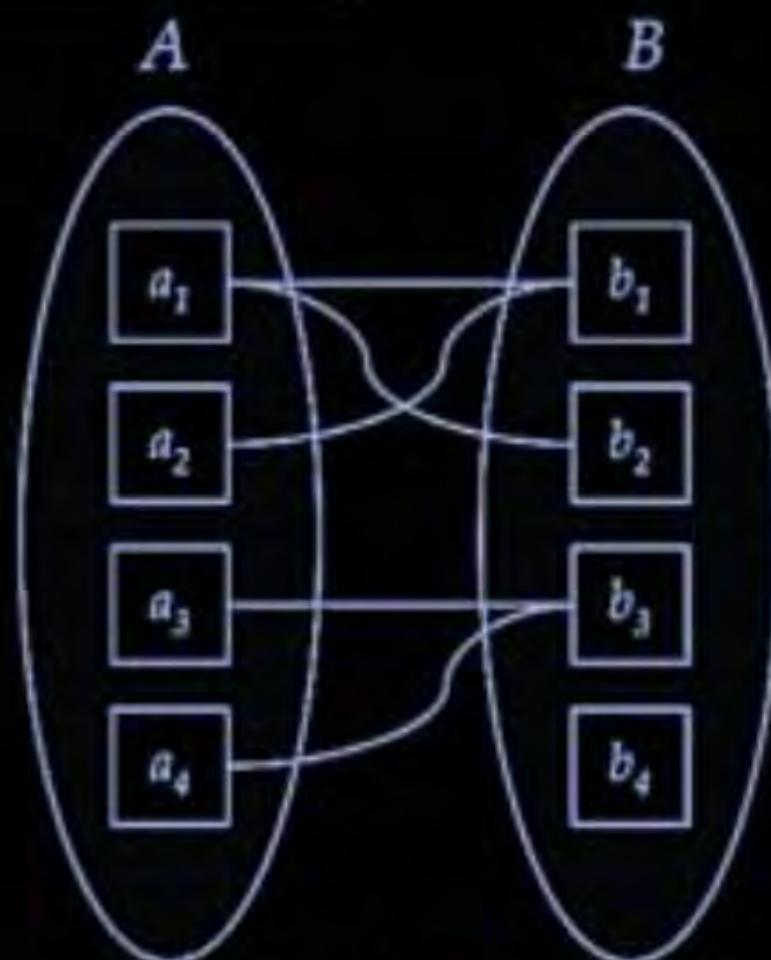
# Mapping Cardinalities



(a)

Many to  
one

**Note:** Some elements in A and B may not be mapped to any elements in the other set



(b)

Many to many

①



OR



②



OR



③

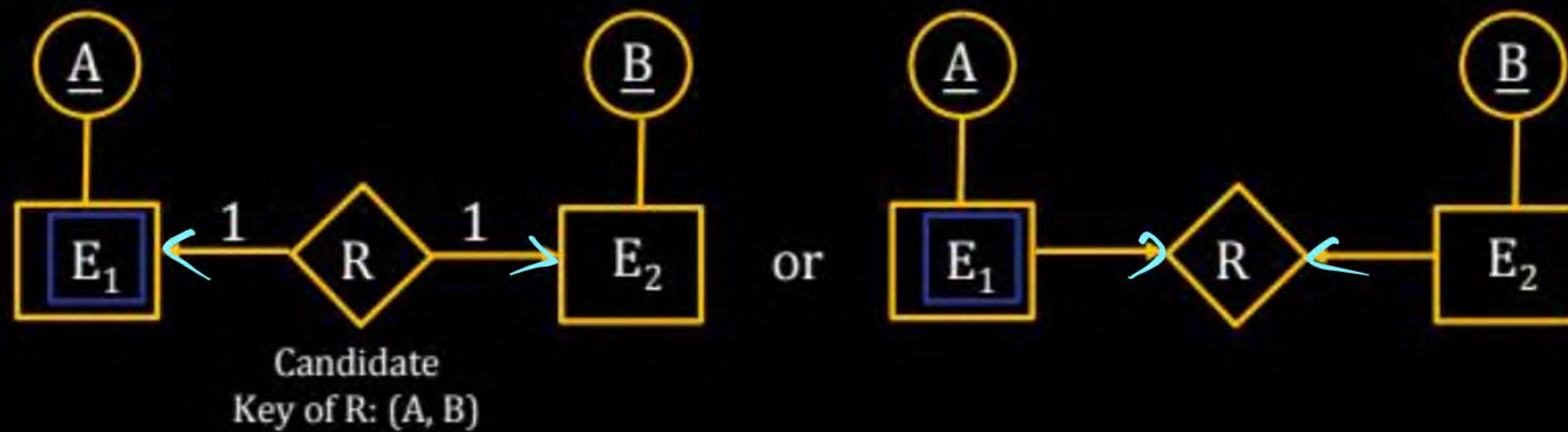


# Mapping [Cardinality constraints of relationship set]

One mapping: At most one (0 or 1)

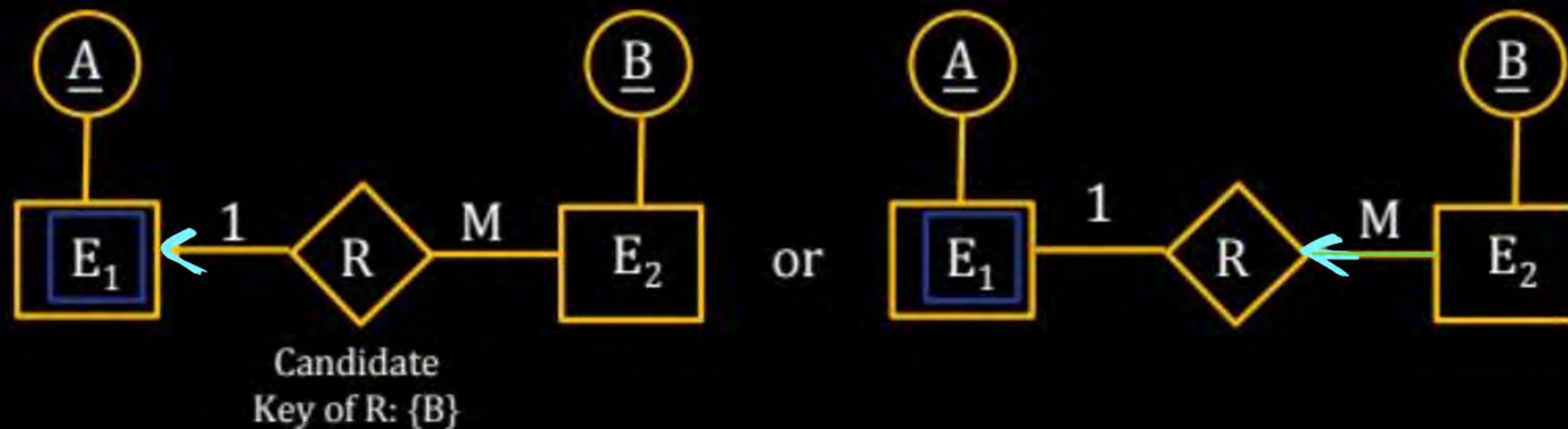
Many mapping: 0 or more (0 ..... \*)

## Binary Relationship Mapping (One : One)



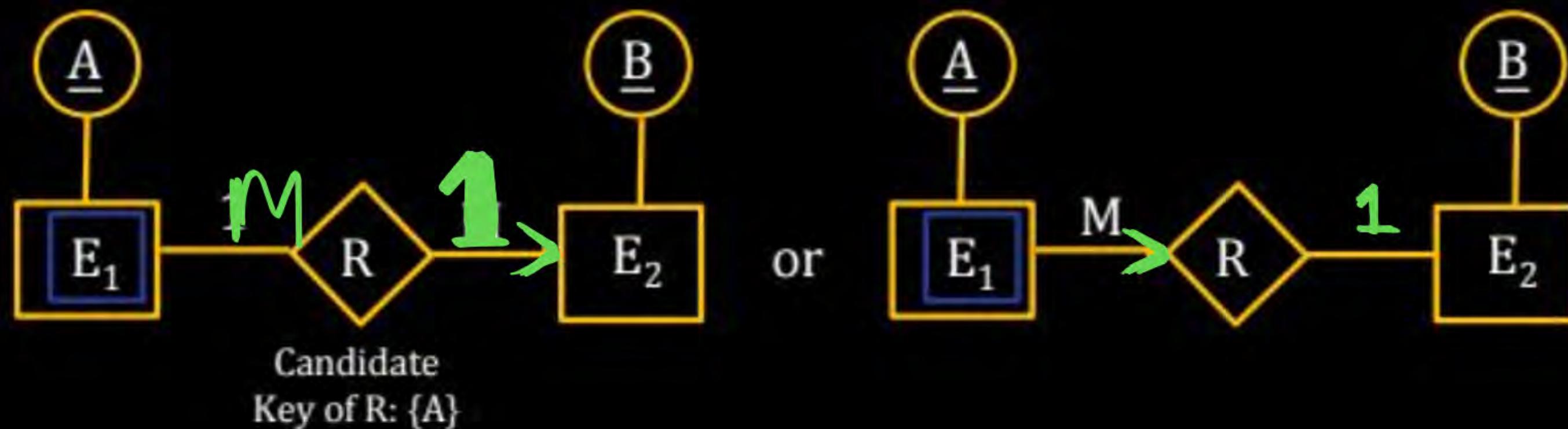
# Mapping [Cardinality constraints of relationship set]

## Binary Relationship Mapping (One : Many)



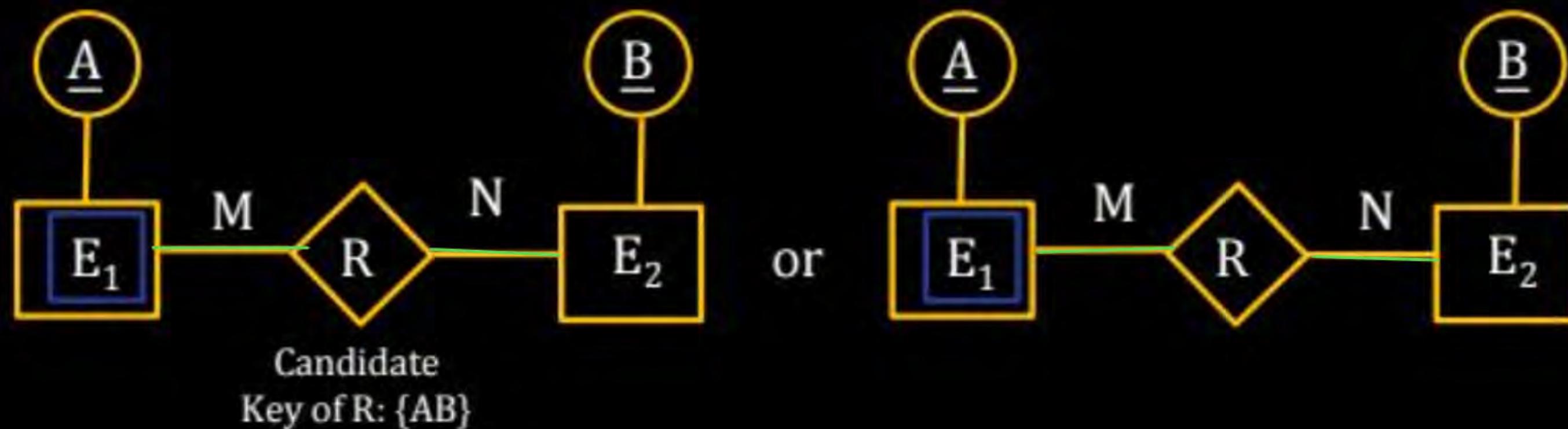
# Mapping [Cardinality constraints of relationship set]

## Binary Relationship Mapping (Many to One)



# Mapping [Cardinality constraints of relationship set]

## Binary Relationship Mapping (Many to Many)



## Revision

- (a) Confuse
- (b)



Pursuing going

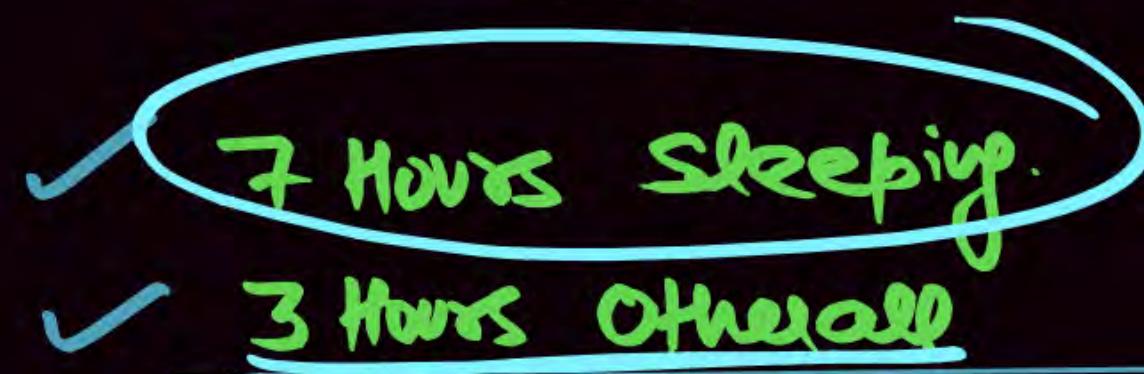
Pursuing But Not Working (Done the Resign)  
④ Freshed

Pursuing & Working

- (c) None
- (d)

Max. 1 Hours for Mobile

24 Hours.



14 Hours

clg 9to5

Office 9to5

8 to 9 Hours

5 Hours

(i) Clg free time (free cl)  
library.

(ii) Travelling time utilized (mentally)  
Revision

Holiday

① Clg going

② Passout but  
Not working

③ Passout &  
Working.

2 Subject  
Parallelly.

Time Management

Consistency

Travelling  
Utilize  
Holidays.

Mentally  
Revision.

Semester

GATE & in the Same Semester

(Notes + PYQ)

(Book)

- ① Dedication
- ② Consistency
- ③ Revision
- ④ Planning

option  
⑤

9-10 Hours

⑥

4 Hours.

⑦

Self Study.

Task to Do ?

~~Revision~~  
~~PyQ Solve, DPP, Weekly Test~~

~~Notes [Short Notes]~~

~~Test Series~~

~~Test Series~~

PW  $\Rightarrow$  Video Solution  
With Video Solution

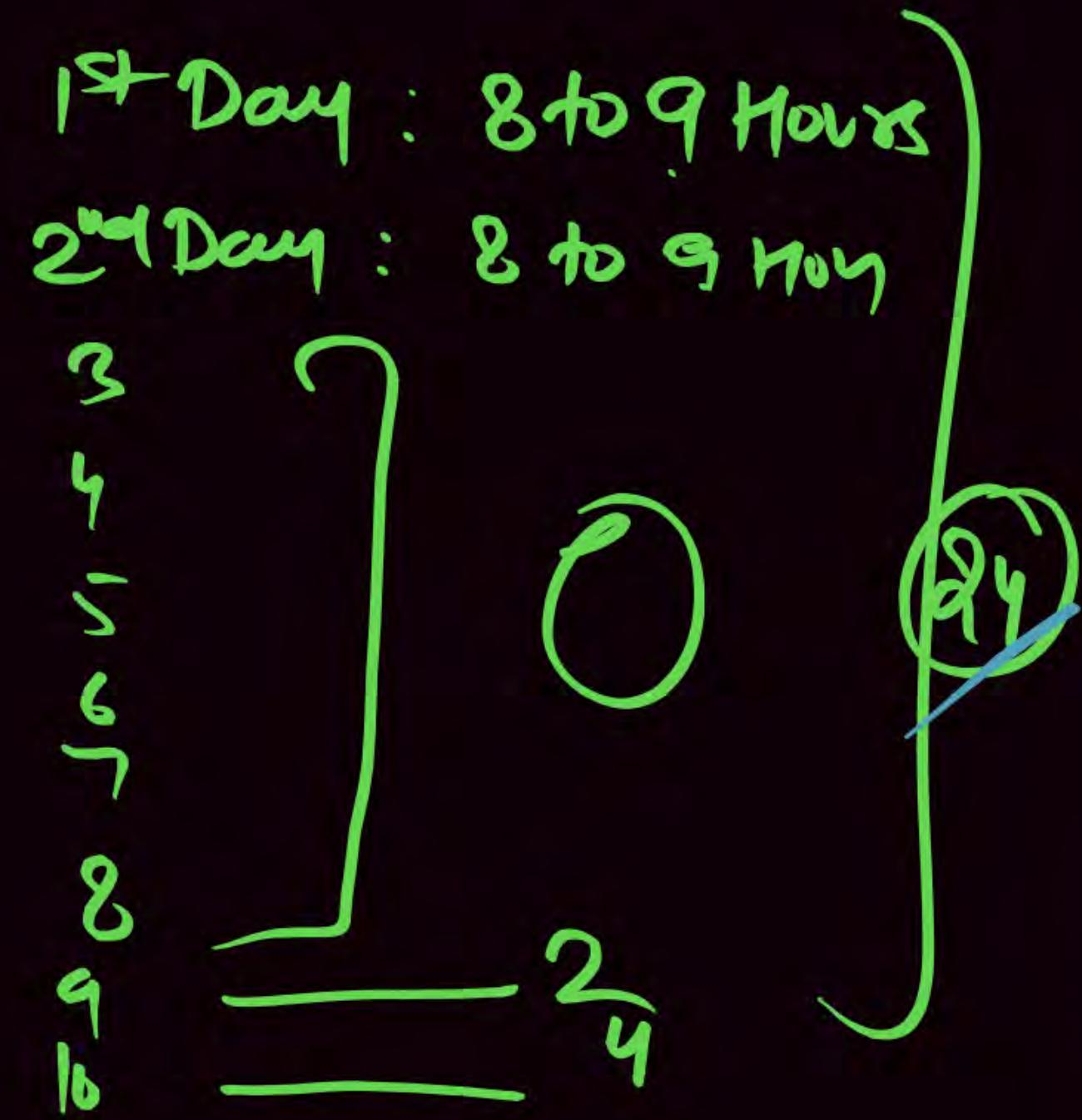
Last 15 years till 2023

DBMS  
CoA

Late Join करा सके.

AIR - 64  
General Category

15 to 20 July  
Admission



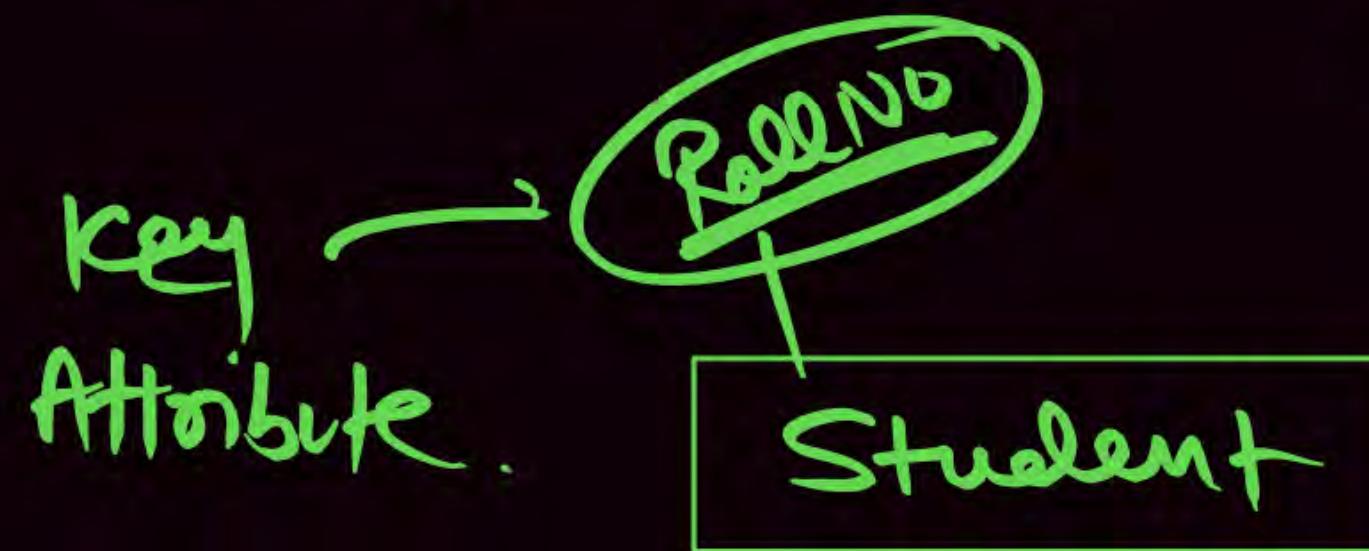
Hours

1 <sup>st</sup> Day	:	3
2 <sup>nd</sup>	:	3
3 <sup>rd</sup>	:	4
4 <sup>th</sup>	:	3
5 <sup>th</sup>	:	4
6 <sup>th</sup>	:	5
7 <sup>th</sup>	:	3
8	:	3
9	:	4
10	:	4
<u>Sum</u>		37 Hours

$$(1.00)^{365} = (1)$$

$$(1.01)^{365} = (37.33)$$

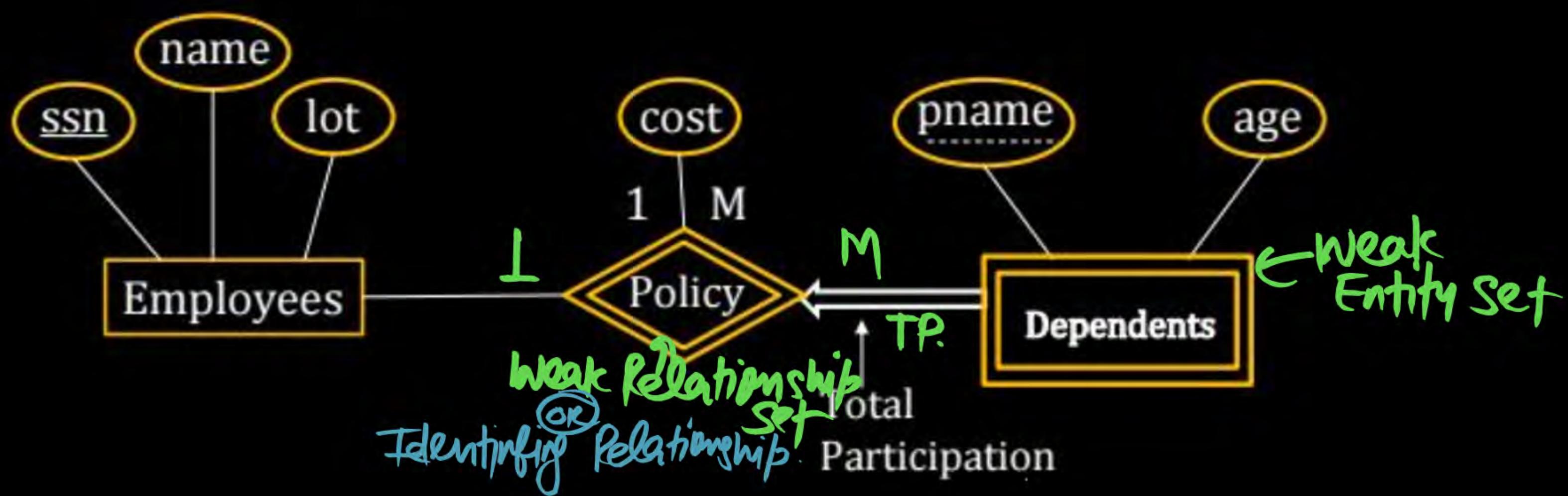
Strong Entity Set : An Entity Set which having  
key Attribute .



# Weak Entity Sets

- ❑ An entity that does not have a key attribute
- ❑ A weak entity must participate in an identifying relationship type with an owner or identifying entity type
- ❑ Entities are identified by the combination of:
  - ❖ A partial key of the weak entity type
  - ❖ The particular entity they are related to in the identifying entity type

- A weak entity can be identified uniquely only by considering the primary key of another (owner) entity.
- ❖ Owner entity set and weak entity set must participate in a one-to-many relationship set (one owner, many weak entities).
- ❖ Weak entity set must have total participation in this identifying relationship set.



# Weak Entity Set and Weak Relationship Set

The entity set with no key. (Attributes of weak entity sets are not sufficient to differentiate entities uniquely).

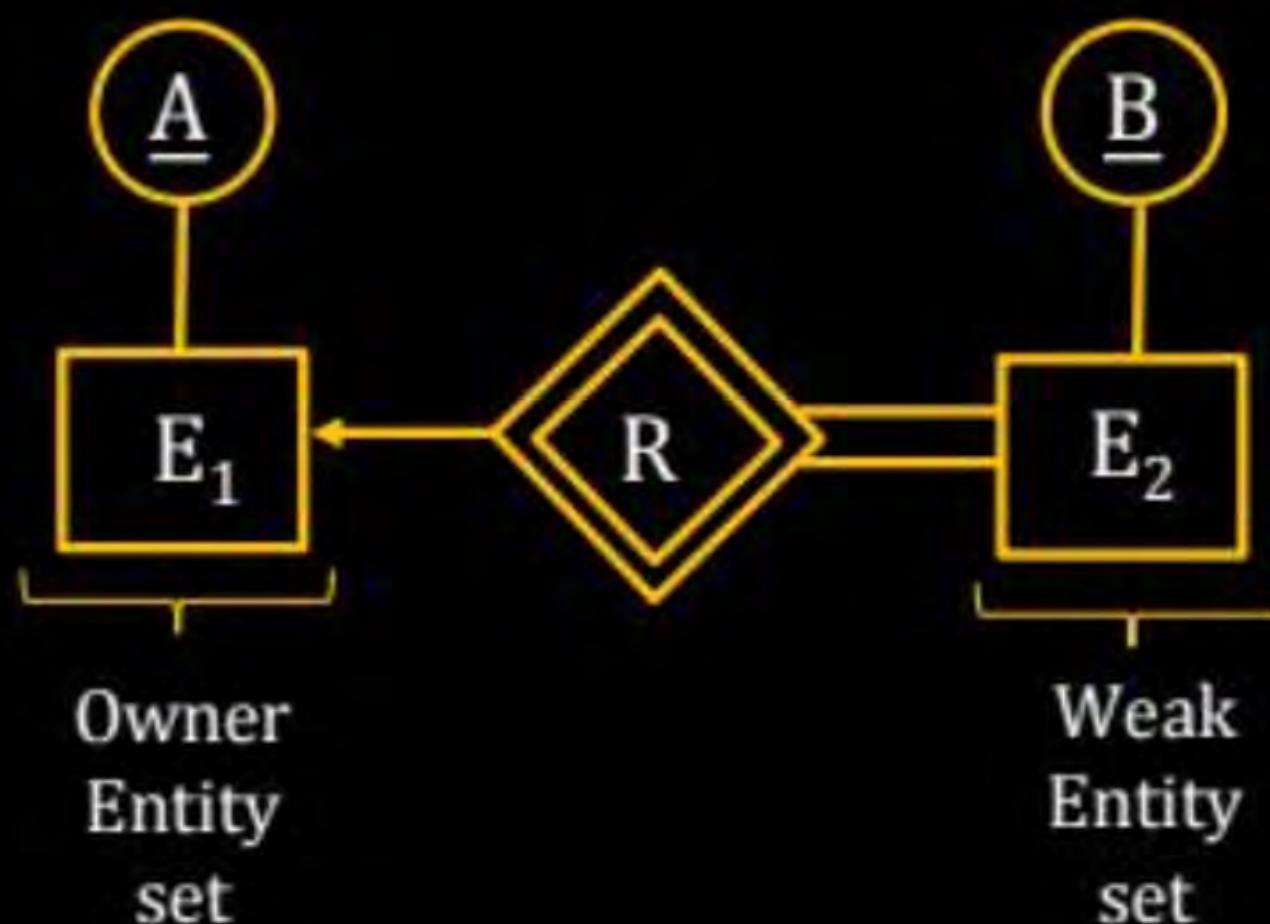


## Points:

- (a) For each weak entity set there must be owner entity set, which is strong entity set.
- (b) Relationship set between weak entity set and identifier entity set is also “weak relationship set”.
- (c) The participation towards weak entity set end must be “total participation”.
- (d) The mapping between identifier entity set and weak entity set must be one : many (1 : M)

# Weak Entity Set and Weak Relationship Set

Example:

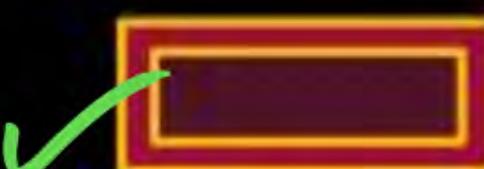


**NOTE:**

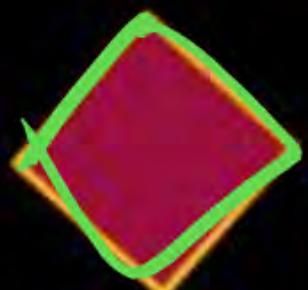
Weak entity set and multivalued attributes allowed to represent in ER diagram but not allowed in RDBMS table.

**Symbol****Meaning**

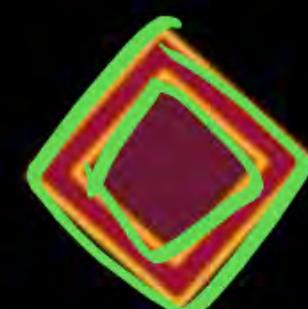
Entity



Weak Entity



Relationship



weak Relationship Set

Identifying Relationship



Attribute



Key Attribute



Multivalued  
Attribute



Composite  
Attribute



Derived  
Attribute

**Symbol****Meaning**

Total Participation of E<sub>2</sub> in R



Cardinality Ratio 1:N for E<sub>1</sub>:E<sub>2</sub> in R



Many - to- Many relationship



One - to - One relationship



Many - to - One relationship

**Q.1** Given the basic ER and relational models,  
which of the following is INCORRECT? [GATE-2012 : 1 Mark]

- A** An attribute of an entity can have more than one value.
- B** An attribute of an entity can be composite.
- C** In a row of a relational table, an attribute can have more than one value.
- D** In a row of a relational table, an attribute can have exactly one value or a NULL value.

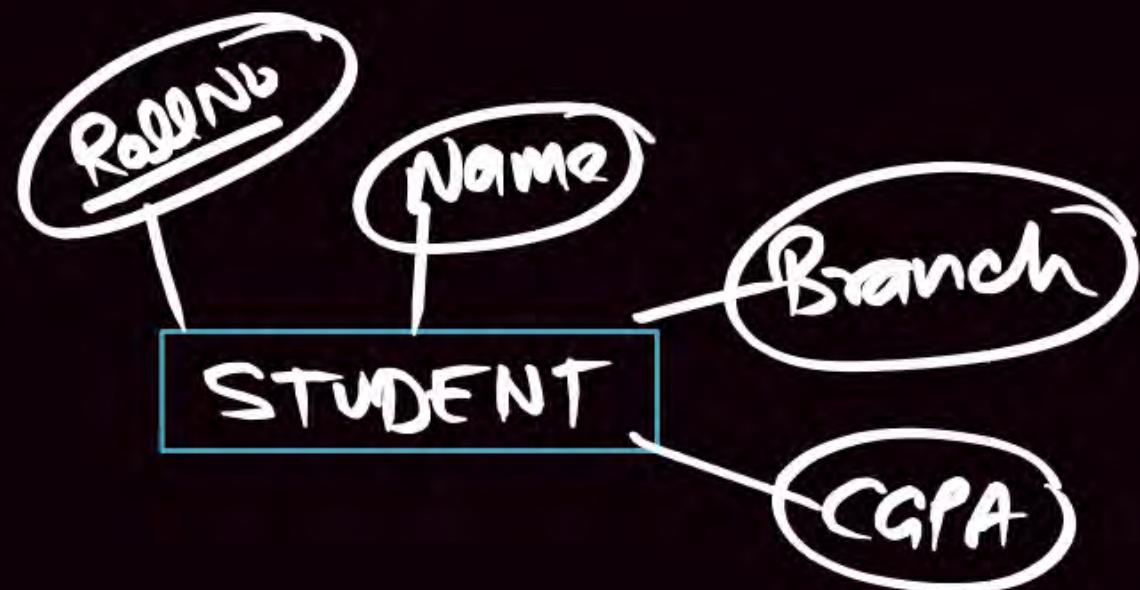
**Q.2**

Which one of the following is used to represent the supporting many-one relationships of a weak entity set in an entity-relationship diagram? [2020:1 Mark]

- A** Rectangles with double/bold border
- B** Ovals with double/bold border
- C** Ovals that contain underlined identifiers
- D** Diamonds with double/bold border

# ER MODEL

①



# RDBMS.

STUDENT

<u>RollNo</u>	Name	Branch	CGPA

Entity Set

key Attribute

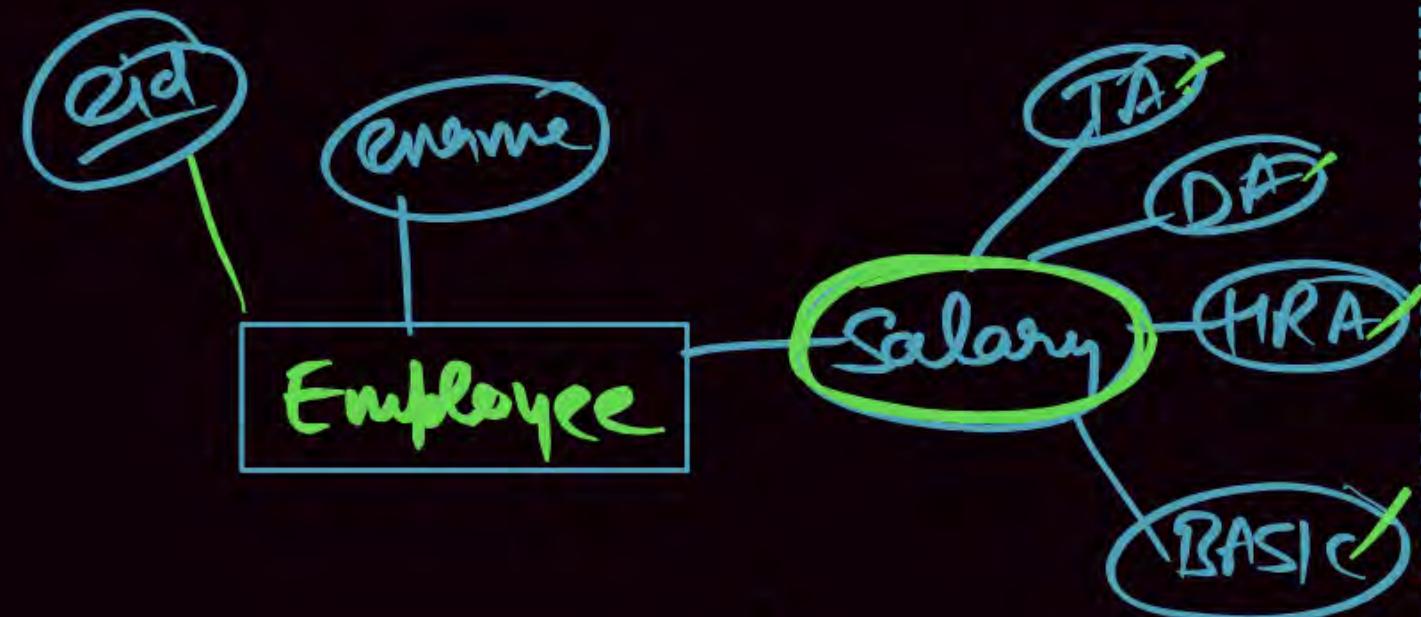
Relation (Table)

Primary key.

# ER MODEL

# RDBMS.

②



Employee

<u>Employee</u>	<u>eid</u>	<u>ename</u>	<u>TA</u>	<u>DA</u>	<u>HRA</u>	<u>Basic</u>

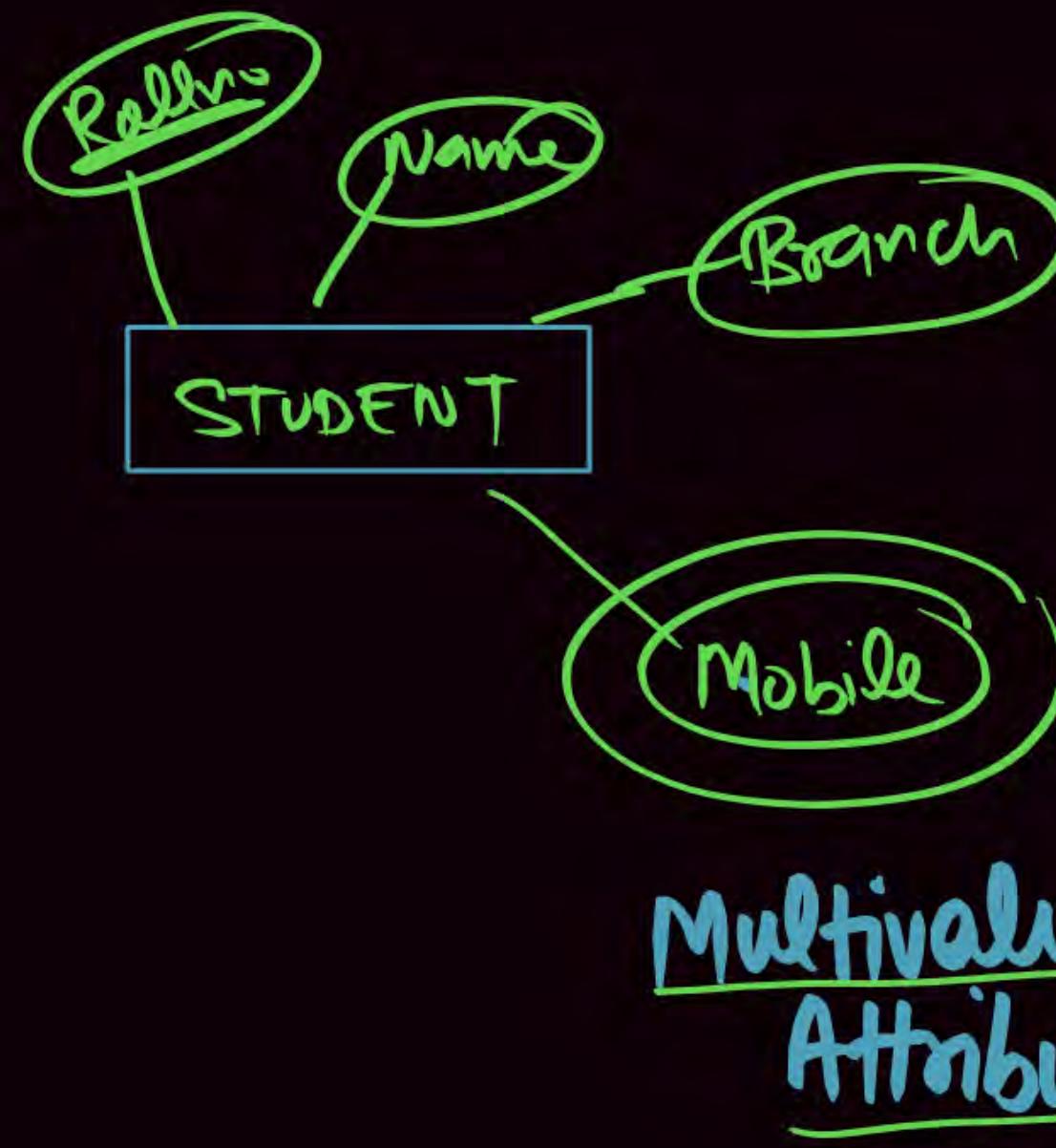
Composite  
Attribute

Set of Simple Component

# ER MODEL

# RDBMS.

③



STUDENT

Rollno	Name	Branch

RollNo	Mobile

Total

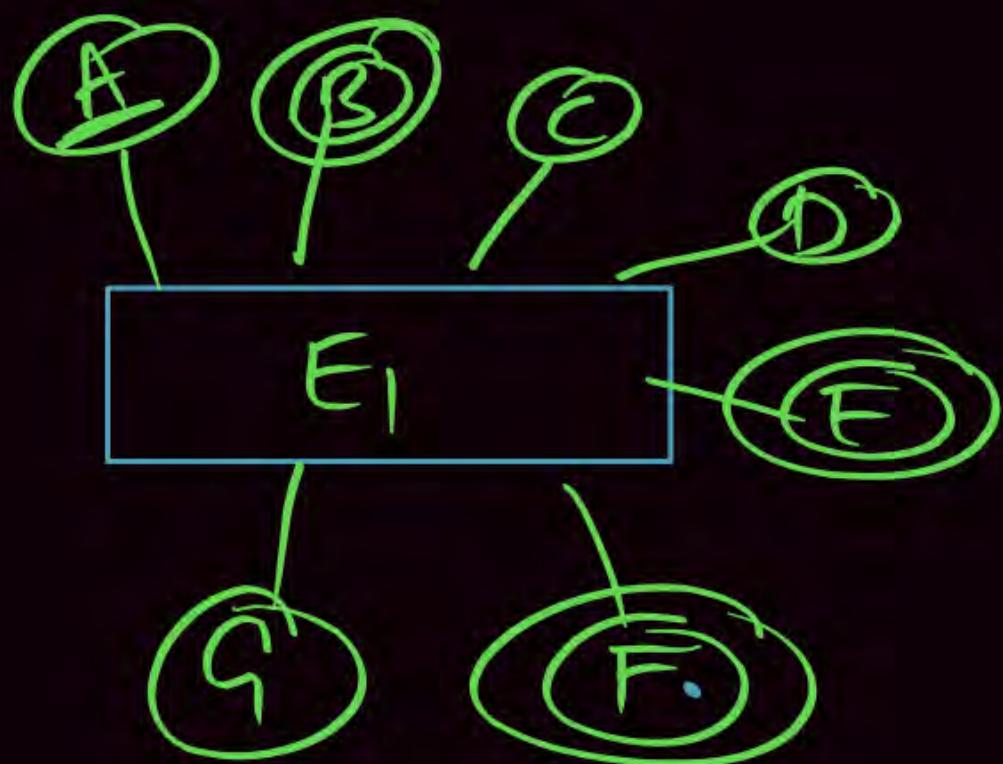
2 Table

Required

- ① Key + All other Attribute
- ② Key + All Multivalued Attribute

# ER MODEL

# RDBMS.



$E_1$

<u>A</u>	<u>C</u>	<u>D</u>	<u>G</u>

$E'_1$

<u>A</u>	<u>B</u>	<u>E</u>	<u>F</u>

2 Table (1) key + All other Attribute

(2) key + All Multivalued Attribute.

Q.

P  
W

The term in list A have been mapped to list B so that is corresponds to the mapping process of ER MODEL into relational. Which of the following represent the mapping process?

[MCQ]

List-A	List-B
A. Entity type - 4	1. Primary key (or alternate key)
B. Key attributes - 1	2. <u>Child table</u>
C. Composite attribute - 3	3. Set of simple component attributes
D. Multivalued attribute-2	4. <u>Relation</u>

A

A-3, B-1, C-4, D-2

A3(B)

C

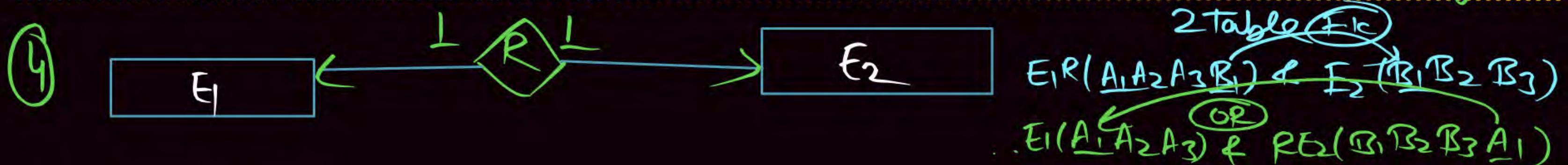
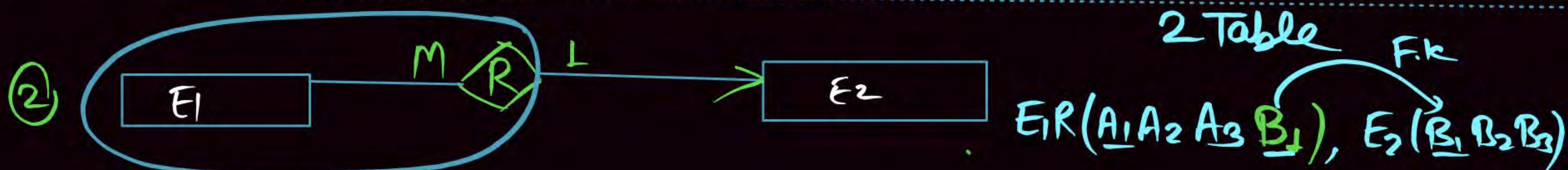
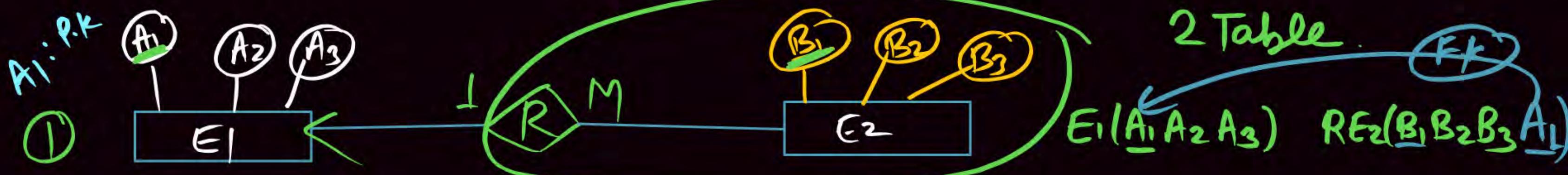
A-3, B-2, C-2, D-4

B

A-4, B-1, C-3, D-2

D

A-4, B-1, C-2, D-3



(For binary relationship)

## Partial participation on both side of binary relationship

- One to Many : Merge relationship set towards many side. So, 2 relational tables.
- Many to one : Merge relationship set towards many side. So, 2 relational tables.
- One to one : Merge relationship set any one side. So, 2 relational tables.
- Many to Many : Separate table for each entity set and relationship set. so, 3 relational tables.

## Mapping [Cardinality constraints of relationship set]

(For binary relationship)

**Full participation on “one” side of many to one relationship**

Merge the entities and relationship set into single relational table. So, 1 table.



## Mapping [Cardinality constraints of relationship set]

(For binary relationship)

**Full participation on “Many” side of Many-to-one relationship**

Merge relationship set towards many side. So, 2 relational tables.



## Mapping [Cardinality constraints of relationship set]

(For binary relationship)

**Full participation on any “one” side in one-to-one relationship**

Merge the entity sets and relationship set into single table. So, 1 table.



## Mapping [Cardinality constraints of relationship set]

(For binary relationship)

### **Full participation on any “Many” side of Many-to-Many relationship**

Merge relationship set towards any “Many” side of relationship. So, 2 table.

# Mapping [Cardinality constraints of relationship set]

(For binary relationship)

## Full participation on both side of relationship

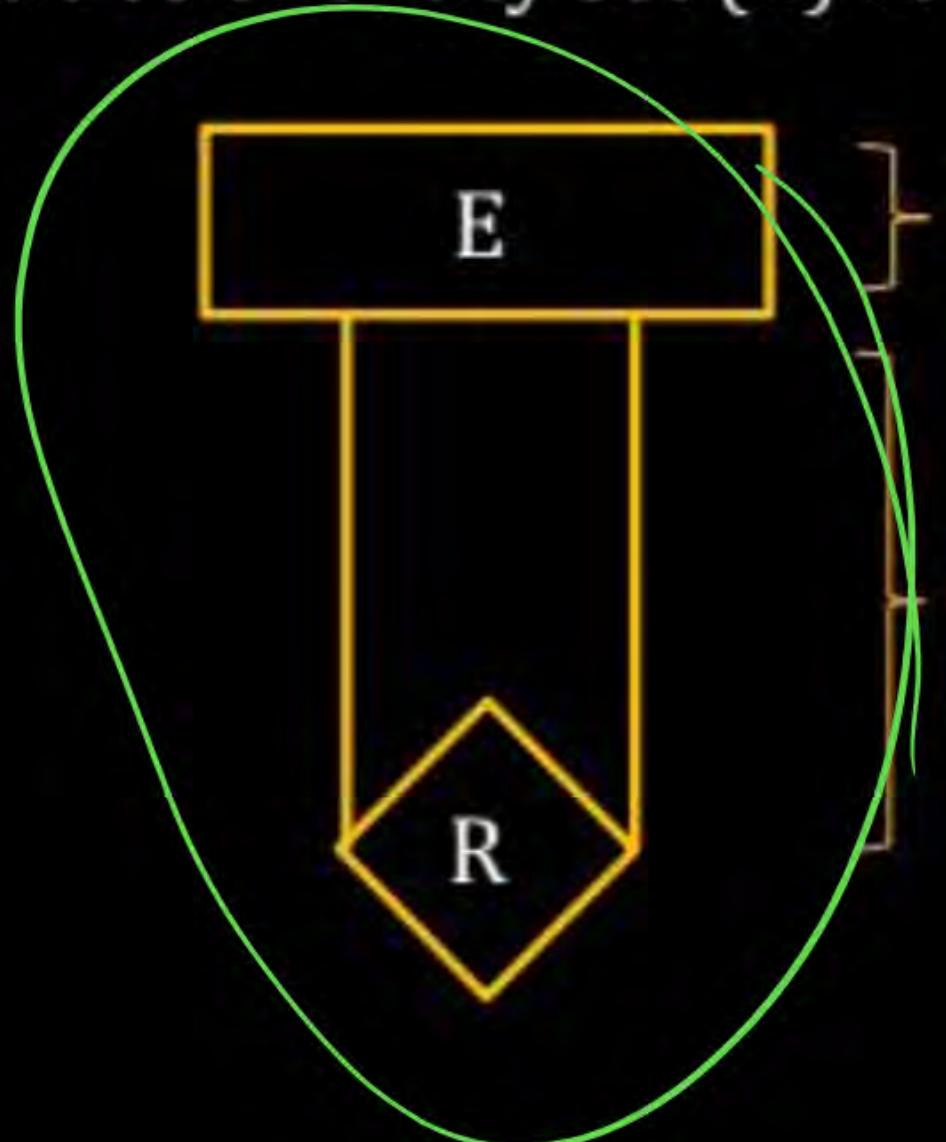
1 : 1	Merge the entity sets and Relationship into single Relational table so, 1 relational table.
1 : M	
M : 1	
M : N	



# Self-Referential Relationship Set

(Recursive entity set)

Entities of entity set (E) related to some other entity of same entity set (E).



} Recursive  
Entity set

Self-referential relationship set

- Binary relationship set
- 1: M, M:1, 1:1, M:N can be any of the relationship

## E-R Model:

Entity Relationship Diagrams used to represent Diagrammatic design [High Level Design] of Databases.

## DB Design Steps:

1. Requirement: What type of data stored and what operation required etc.
  2. Conceptual and Logical: [ER Diagram]
  3. ER Diagram to RDBMS table design and apply normalization.
  4. Physical DB Design (Indexing Design)
  5. User interface Design & Security Design
- 
- High Level Design
- Low Level Design

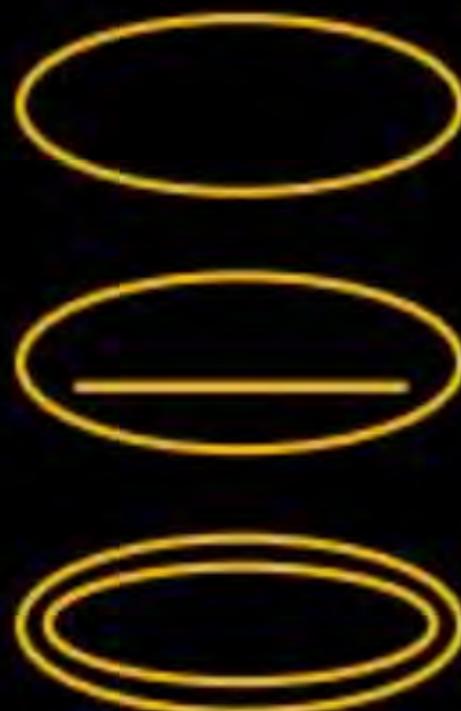
## Main Components in ERD:

1. Attributes
2. Entity Sets
3. Relationship Sets



# Attribute

Attributes:



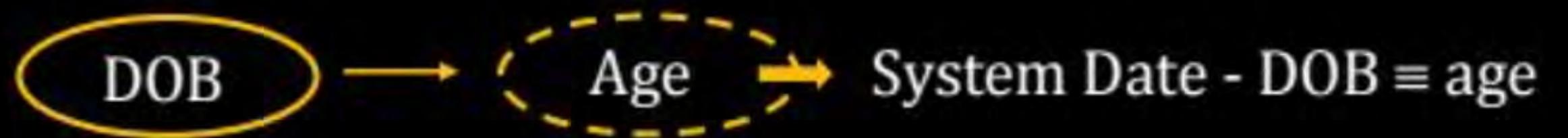
Key Attributes:

Multi valued Attribute:

Derived Attribute:

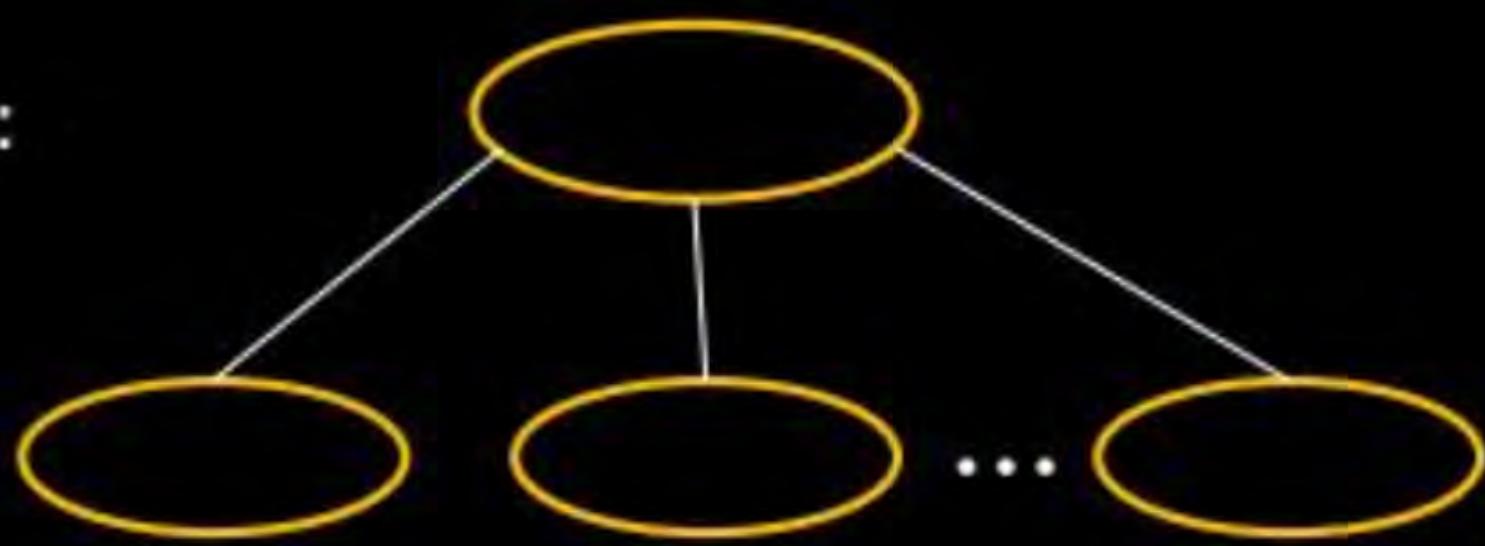
Value derived from  
Other stored value

Example:



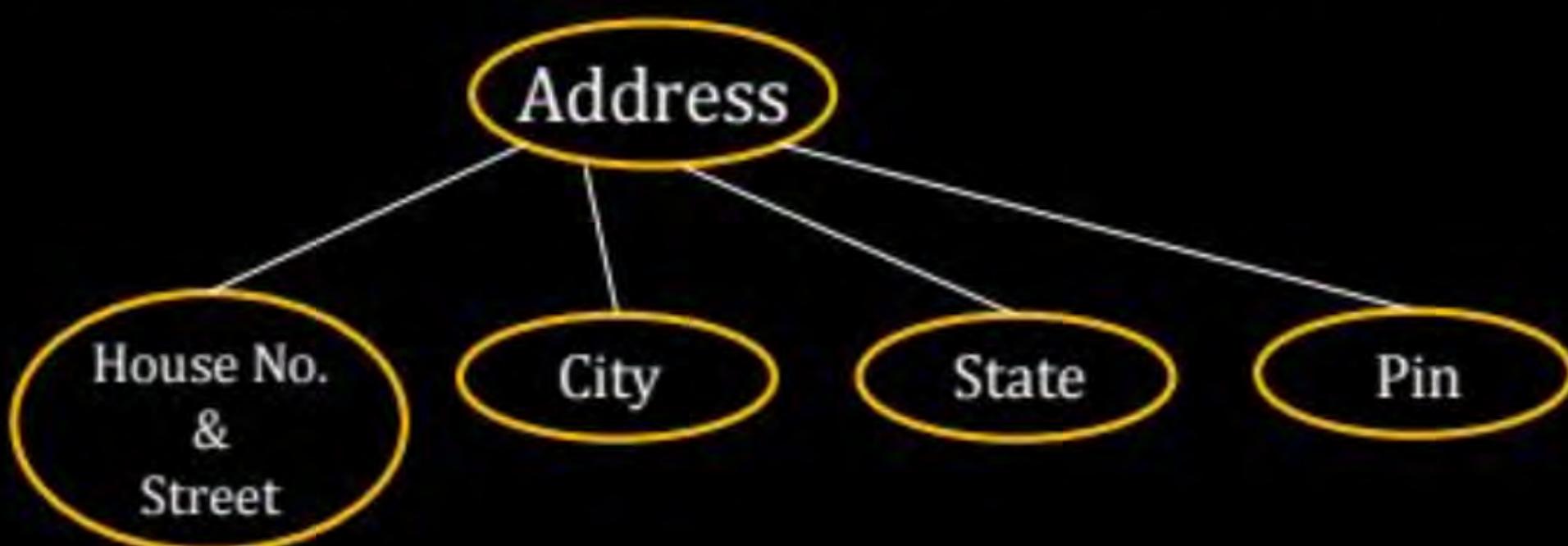
# Attribute

Composite Attribute:



Attribute Which can represent as two or more attributes

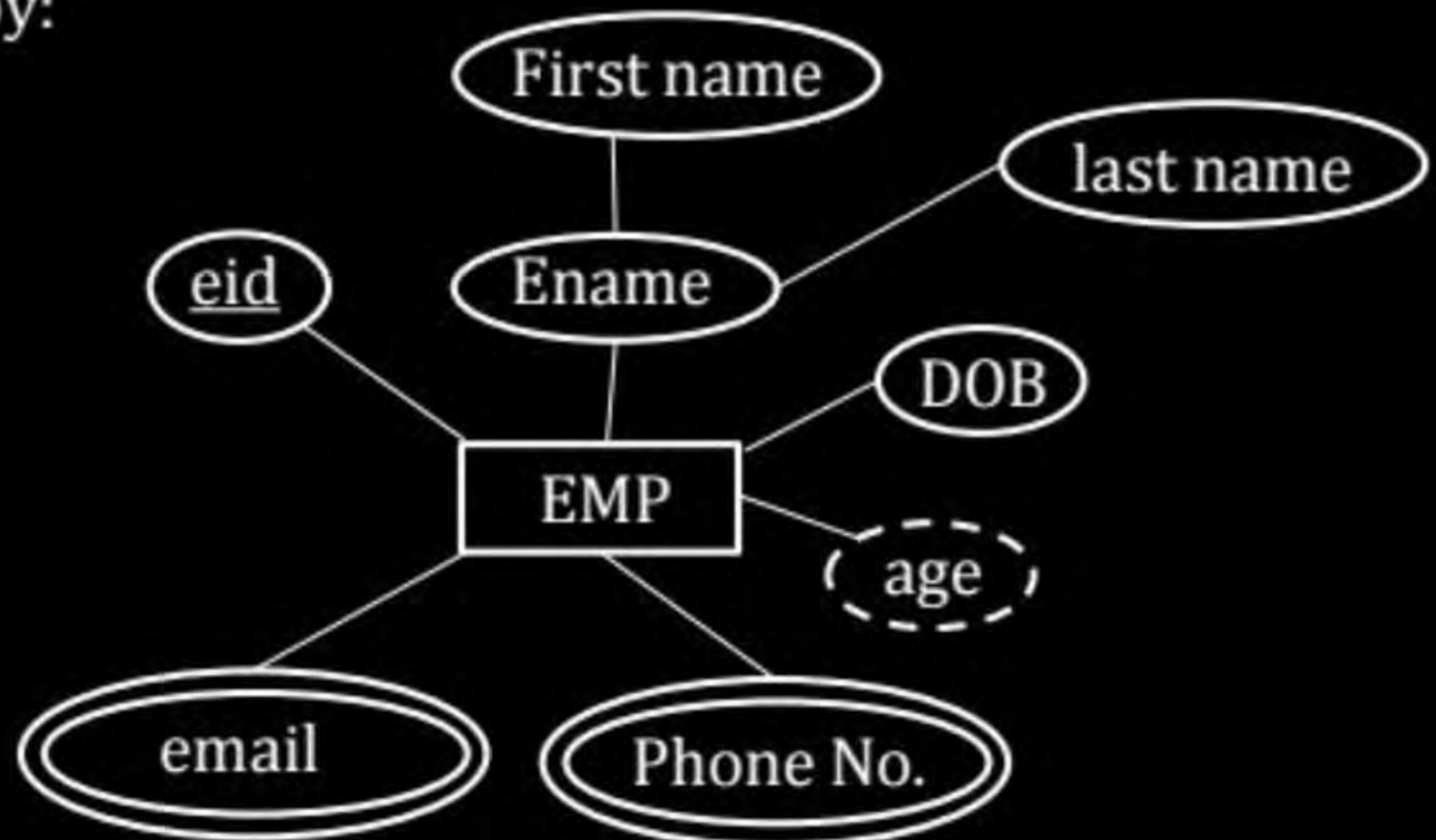
Example:



## Entity Set:

Set of similar entities (recorded/objects).

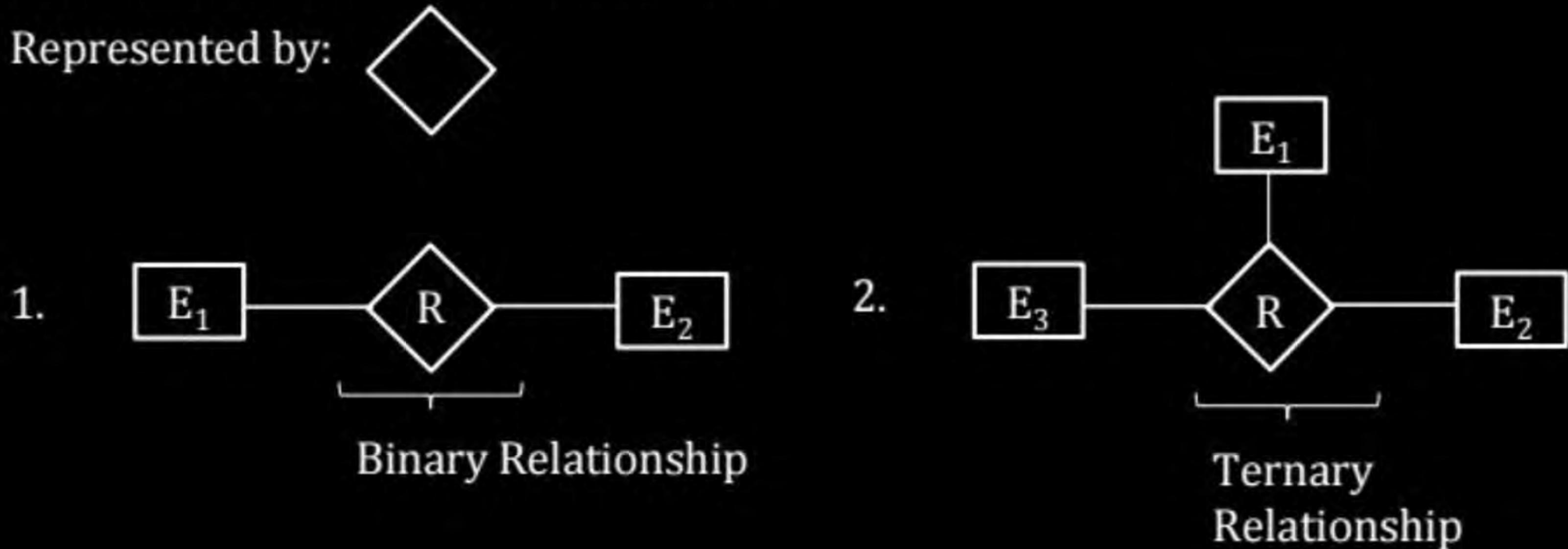
Represented by:



## Relationship Set:

Used to relate two or more entity set.

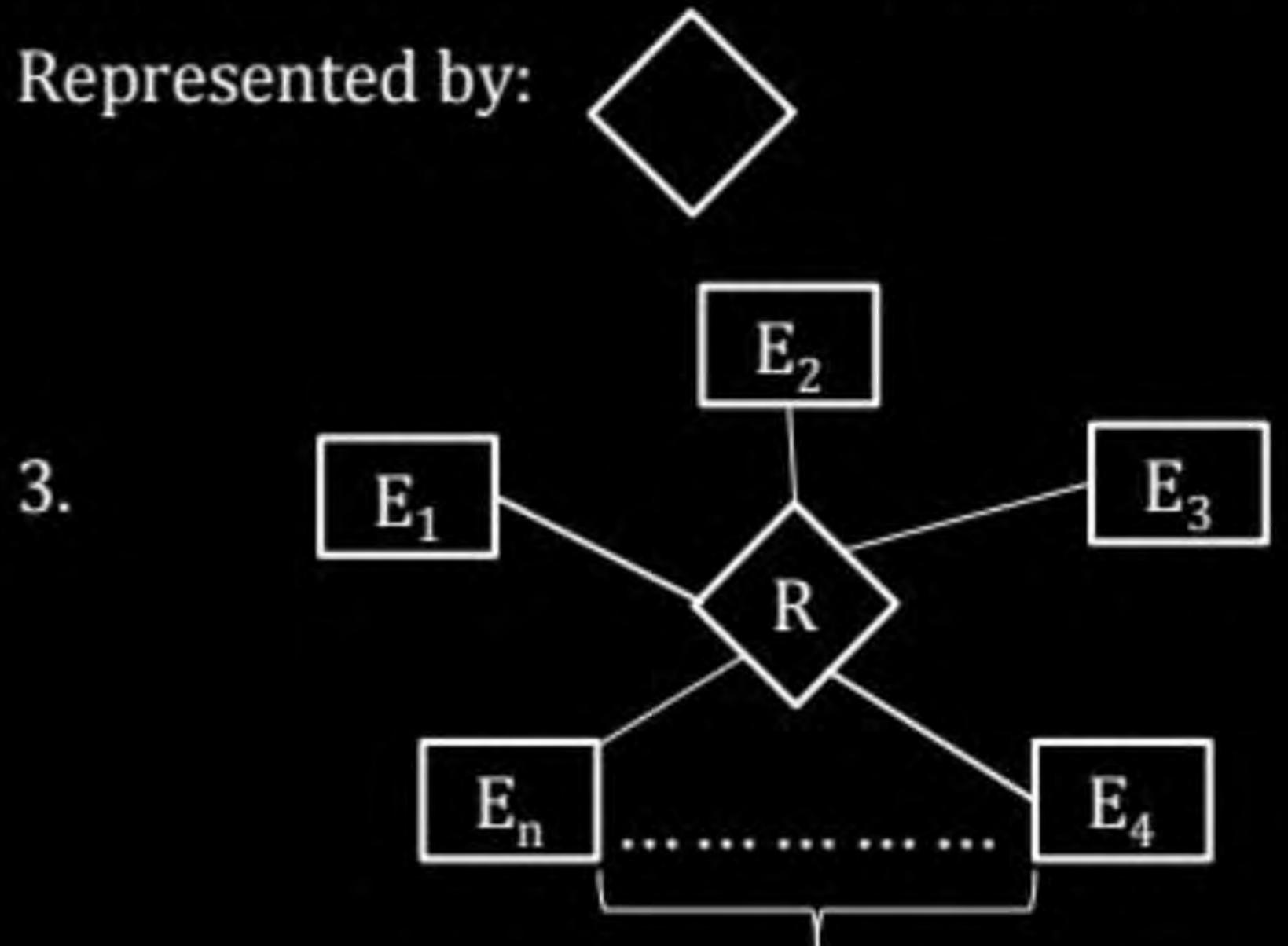
Represented by:



## Relationship Set:

Used to relate two or more entity set.

Represented by:



N-ary Relationship

## Participation:

If every entity of entity set (E1) must participate with relationship set than Total Participation.

[must be 100% participation]

Otherwise:

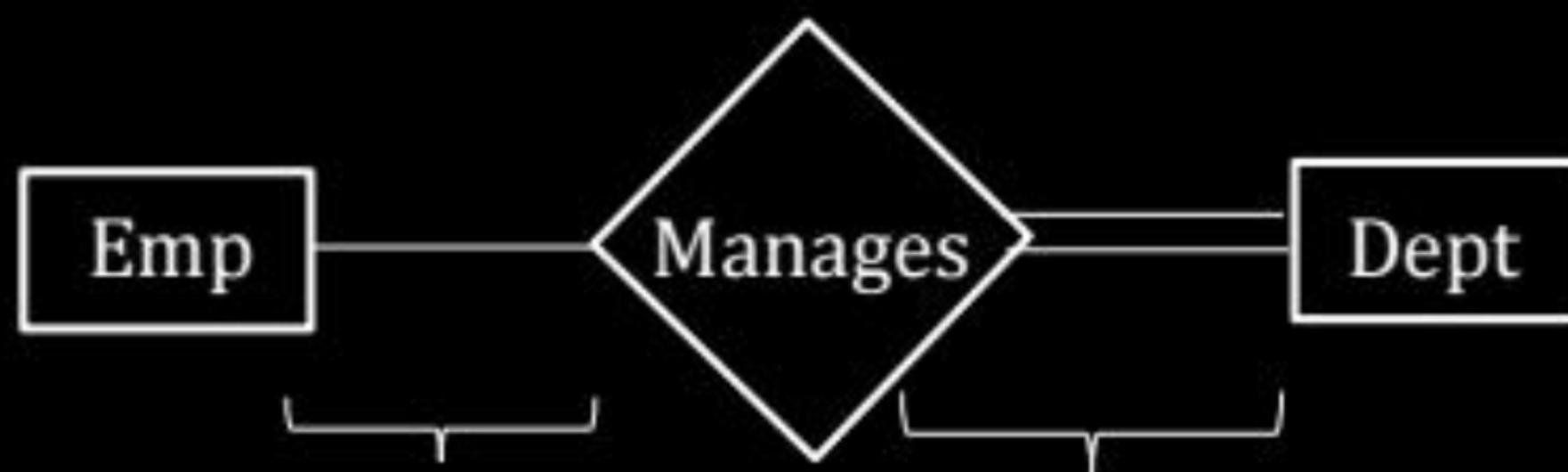
Partial Participation:

May or may not 100% participation

Example:

"Emp" & "Dept" Entity Set.

"Manages" Relationship Set such that each dept there must be a manager.



Partial  
Participation

Total  
Participation

## Mapping:

Mapping [cardinality of Relationship set]:

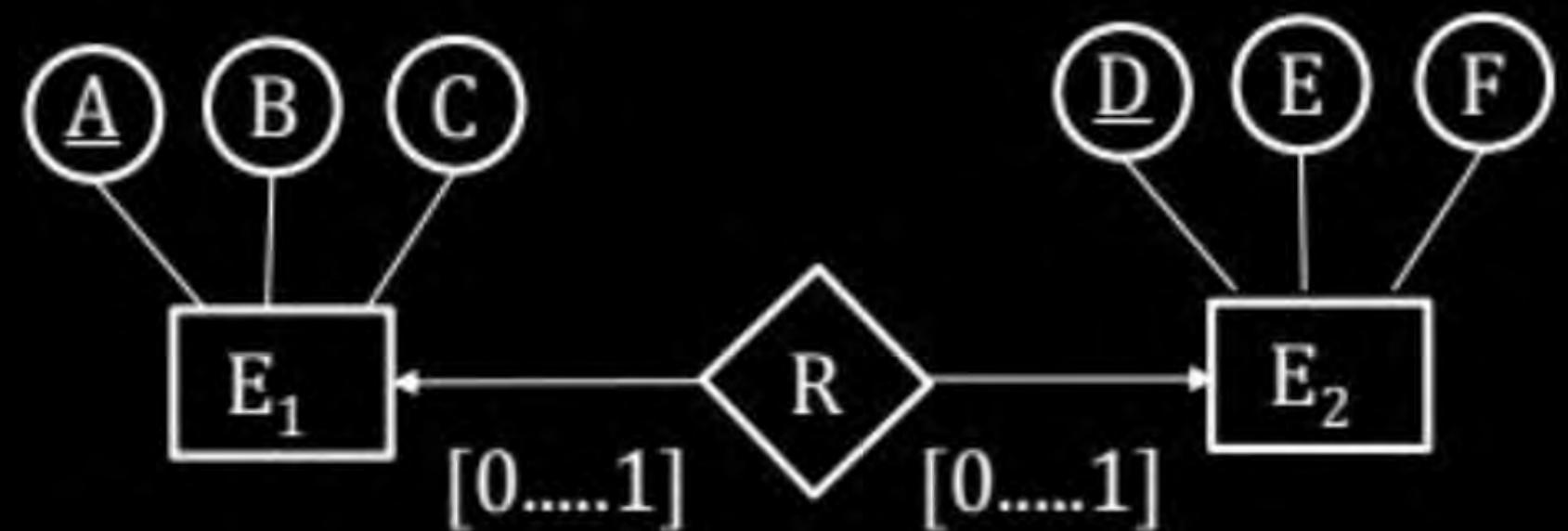
One: [At most one] [0....1]

Many: [0 or more] [0.....M]

Possible Mapping of binary relationship sets are:

- 1) One : One
- 2) One : Many
- 3) Many : One
- 4) Many : Many

Candidate key's of  
Relationship set is  
Based on mapping

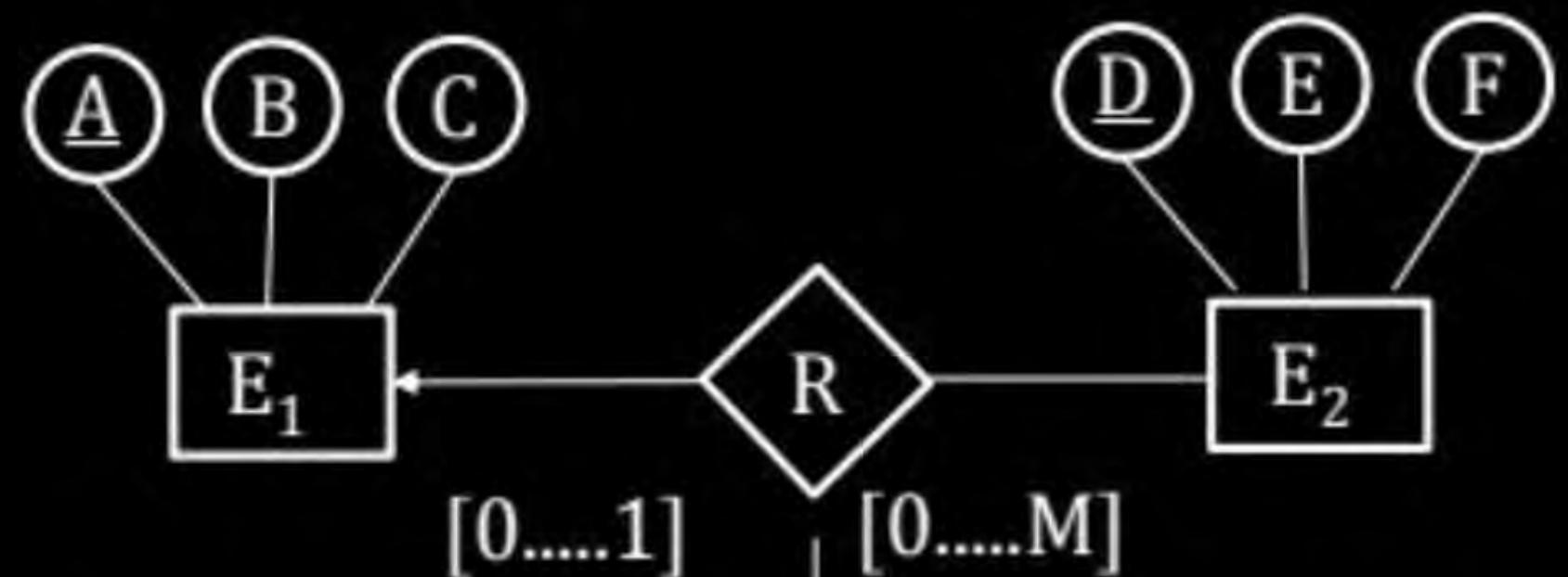
**One to One:**

R (A D) = {A, D}

a<sub>1</sub>   d<sub>1</sub>   1 : 1 mapping

a<sub>2</sub>   d<sub>2</sub>   candidate key of

a<sub>3</sub>   d<sub>5</sub>   Relationship set

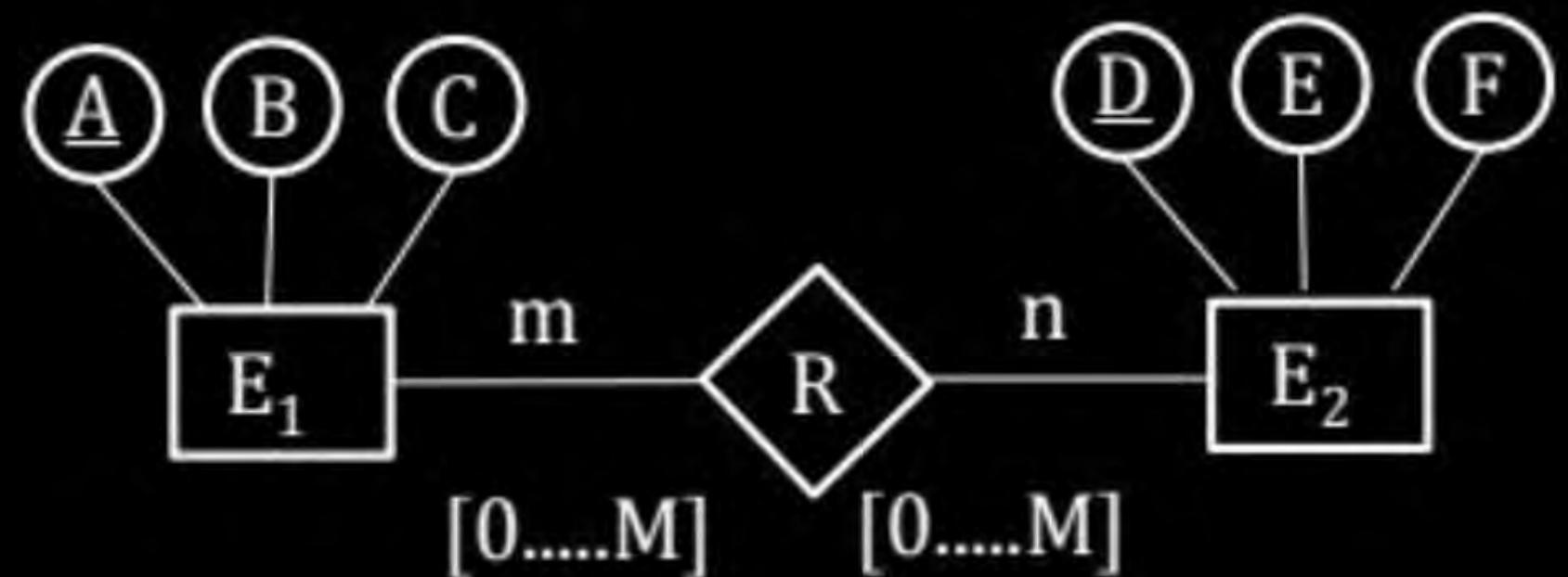
**One: Many:**

Each object of  $E_2$  allowed to pair by at most one entity of  $E_1$

Each entity of  $E_1$  can pair with many  $E_2$  entity.

Candidate key of  $R$  (A    D) = { D }

$a_1 \quad d_1$  : for 1: M  
 $a_1 \quad d_2$       Relationship  
 $a_2 \quad d_3$

**Many to Many:**

$$R(\underline{A} \underline{D}) = \{\underline{AD}\}$$

$a_1 \quad d_1 \quad M:N \Rightarrow$

$a_1 \quad d_2 \quad$  for many to many mapping

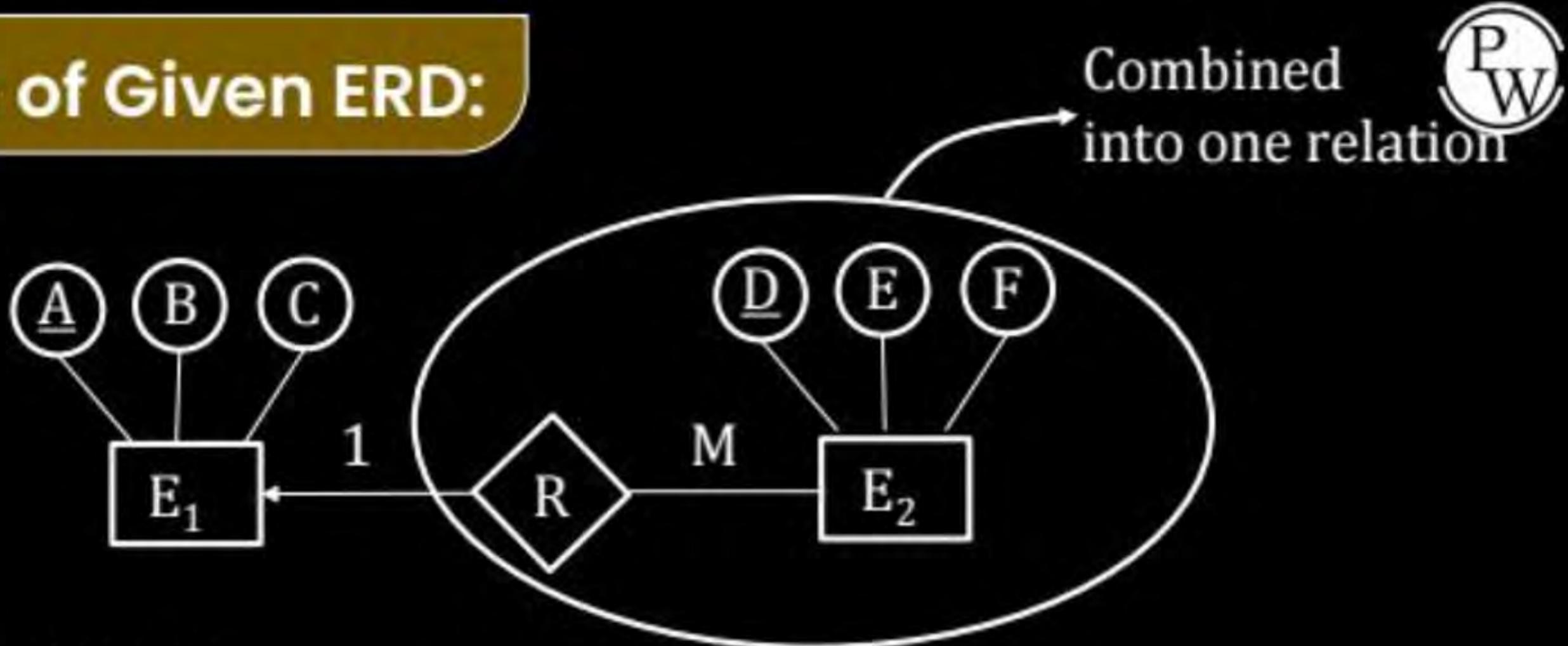
$a_2 \quad d_2 \quad$  Candidate Key for

$a_3 \quad d_3 \quad$  Relationship Set is

$\{\underline{AD}\}$

## RDBMS Design of Given ERD:

1 : M Relationship:



$E_1(\underline{A} B C)$

$a_1 \text{--- } a_2 \text{--- } a_3 \text{--- } a_4$   
 $A \rightarrow BC$

{A}

$R(A \underline{D})$

$a_1 \text{--- } a_1 \text{--- } a_2 \text{--- }$   
 $D \rightarrow A$

{D}

$E_2(D \underline{E} F)$

$d_1 \text{--- } d_2 \text{--- } d_3 \text{--- } d_4$   
 $D \rightarrow EF$

{D}

P  
W

$\{A \rightarrow BC\}$  E<sub>1</sub>(A B C)  
a<sub>1</sub> --  
a<sub>2</sub> --  
a<sub>3</sub> --  
a<sub>4</sub> --

E<sub>2</sub>R(D E F A)  
d<sub>1</sub>--a<sub>1</sub>  
d<sub>2</sub>--a<sub>1</sub>  
d<sub>3</sub>--a<sub>2</sub>  
d<sub>4</sub>--NULL

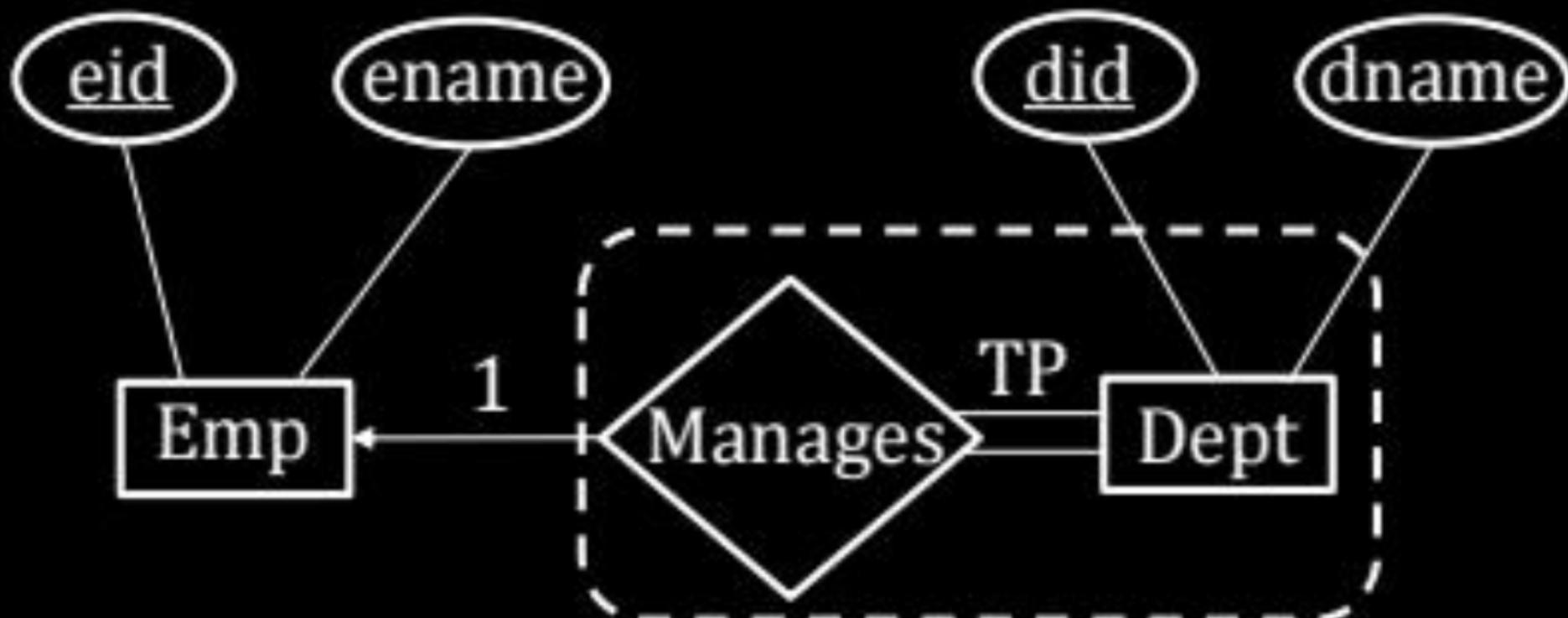
{D  $\rightarrow$  A E F}

Partial participation  
between E<sub>2</sub> and R

Due to partial participations.

$\therefore$  minimum 2 relational Table Required and 1 Foreign Key required for given ERD

Given ERD  
Example:



TP: Total Participation

Emp(eid ename)    Dep Manager(did dname eid)

- F.K
- $d_1 - - e_1$  NOT NULL
  - $d_2 - - e_2$  It act as
  - $d_3 - - e_3$  Total Participation
  - $d_4 - - e_4$  at  $e_2$  side

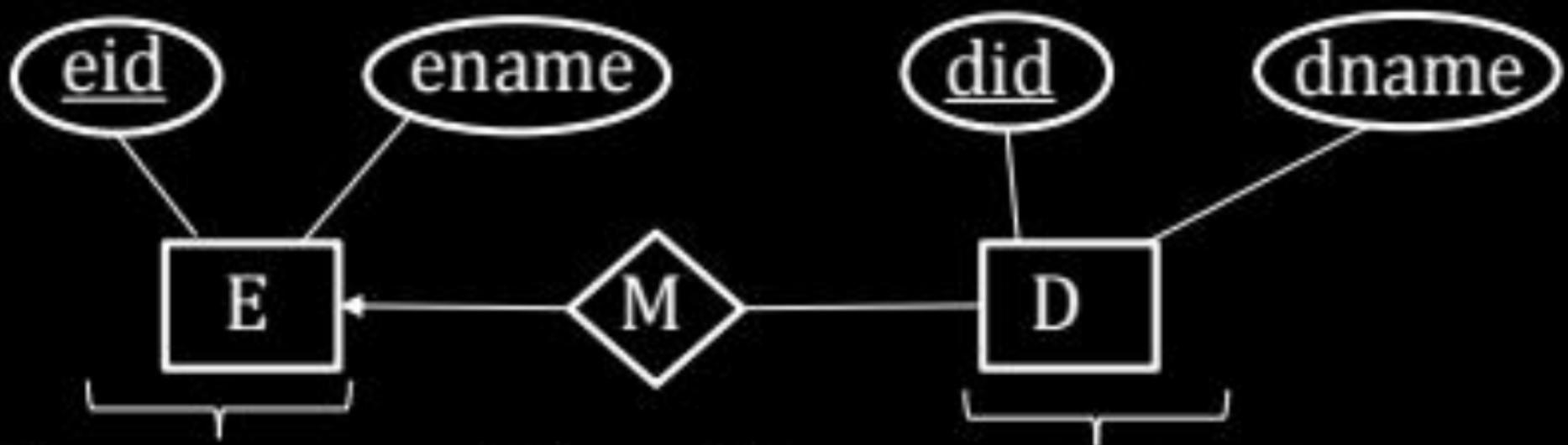
Given ERD



Emp\_Dept\_Manages  
(did dname eid ename)  
 $\text{did} \rightarrow \text{dname}$   
 $\text{did} \rightarrow \text{eid}$   
 $e_5$  A)  
Not allowed because  $e_5$   
not in relationship

CREATE TABLE Dept\_manages  
(did varchar(10) primary key,  
dname varchar(30),  
eid varchar(10) NOT NULL,  
FOREIGN KEY(eid)  
REFERENCES Emp);

If 1 : M relationship set merges into left side Entity set:



$\text{eid} \rightarrow \text{ename}$      $\text{did} \rightarrow \text{eid}$

$\text{did} \rightarrow \text{dname}$

$E_M(\text{eid } \text{ename } \underline{\text{did}})$

$D(\underline{\text{did }} \text{dname})$

$e_1$	A	$d_1$
$e_1$	A	$d_2$
$e_1$	B	$d_2$
$e_1$	C	$d_3$
$e_1$	D	Null

Not valid as did is key of  $E_M$   
 (Partial Participation)  
 [lost at E side]

## Disadvantage:

- 1) Data Redundancy Occurs

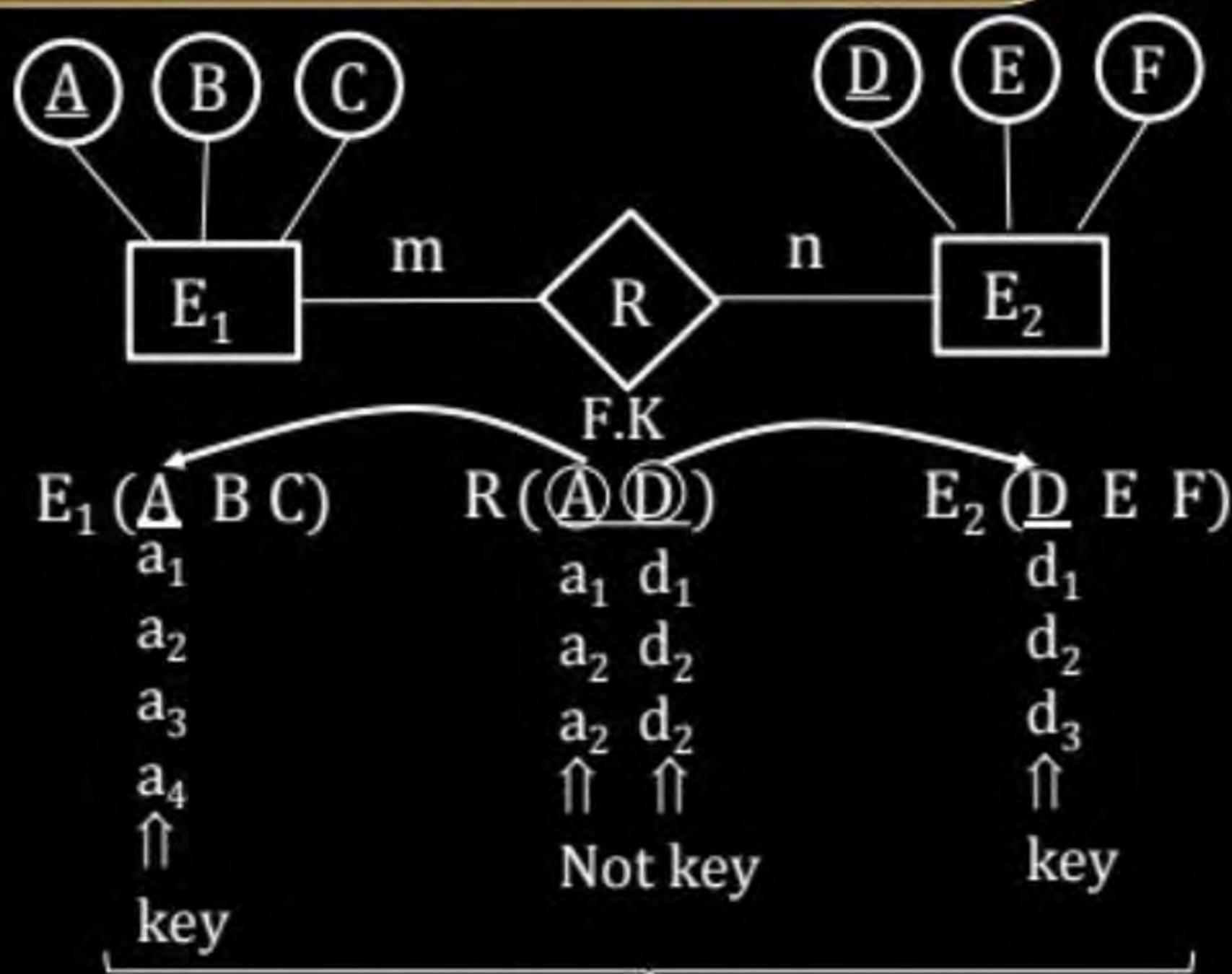
$\text{eid} \rightarrow \text{ename}$

Not Super Key(S.K)

- 2) Partial Participation will be lost

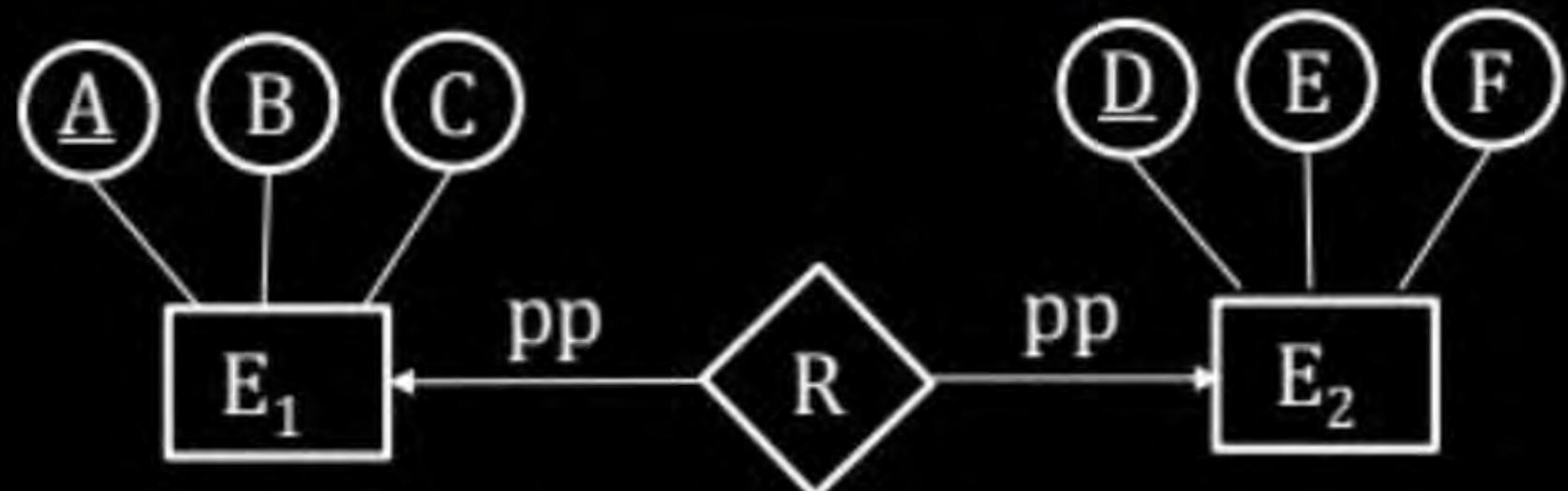
[Not possible to insert employees who are not manager of dept.]

## Many : Many Relationship:



Minimum 3 relational table required and 2 foreign key required.  
M:N relationship set not allowed to merge with any entity set.

## One : One Relationship:



$E_1, E_2$  entity sets & R relationship set related between  $E_1$  and  $E_2$  with 1:1 cardinality and partial participation(pp) at both side.

$E_1$	$(A \ B \ C)$
$a_1$	
$a_2$	
$a_3$	
$a_4$	
$\uparrow$	
key	
$[A \rightarrow BC]$	

$R$	$(A \ D)$
$a_1$	$d_2$
$a_2$	$d_3$
$a_3$	$d_4$
$\uparrow \ \uparrow$	
key	key
$[A \rightarrow D]$	
$D \rightarrow A$	

$E_2$	$(D \ E \ F)$
$d_1$	
$d_2$	
$d_3$	
$d_4$	
$\uparrow$	
key	
$[D \rightarrow EF]$	

## If all merge with single Table:

$E_1 \text{RE}_2$

	A	B	C	D	E	F
a <sub>1</sub>	-	-	-	d <sub>2</sub>	-	-
a <sub>2</sub>	-	-	-	d <sub>3</sub>	-	-
a <sub>3</sub>	-	-	-	d <sub>4</sub>	-	-
a <sub>4</sub>	-	-	-	Null	Null	Null
Null	NULL			d <sub>1</sub>	-	-

Candidate key = {A, D}

No Candidate key is present, & No primary key

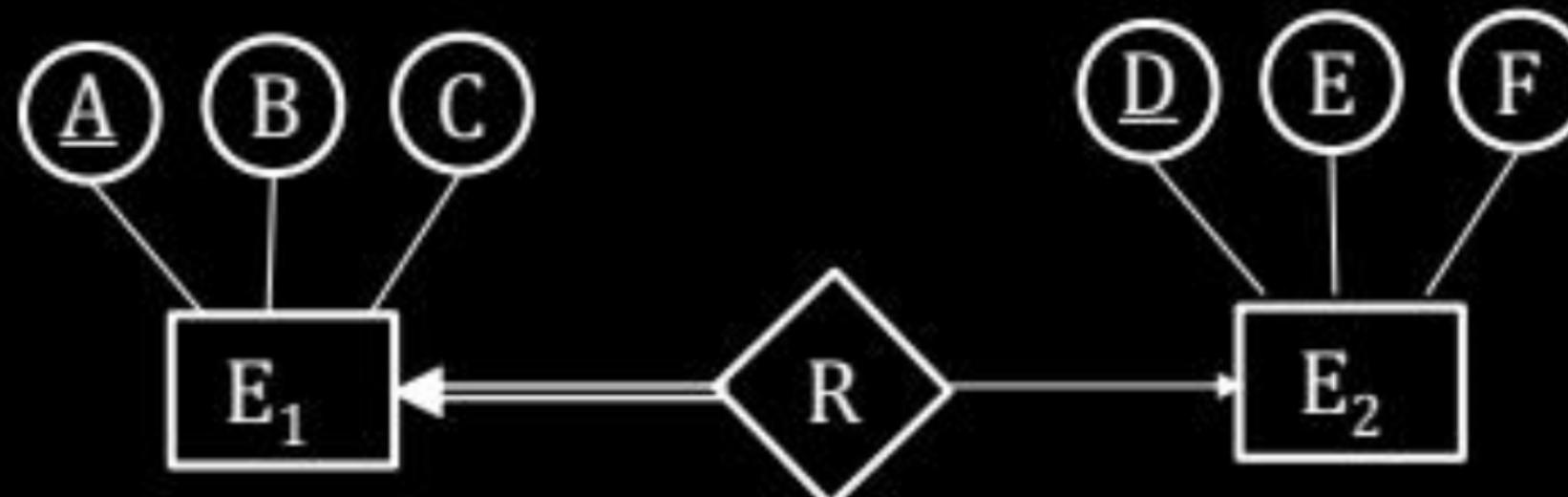
A relational table in which no attribute having "NOT NULL" values are "NOT" allowed in RDBMS . So,

- minimum 2 Relation Table Required and 1 Foreign key.

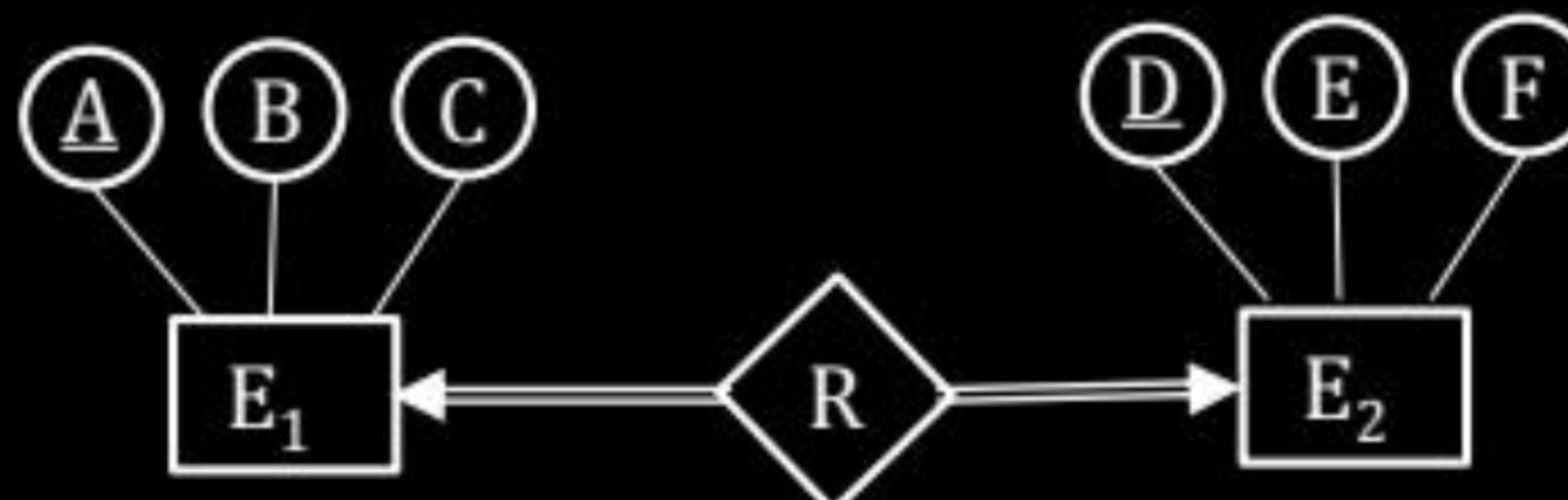
P  
W

$E_1 E_2$  Entity set R Rel set between  $E_1 E_2$

With 1:1 mapping and at least one end having total participation.



$E_1 R E_2$  (A      B      C      D      E      F)

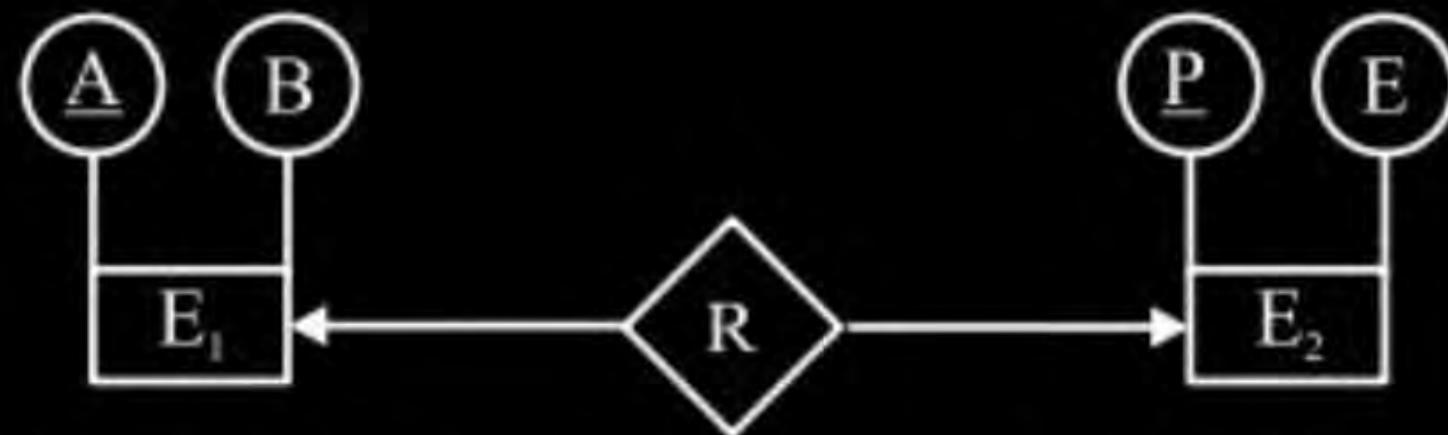


$E_1 R E_2$  (A      B      C      D      E      F)

Primary Key

UNIQUE & NOT NULL (Alternative Key)

Q.



P  
W

70% participation at E<sub>1</sub> end & 40% participation at E<sub>2</sub> end.  
Which is best possible design?

- A. E<sub>1</sub> E<sub>2</sub> entity set kept separate with F.K at E<sub>1</sub>
- B. E<sub>1</sub> E<sub>2</sub> entity set kept separate with F.K at E<sub>2</sub>
- C. E<sub>1</sub> E<sub>2</sub> entity set kept separate with F.K at both E<sub>1</sub> E<sub>2</sub>
- D. E<sub>1</sub> E<sub>2</sub> merges into single table with No F.K.

P  
W

(a)  $E_1 \cap (A \cup B \cup D)$



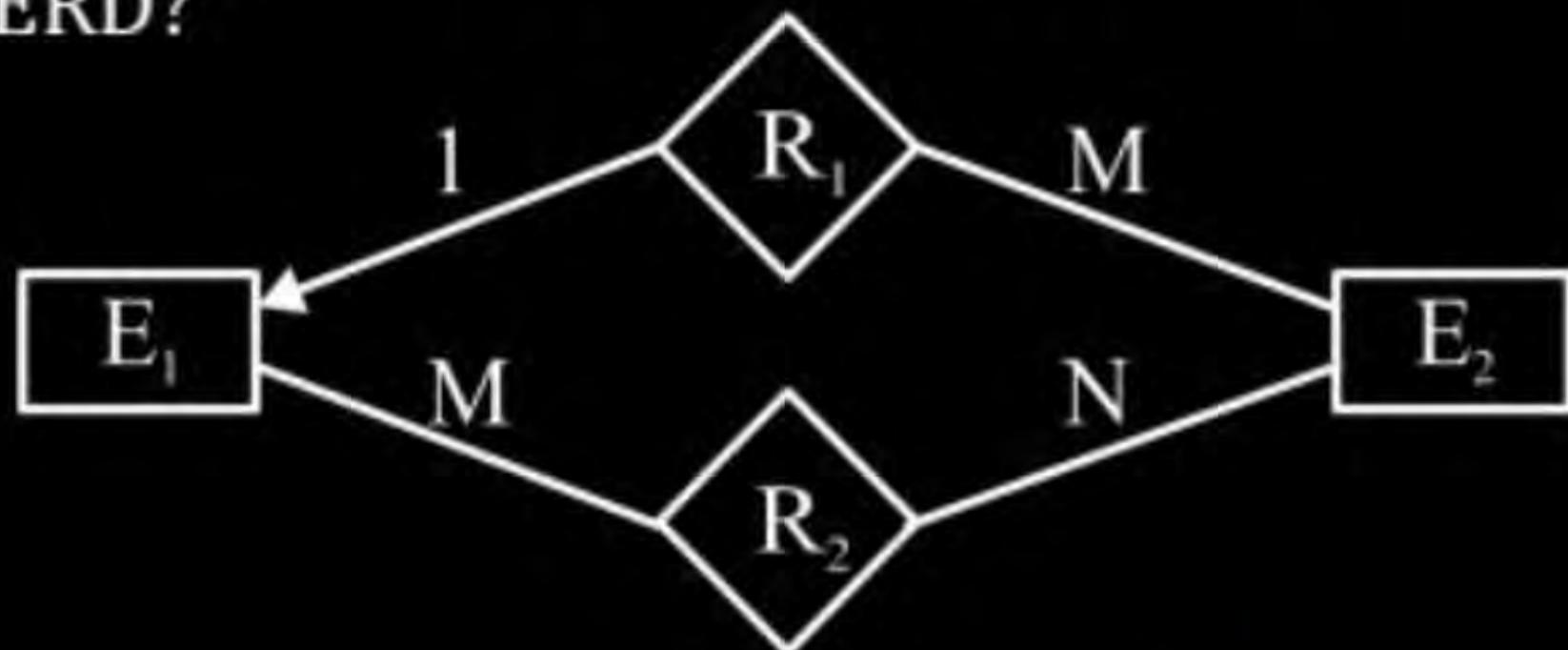
$E_2(D \cup E)$

(b)  $E_1(A \cup B) \cap E_2(D \cup E \cup A)$



**Q.**

E<sub>1</sub> E<sub>2</sub> entity set R<sub>1</sub> R<sub>2</sub> Relationship set related between E<sub>1</sub> and E<sub>2</sub> with 1:M and M : N mapping min Relational Table required in ERD?



- A. 2
- C. 4

- B. 3
- D. 5

**P  
W**

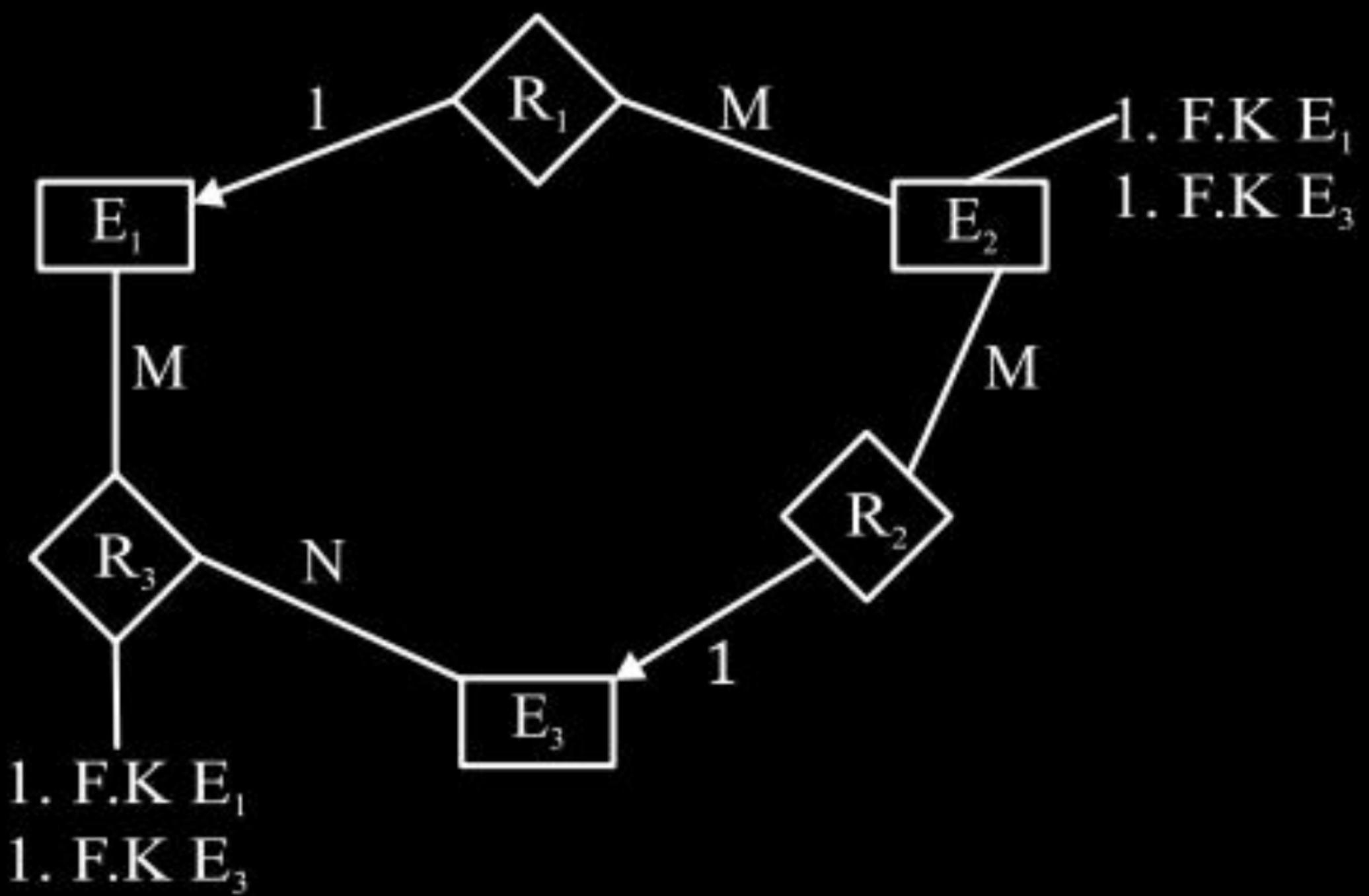
**Q.**

$E_1 E_2 E_3$  entity set  $R_1$  Relation between  $E_1 E_2$  with  $1 : M$ ,  $R_2$  Relations between  $E_2 E_3$  with  $M : 1$ ,  $R_3$  Relationship between  $E_1$  &  $E_3$  with  $M : N$

P  
W

How many minimum relational tables required for given ERD?

- A. 2
- B. 3
- C. 4
- D. 5



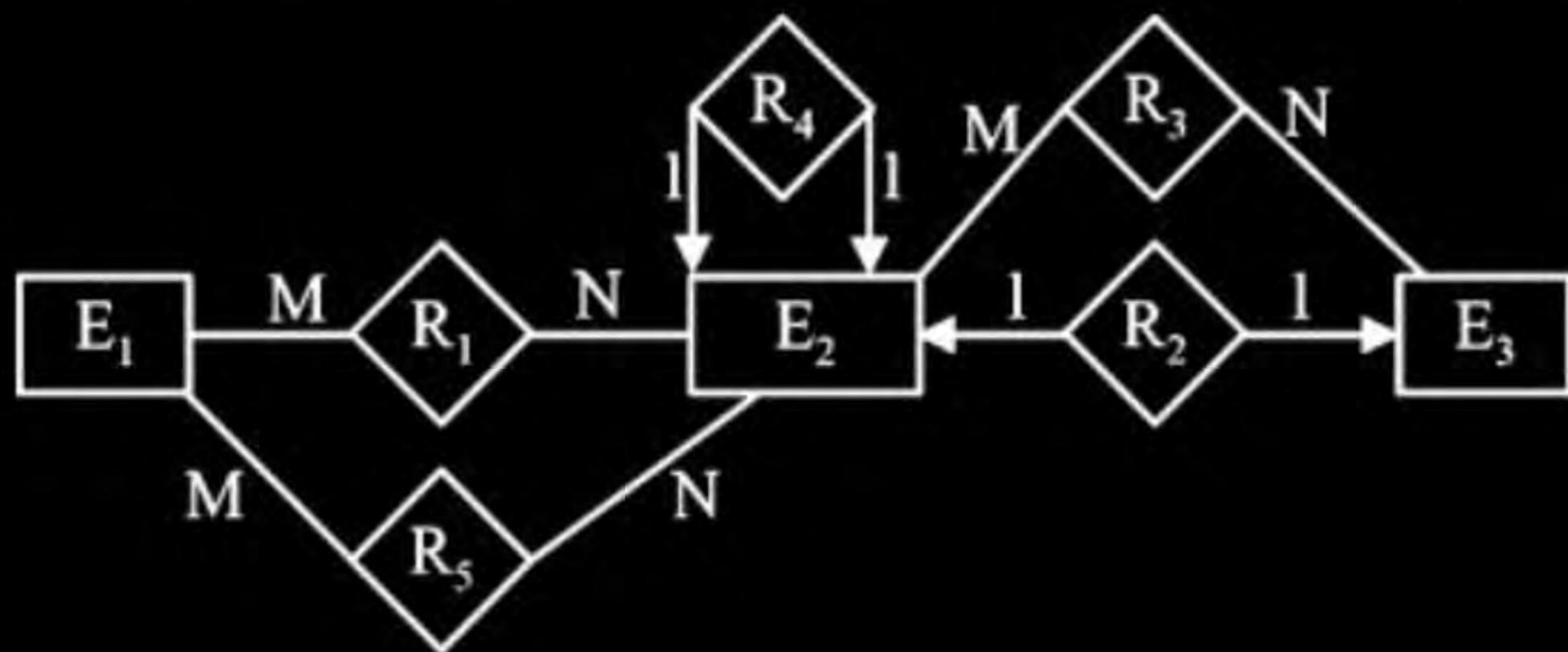
Min 4 Rel Table and 4 Foreign key.

**Q.**

Consider the following ER diagram

**[NAT]** P  
W

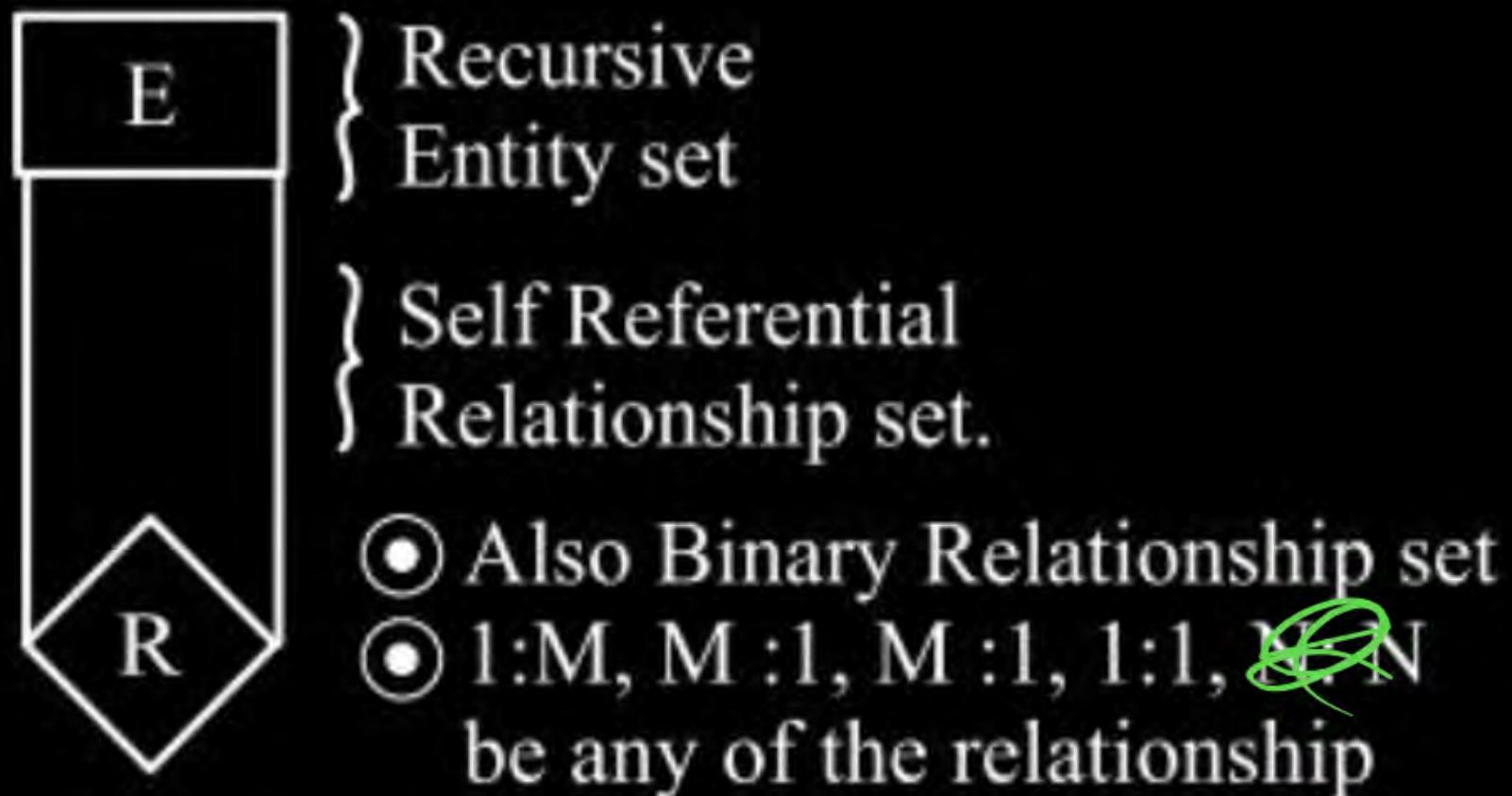
Total number of RDBMS table in the above diagram?



## Self Referential Relationship set:

[ Recursive entity set]

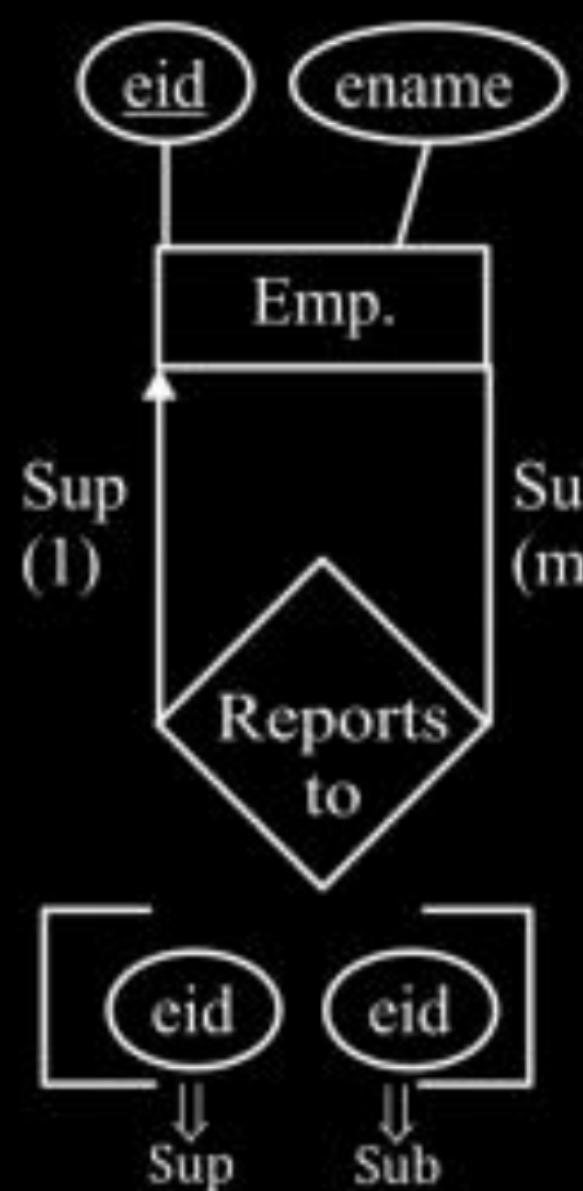
Entities of entity set (E) related to some other entity of same entity set (E)



⇒ Emp entity set.

Reports to Relationship Set Related between Supervisor and Subordinate

- (i) Each supervisor can supervise many subordinates and each subordinate reports to one supervisor.



**Emp.**

**Reports to**

**(eid**

**e1**

**e2**

**e3**

**e4**

**(Sup**

**e1**

**e1**

**e2**

**ename)**

**-**

**-**

**-**

**-**

**Sub)**

**e2**

**e3**

**e4**

Emp.	(eid	ename)
	e1	-
	e2	-
	e3	-
	e4	-
Reports to	(Sup	Sub)
	e1	- e2
	e1	- e3
	e2	- e4

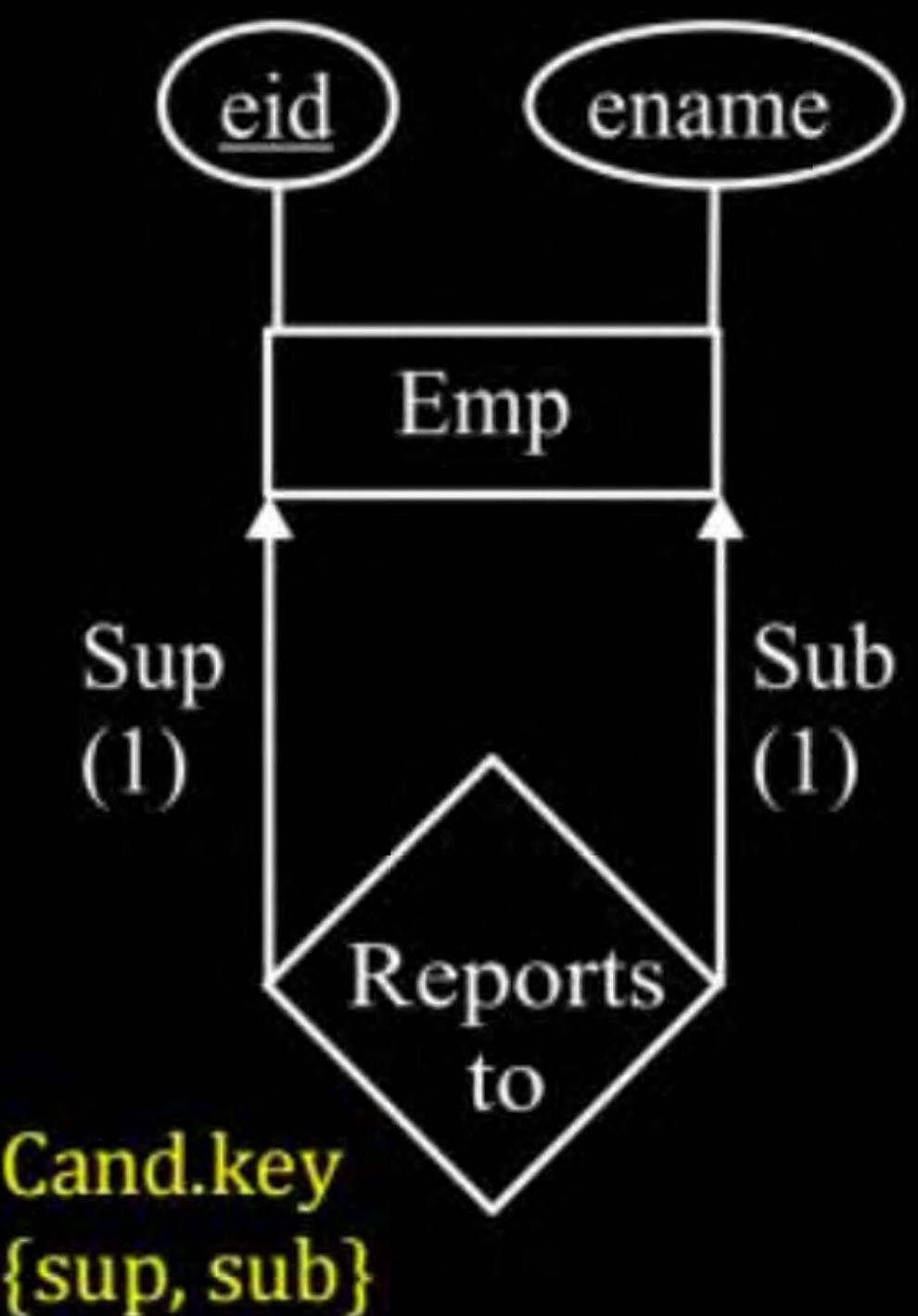
(eid + sub)      ↓      Combine

Cand. Key; {eid}  
“Sup” Foreign key Ref.  
to same table

Emp. Reports to	(eid	ename	Sup)
	e <sub>1</sub>	→	Null
	e <sub>2</sub>	→	e <sub>1</sub>
	e <sub>3</sub>	→	e <sub>1</sub>
	e <sub>4</sub>	→	e <sub>2</sub>

Min 1 RDBMS table required with 1 F.K refer to same table

(ii) Each supervisor can supervise one subordinates and each subordinate reports to one supervisor



Emp.

Reports to

(**eid**

e1

e2

e3

e4

(Sub

e1

e2

e3

e4

**ename**)

-

-

-

-

Sub)

e2

e3

e4

Cand.key  
{sup, sub}

Emp\_Report to

Merge

Emp\_Reports to

(eid

ename

Sup)

e<sub>1</sub>

→

Null

e<sub>2</sub>

→

e<sub>1</sub>

e<sub>3</sub>

→

e<sub>2</sub>

e<sub>4</sub>

→

e<sub>3</sub>

Can. Key : {eid, sub}

↓

P.K.

↓

A.K

(eid + sub)

"Sup" foreign key Refers to same Table eid.

Or one more possibilities

(eid

ename

sub)

↓

P.K (eid+sup)

↓

A.K

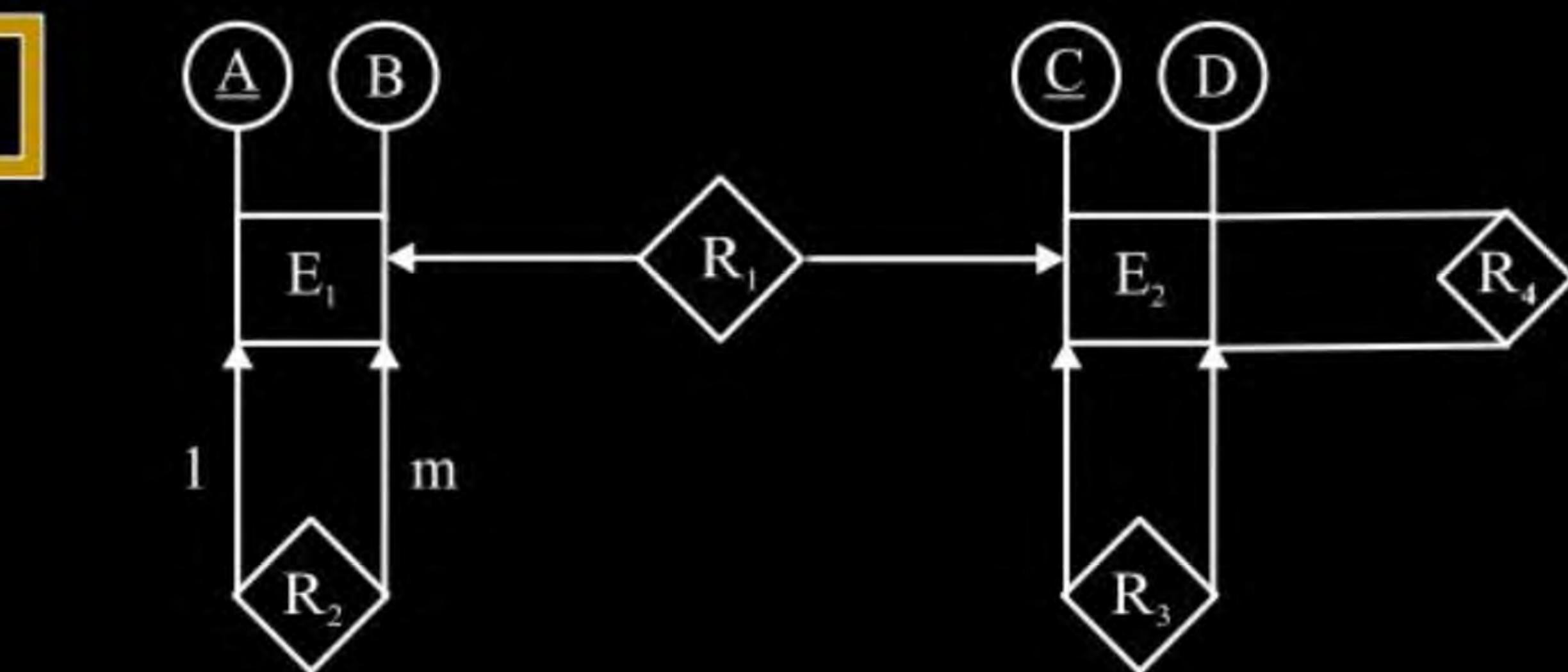
P  
W

(iii) Each supervisor can supervise many subordinate and each subordinate reports to many supervisor.



Minimum 2 relational table and 2 foreign keys.

Q.



P  
W

- (I)       $E_1 \ R_2 (\underline{A} \quad B \quad A)$
- (II)      $E_2 \ R_1 \ R_3 (\underline{C} \quad D \quad A \quad C)$
- (III)     $R_4 \ C_3 \ C_4$

**Q.**

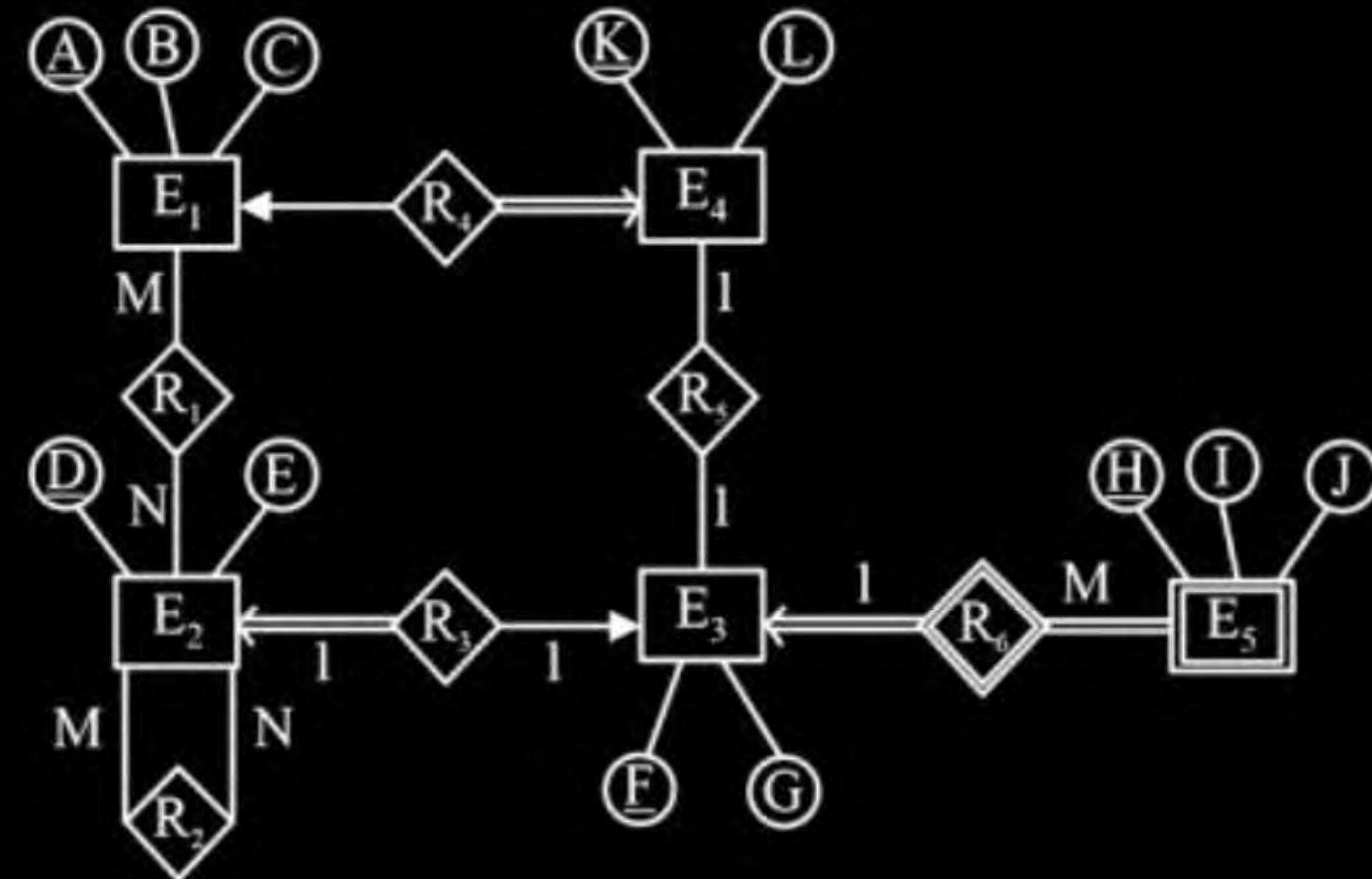
Consider the following ER diagram:

**[MCQ]**

P  
W

How many total attributes required for the minimized relations of the above ER diagram?

- A. 14
- B. 15
- C. 18
- D. None of these

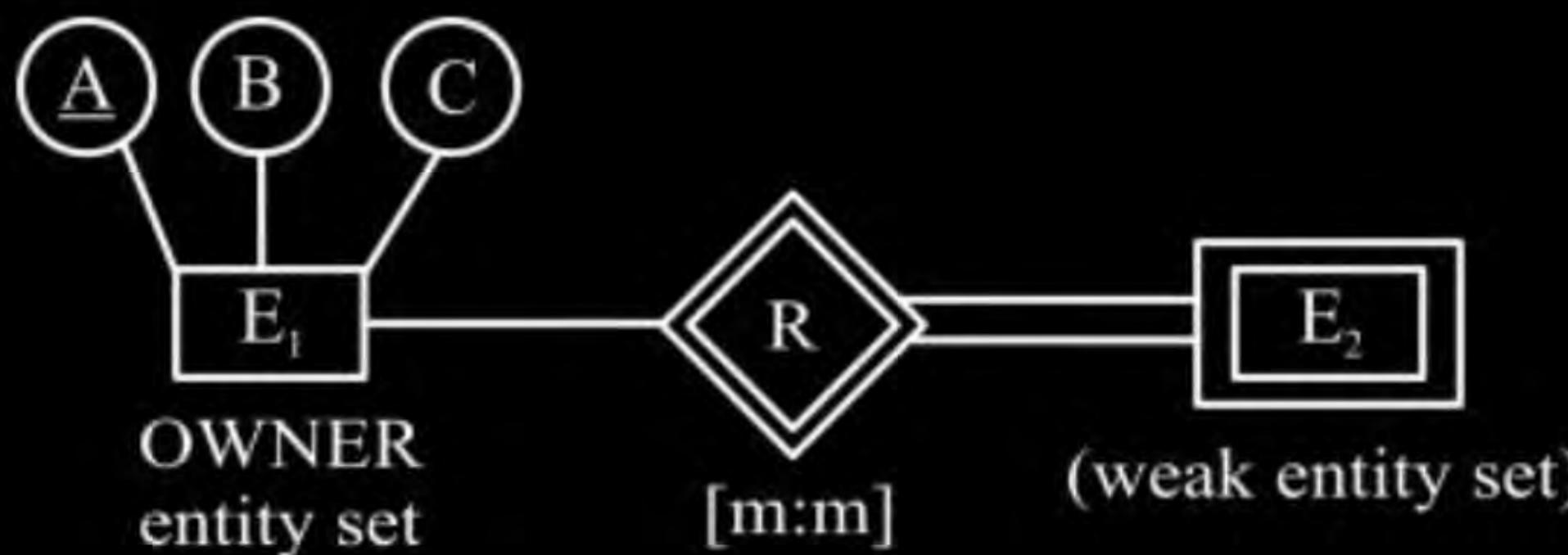


## WEAK ENTITY SET:

- ⇒ Entity set with no key.  
[Attributes of weak entity set not sufficient to differentiate entities uniquely]

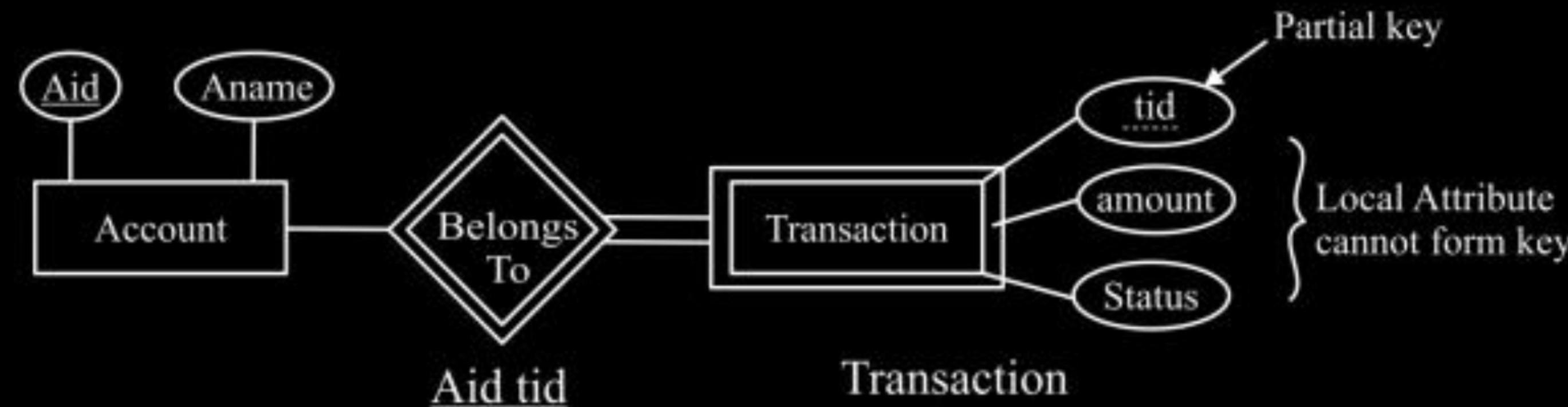


- ⇒ For each weak entity set there must be OWNER entity set which is strong entity.



⇒ Entities of weak entity set are depending entities.

Ex.



Aid	Aname	Aid	tid	tid	amount	Status
A <sub>1</sub>		A <sub>1</sub>	t <sub>1</sub>	t <sub>1</sub>	5000	Debit
A <sub>2</sub>		A <sub>2</sub>	t <sub>1</sub>	t <sub>1</sub>	4000	Credit
A <sub>3</sub>		A <sub>2</sub>	t <sub>2</sub>	t <sub>2</sub>	5000	Debit
A <sub>4</sub>		A <sub>3</sub>	t <sub>2</sub>	t <sub>2</sub>	5000	Debit

[1: m]  
Ambiguity

- Relationship set between weak entity set and identifier entity is also weak relationship set.



- Participation towards weak entity set end must be TOTAL PARTICIPATION.
- Mapping between identifier set must be one: many (1: m )
- RDBMS Design:  
Transaction belongs (Aid tid amount state)  
Account (Aid Aname)

**NOTE:** Weak entity set and multivalued attributes allowed to represent in ERD, but NOT allowed in RDBMS Table.

**Q.**

Consider the following statements:

- S<sub>1</sub>:** All strict recoverable schedules are serial.
- S<sub>2</sub>:** All recoverable schedules are conflict serializable.
- S<sub>3</sub>:** All strict schedules are conflict serializable.
- S<sub>4</sub>:** All conflict serializable schedules are free from cascading rollbacks.

✓

Which of the following is true?

- (a) Only S<sub>1</sub> and S<sub>4</sub>
- (b) Only S<sub>2</sub>, S<sub>3</sub> and S<sub>4</sub>
- (c) Only S<sub>2</sub> and S<sub>4</sub>
- (d) None of these

P  
W

**Q.**

Consider the following transaction:

P  
W

$T_1: R_1(x) W_1(x) R_1(y) W_1(y)$

$T_2: W_2(y) W_2(x)$

The number of non-serial schedules between  $T_1$  and  $T_2$  which are serializable?

(a) 2

(b) 13

(c) 15

(d) None of these



In an Entity-Relationship (ER) model, suppose R is a many-to-one relationship from entity set E1 to entity set E2. Assume that E1 and E2 participate totally in R and that the cardinality of E1 is greater than the cardinality of E2.

Which one of the following is true about R?

[GATE-2018-CS: 1M]

- A Every entity in E1 is associated with exactly one entity in E2.
- B Some entity in E1 is associated with more than one entity in E2.
- C Every entity in E2 is associated with exactly one entity in E1.
- D Every entity in E2 is associated with at most one entity in E1.

Consider an Entity-Relationship (ER) model in which entity sets  $E_1$  and  $E_2$  are connected by an  $m: n$  relationship  $R_{12}$ .  $E_1$  and  $E_3$  are connected by a  $1: n$  ( $1$  on the side of  $E_1$  and  $n$  on the side of  $E_3$ ) relationship  $R_{13}$ .

$E_1$  has two single-valued attributes  $a_{11}$  and  $a_{12}$  of which  $a_{11}$  is the key attribute.  $E_2$  has two single valued attributes  $a_{21}$  and  $a_{22}$  of which  $a_{21}$  is the key attribute.  $E_3$  has two single valued attributes  $a_{31}$  and  $a_{32}$  of which  $a_{31}$  is the key attribute. The relationships do not have any attributes.

If a relational model is derived from the above ER model, then the minimum number of relations that would be generated if all the relations are in 3 NF is \_\_\_\_\_

Consider the following statements S1 and S2 about the relational data model:

- S1: A relation scheme can have at most one foreign key.  
S2: A foreign key in a relation scheme R cannot be used to refer to tuples of R.

Which one of the following choices is correct?

[GATE-2021-CS: 1M]

- A Both S1 and S2 are true
- B S1 is true and S2 is false
- C S1 is false and S2 is true
- D Both S1 and S2 are false

Consider the following tables T1 and T2.

In table T1, P is the primary key and Q is the foreign key referencing R in table T2 with on-delete cascade and on-update cascade. In table T2, R is the primary key and S is the foreign key referencing P in table T1 with on-delete set NULL and on-update cascade. In order to delete record  $\langle 3,8 \rangle$  from table T1, the number of additional records that need to be deleted from table T1 is

T <sub>1</sub>	
P	Q
2	2
3	8
7	3
5	8
6	9
8	5
9	8

T <sub>2</sub>	
R	S
2	2
8	3
3	2
9	7
5	7
7	2

[GATE-2017-CS: 1M]

## MCQ

Q.5

Let  $E_1$  and  $E_2$  be two entities in an E-R diagram with simple single-valued attributes.  $R_1$  and  $R_2$  are two relationships between  $E_1$  and  $E_2$ , where  $R_1$  is one-to-many and  $R_2$  is many-to-many.  $R_1$  and  $R_2$  do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model?

[GATE-2005]

- A 2
- B 3
- C 4
- D 1

Consider the entities 'hotel room', and 'person' with a many to many relationship 'lodging' as shown below:



If we wish to store information about the rent payment to be made by person (s) occupying different hotel rooms, then this information should appear as an attribute of [GATE-2005]

- A Person
- B Hotel Room
- C Lodging
- D None of these

Amongst the ACID properties of a transaction, the 'Durability' property requires that the changes made to the database by a successful transaction persist

[GATE-2005]

- A Except in case of an Operating System crash
- B Except in case of a Disk crash
- C Except in case of a power failure
- D Always, even if there is a failure of any kind

Consider the following schedules involving two transactions. Which one of the following statements is TRUE?

$S_1 : r_1(X); r_1(Y); r_2(X); r_2(Y); w_2(Y); w_1(X)$

$S_2 : r_1(X); r_2(X); r_2(Y); w_2(Y); r_1(Y); w_1(X)$

[GATE-2007]

- A Both  $S_1$  and  $S_2$  are conflict serializable.
- B  $S_1$  is conflict serializable and  $S_2$  is not conflict serializable.
- C  $S_1$  is not conflict serializable and  $S_2$  is conflict serializable.
- D Both  $S_1$  and  $S_2$  are not conflict serializable.

Consider the following log sequence of two transactions on a bank account, with initial balance 12000, that transfer 2000 to a mortgage payment and then apply a 5% interest.

1. T1 start
2. T1 B old=12000 new=10000
3. T1 M old=0 new=2000
4. T1 commit
5. T2 start
6. T2 B old=10000 new=10500
7. T2 commit

Suppose the database system crashes just before log record 7 is written. When the system is restarted, which one statement is true of the recovery procedure?

[GATE-2006]

- A We must redo log record 6 to set B to 10500
- B We must undo log record 6 to set B to 10000 and then redo log records 2 and 3.
- C We need not redo log records 2 and 3 because transaction T1 has committed.
- D We can apply redo and undo operations in arbitrary order because they are idempotent

Which one of the following statements about normal forms is FALSE?

[GATE-2005]

- A BCNF is stricter than 3NF
- B Lossless, dependency-preserving decomposition into 3NF is always possible
- C Lossless, dependency-preserving decomposition into BCNF is always possible
- D Any relation with two attributes is in BCNF

A table has fields  $F_1, F_2, F_3, F_4, F_5$  with the following functional dependencies

- $F_1 \rightarrow F_3, F_2 \rightarrow F_4, (F_1 \cdot F_2) \rightarrow F_5$

In terms of Normalization, this table is in

[GATE-2005]

- A 1 NF
- B 2 NF
- C 3 NF
- D none

Consider two tables in a relational database with columns and rows as follows:

Table: Student

ROLL_NO	NAME	DEPT_ID
1	ABC	1
2	DEF	1
3	GHI	2
4	JKL	3

Table: Department

DEPT_ID	DEPT_NAME
1	A
2	B
3	C

Roll\_no is the primary key of the Student table, Dept\_id is the primary key of the Department table and Student.Dept\_id is a foreign key from Department.Dept\_id. What will happen if we try to execute the following two SQL statements?

- i. update Student set Dept\_id = Null where Roll\_on = 1
- ii. update Department set Dept\_id = Null where Dept\_id = 1

[GATE-2004]

- A Both (i) and (ii) will fail
- B (i) will fail but (ii) will succeed
- C (i) will succeed but (ii) will fail
- D Both (i) and (ii) will succeed

Which of the following scenarios may lead to an irrecoverable error in a database system?

[GATE-2003]

- A** A transaction writes a data item after it is read by an uncommitted transaction
- B** A transaction reads a data item after it is read by an uncommitted transaction
- C** A transaction reads a data item after it is written by a committed transaction
- D** A transaction reads a data item after it is written by an uncommitted transaction

Consider the following functional dependencies in a database.

$\text{Date\_of\_Birth} \rightarrow \text{Age}$

$\text{Age} \rightarrow \text{Eligibility}$

$\text{Name} \rightarrow \text{Roll number}$

$\text{Roll\_number} \rightarrow \text{Name}$

$\text{Course\_number} \rightarrow \text{Course name}$

$\text{Course\_number} \rightarrow \text{Instructor}$

$(\text{Roll\_number}, \text{Course\_number}) \rightarrow \text{Grade}$

The relation  $(\text{Roll\_number}, \text{Name}, \text{Date\_of\_birth}, \text{Age})$  is

[GATE-2003]

- A in second normal form but not in third normal form
- B in third normal form but not in BCNF
- C in BCNF
- D none of tire above

Consider three data items D1, D2, and D3, and the following execution schedule of transactions T1, T2, and T3. In the diagram, R(D) and W(D) denote the actions reading and writing the data item D respectively,

[GATE-2003]

T1	T2	T3
	R(D3); R(D2); W(D2);	
R(D1); W(D1);		R(D2); R(D3);
		W(D2); W(D3);
	R(D1);	
R(D2); W(D2);		
		W(D1);

Which of the following statements is correct?

- A The schedule is serializable as T2; T3; T1
- B The schedule is serializable as T2 ; T1 ; T3
- C The schedule is serializable T3 ; T2 ; T1
- D The schedule is not serializable

For relation  $R = (L, M, N, O, P)$ , the following dependencies hold:

$M \rightarrow O$ ,  $NO \rightarrow P$ ,  $P \rightarrow L$ , and  $L \rightarrow MN$

$R$  is decomposed into  $R_1 = (L, M, N, P)$  and  $R_2 = (M, O)$ .

- a Is the above decomposition a lossless-join decomposition? Explain.
- b Is the above decomposition dependency-preserving ? If not ,list all the dependencies that are not preserved.
- c What is the highest normal form satisfied by the above decomposition?

[GATE-2002]

Consider a schema  $R(A,B,C,D)$  and functional dependencies  $A \rightarrow B$  and  $C \rightarrow D$ .

Then the decomposition of  $R$  into  $R_1(A, B)$  and  $R_2(C, D)$  is

[GATE-2001]

- A Dependency preserving and lossless join
- B Lossless join but not dependency preserving
- C Dependency preserving but not lossless join
- D Not dependency preserving and not lossless join

For a database relation  $R(a, b, c, d)$ , where the domains  $a, b, c, d$  include only atomic values, only the following functional dependencies and those that can be inferred from them hold:

- $a \rightarrow c$
- $b \rightarrow d$

The relation is

[GATE-1997]

- A in first normal form but not in second normal form
- B in second normal form but not in first normal form
- C in third normal form
- D none of the above

Consider the relation scheme  $R(A,B,C)$  with the following functional dependencies:

- $A, B \rightarrow C$
- $C \rightarrow A$

- (a) Show that the scheme  $R$  is in Third Normal Form (3NF) but not in Boyce-Codd Normal Form (BCNF).
- (b) Determine die minimal keys of relation  $R$ .

[GATE-1995]

Consider the following database relations containing the attributes

- Book-id
- Subject\_Category\_of\_book
- Name\_of\_Author
- Nationality\_of\_Author

with Book\_id as the primary key

- a. What is the highest normal form satisfied by this relation?
- b. Suppose the attributes Book\_title and Author\_address are added to the relation, and the primary key is changed to {Name\_of \_Author, Book \_title}, What will be the highest normal form satisfied by the relation?

[GATE-1998]



Any Doubt ?

**THANK  
YOU!**

