

# Computer Science & IT

## Database Management System

Entity Relationship Model  
&  
Integrity constraints

Lecture No. 04



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# Recap of Previous Lecture



- \* **Topic** Mapping cardinalities (Cardinality ratio)
- \* **Topic** Mix-max representation

# Topics to be Covered



Topic

Relational table w.r.t. Entity type



Topic

Conversion from ER model to relational table

## Objective:

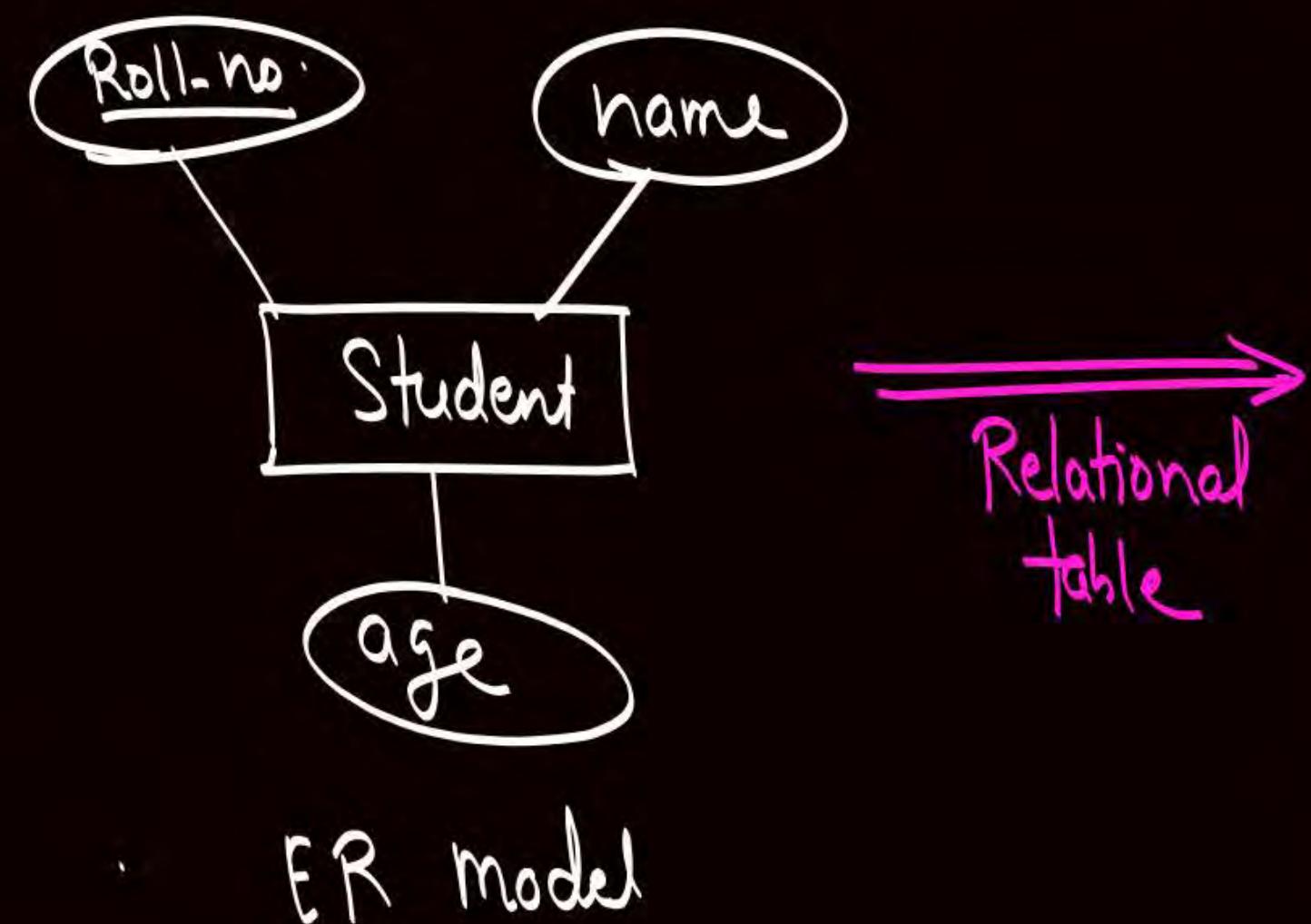
Given an  
ER Model .

We need to  
Convert it  
into relational  
Model ,

Using minimum no.  
of relational tables

Given an entity set, we will define relation w.r.t. that entity set.

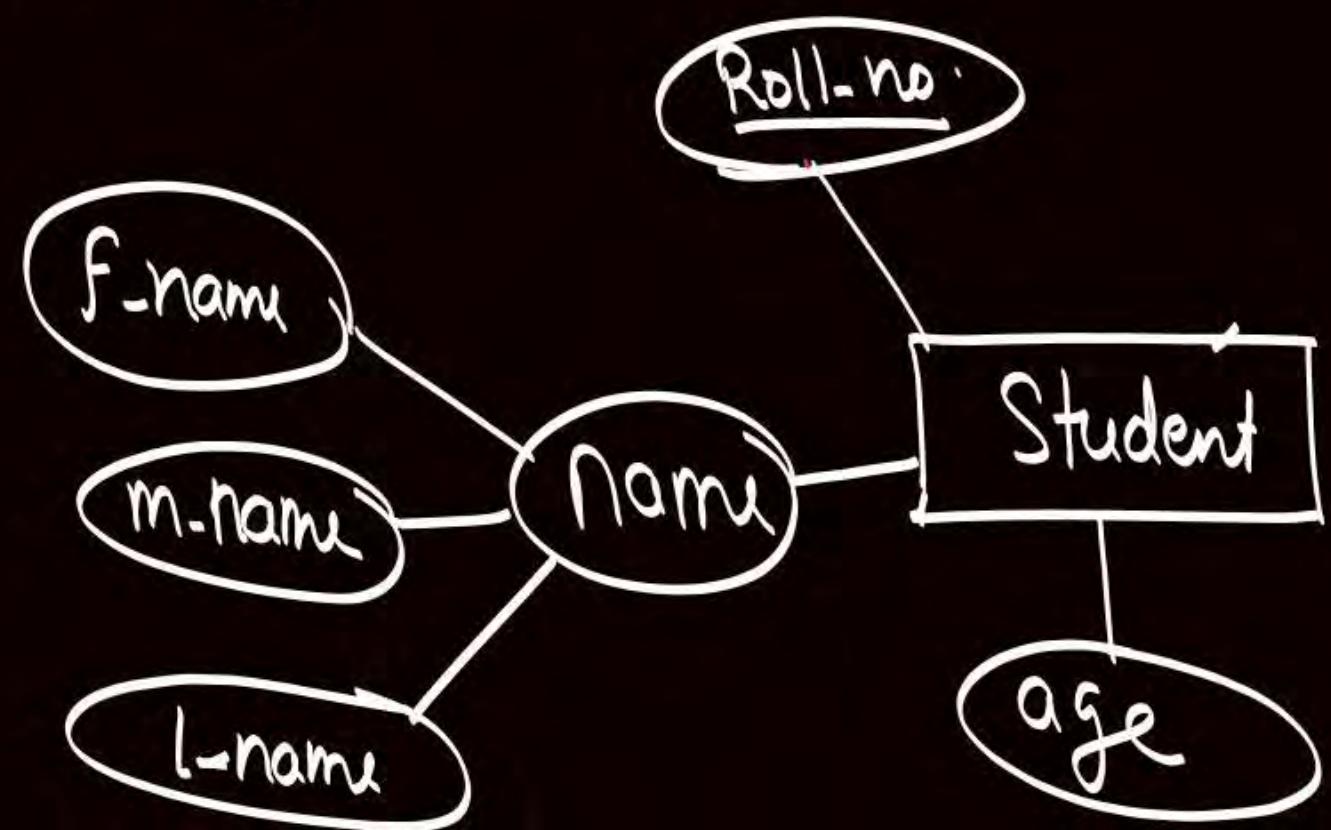
Case ① All attributes are Simple attributes: -



Student		
<u>Roll-no.</u>	name	Age

\* Given an entity set, we will define relation w.r.t. that entity set.

Case ② When some attributes are Composite attributes:-



ER model

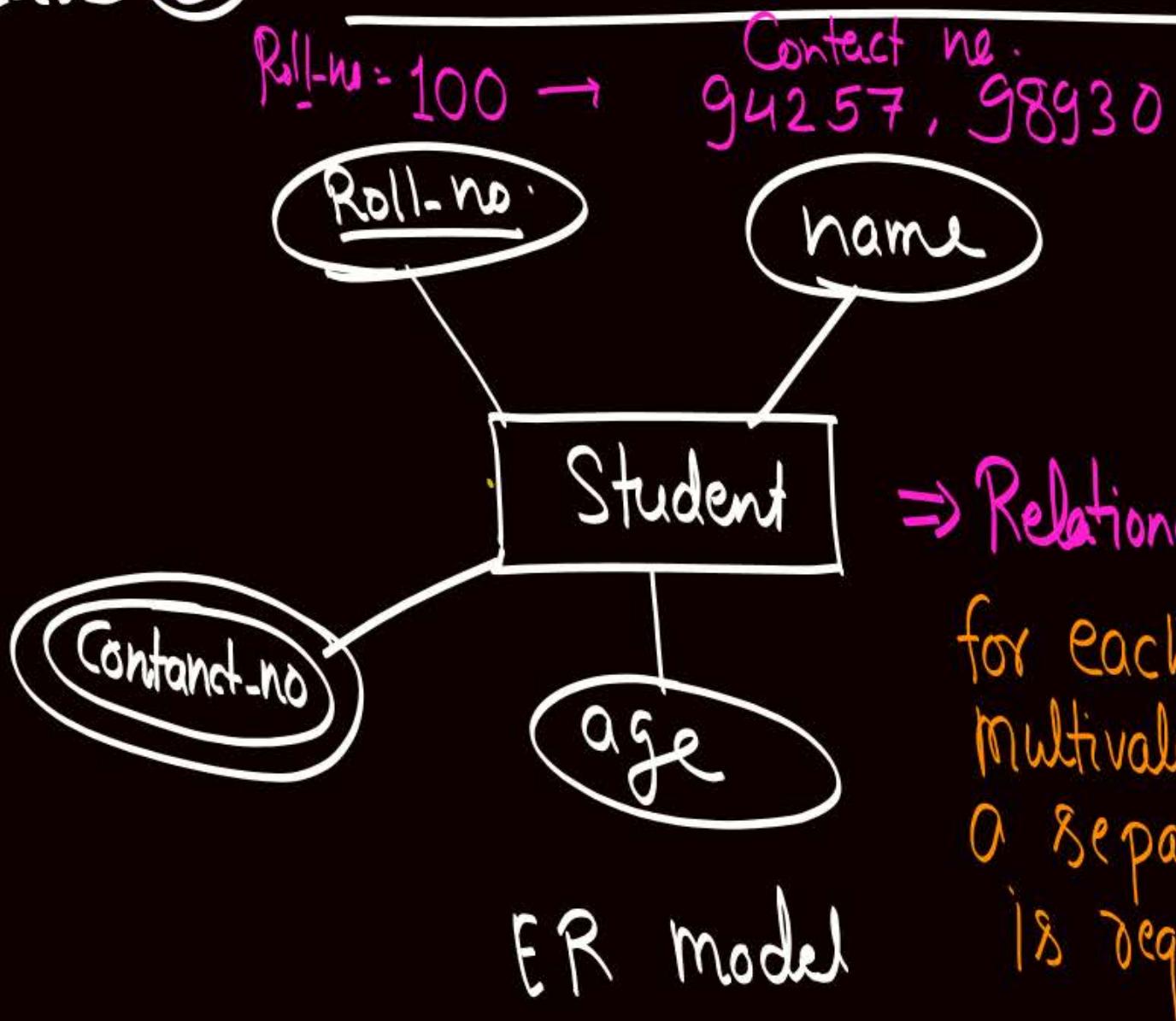
Relational  
table

{ In the relational  
table we will  
consider only simple  
components of  
Composite attribute }

Student				
Roll-no	f-name	m-name	l-name	Age

\* Given an entity set, we will define relation w.r.t. that entity set.

Case ③ Some attributes are multivalued attributes:



⇒ Relational tables ⇒ Two relational tables

for each multivalued attribute  
a separate table  
is required

One w.r.t. all simple attributes

(Simple components of composite attribute)

one w.r.t. multivalued attribute "Contact-no"

Student		
Roll-no	Name	age

Contact-info	
Roll-no	Contact-no.
100	94257
100	98930
200	98930

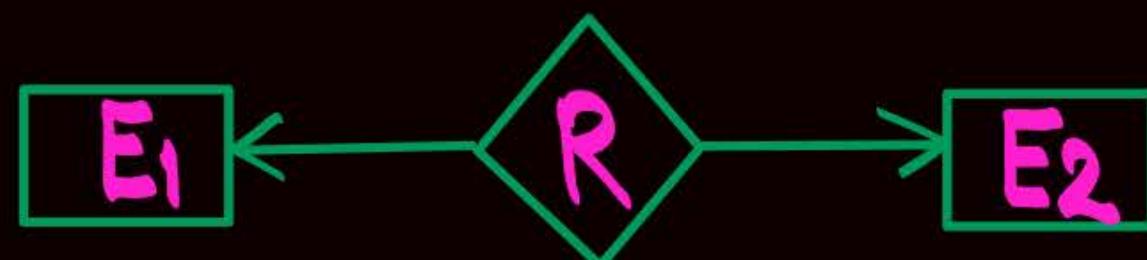
Note:

There is no representation of Composite attributes  
and multivalued attributes in relational model

# ER Model to Relational Table

✓ \* ① One to One Relation

1



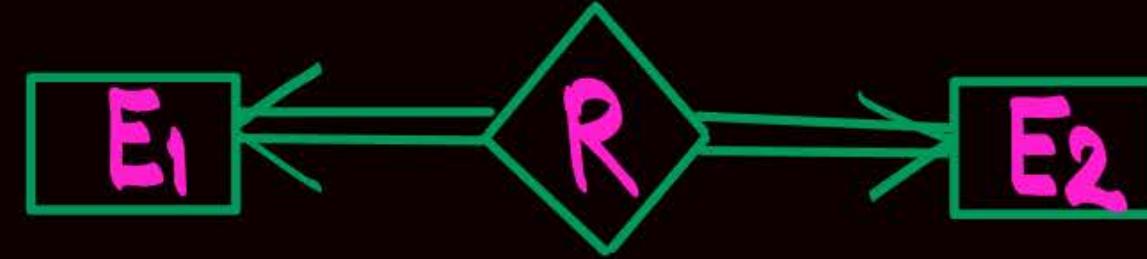
2



3



4



## ER Model to Relational Table

① One to one Relation { Partial participation of both side entities }



P.K.

E<sub>1</sub>

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>
a <sub>1</sub>		
a <sub>2</sub>		
a <sub>3</sub>		

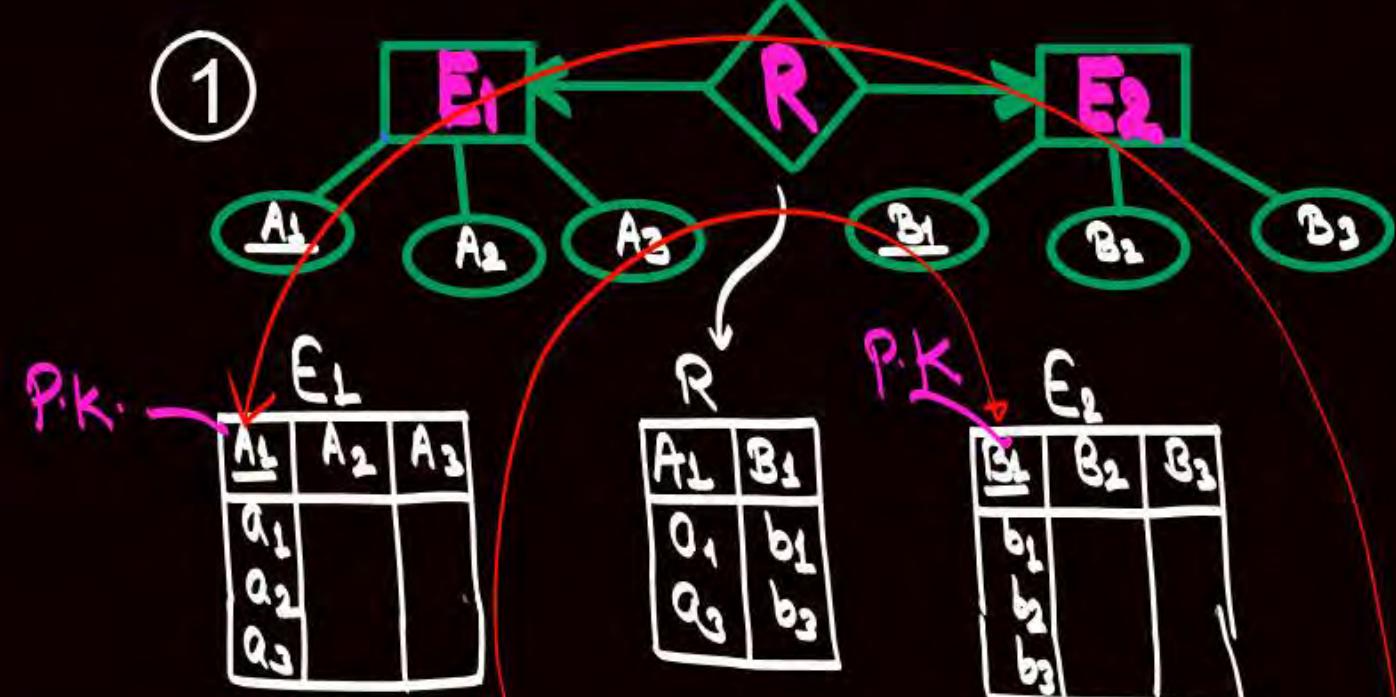
R

E<sub>2</sub>

B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
b <sub>1</sub>		
b <sub>2</sub>		
b <sub>3</sub>		

# ER Model to Relational Table

① one to one Relation { Partial participation of both side entities }



$(E_1 E_2 R)$

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>	-	-
a <sub>2</sub>	-	-	NULL	NULL	NULL
a <sub>3</sub>	-	-	b <sub>3</sub>	-	-

Primary key  
Can not be defined  
for  $(E_1 E_2 R)$   
i. Can not be merged  
into a single relation

P.K.  $E_{1R}$  F.K.

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>
a <sub>2</sub>	-	-	NULL
a <sub>3</sub>	-	-	b <sub>3</sub>

P.K.  $E_{2R}$  F.K.

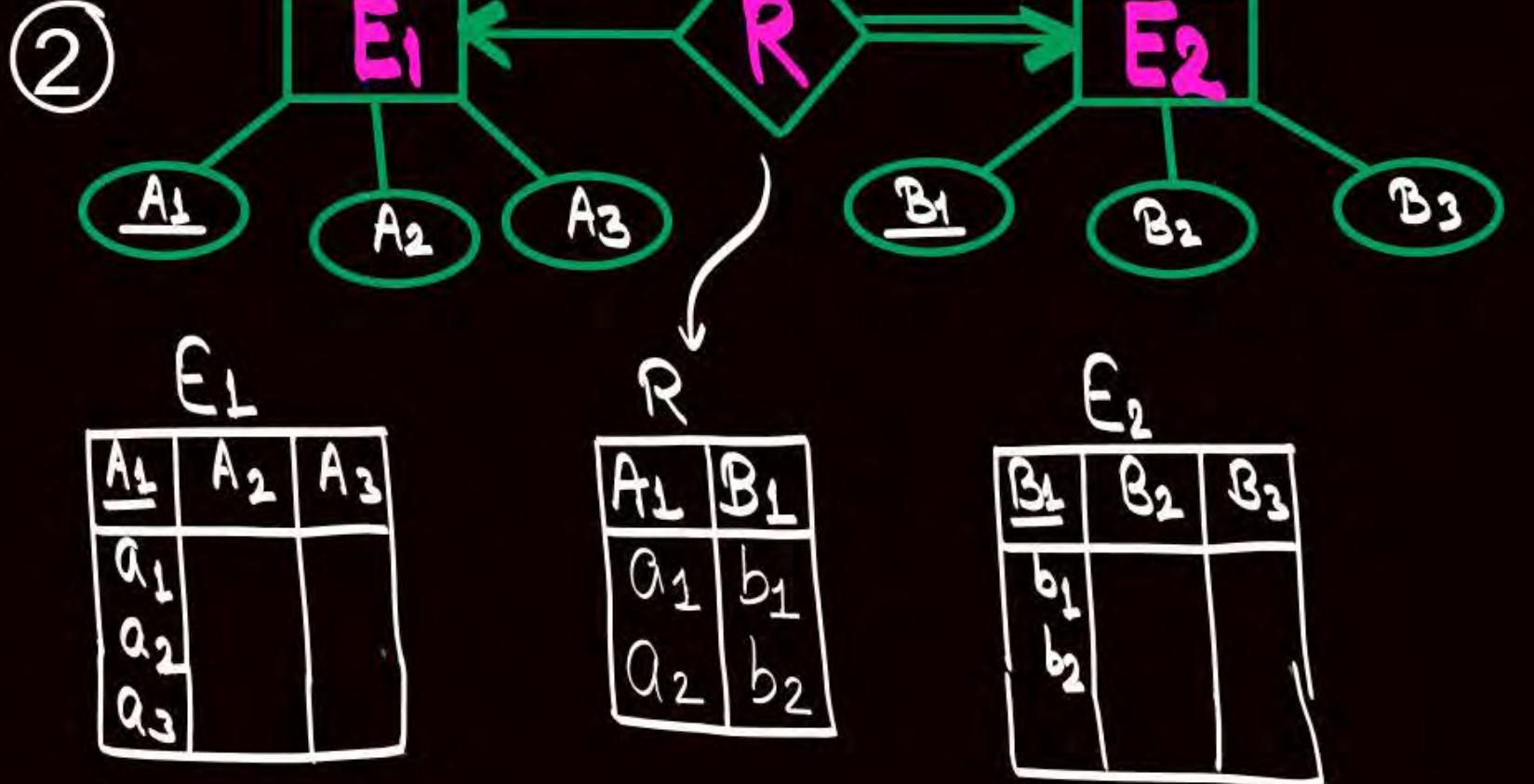
B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	A <sub>1</sub>
b <sub>1</sub>	-	-	a <sub>1</sub>
b <sub>2</sub>	-	-	NULL
b <sub>3</sub>	-	-	a <sub>3</sub>

Possibilities:

- ①  $E_{1R}(A_1, A_2, A_3, B_1)$  and  $E_2(B_1, B_2, B_3)$   
(or)
- ②  $E_1(A_1, A_2, A_3)$  and  $E_{2R}(B_1, B_2, B_3, A_1)$

# ER Model to Relational Table

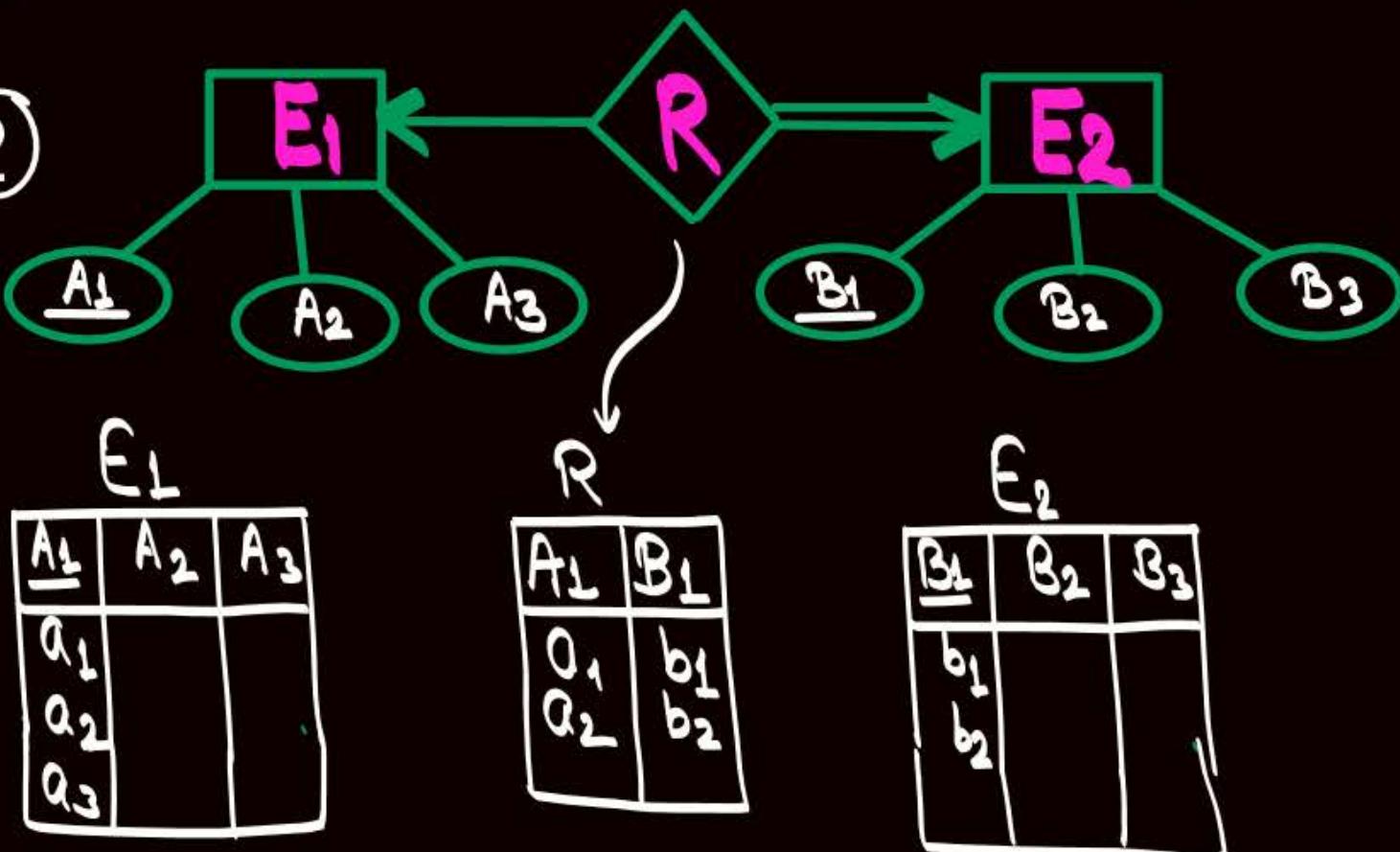
① One to One Relation { total participation of one entity set }



# ER Model to Relational Table

① One to One Relation { total Participation of one entity set }

②



(E1 E2 R)

P.K.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>	-	-	-
a <sub>2</sub>	-	-	b <sub>2</sub>	-	-	-
a <sub>3</sub>	-	-	NULL	NULL	NULL	-

We can combine all three tables into a single table

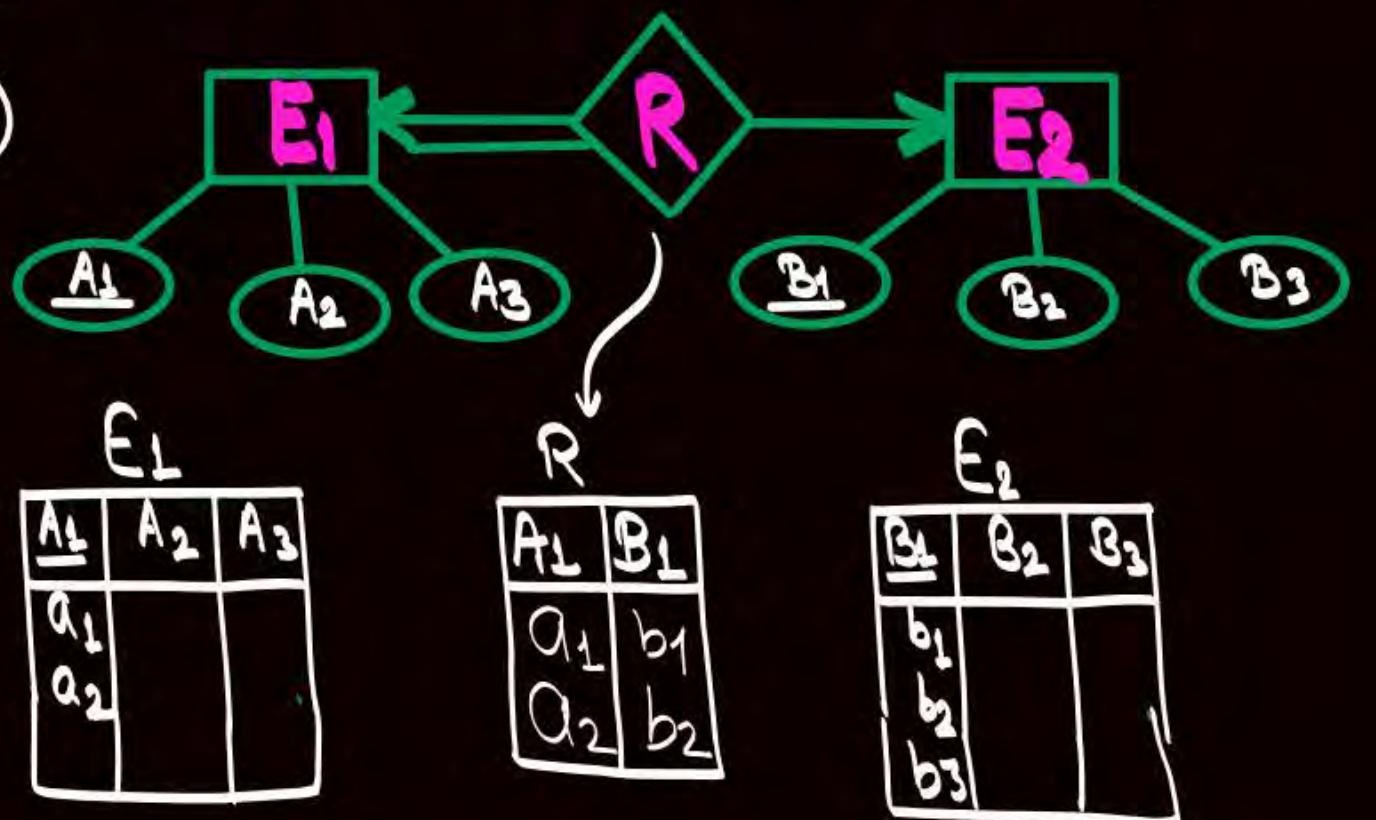
{ No foreign key }

Primary Key = A<sub>1</sub> { Primary key of merged relation will be same as P.K. of Entity set with Partial participation }

## ER Model to Relational Table

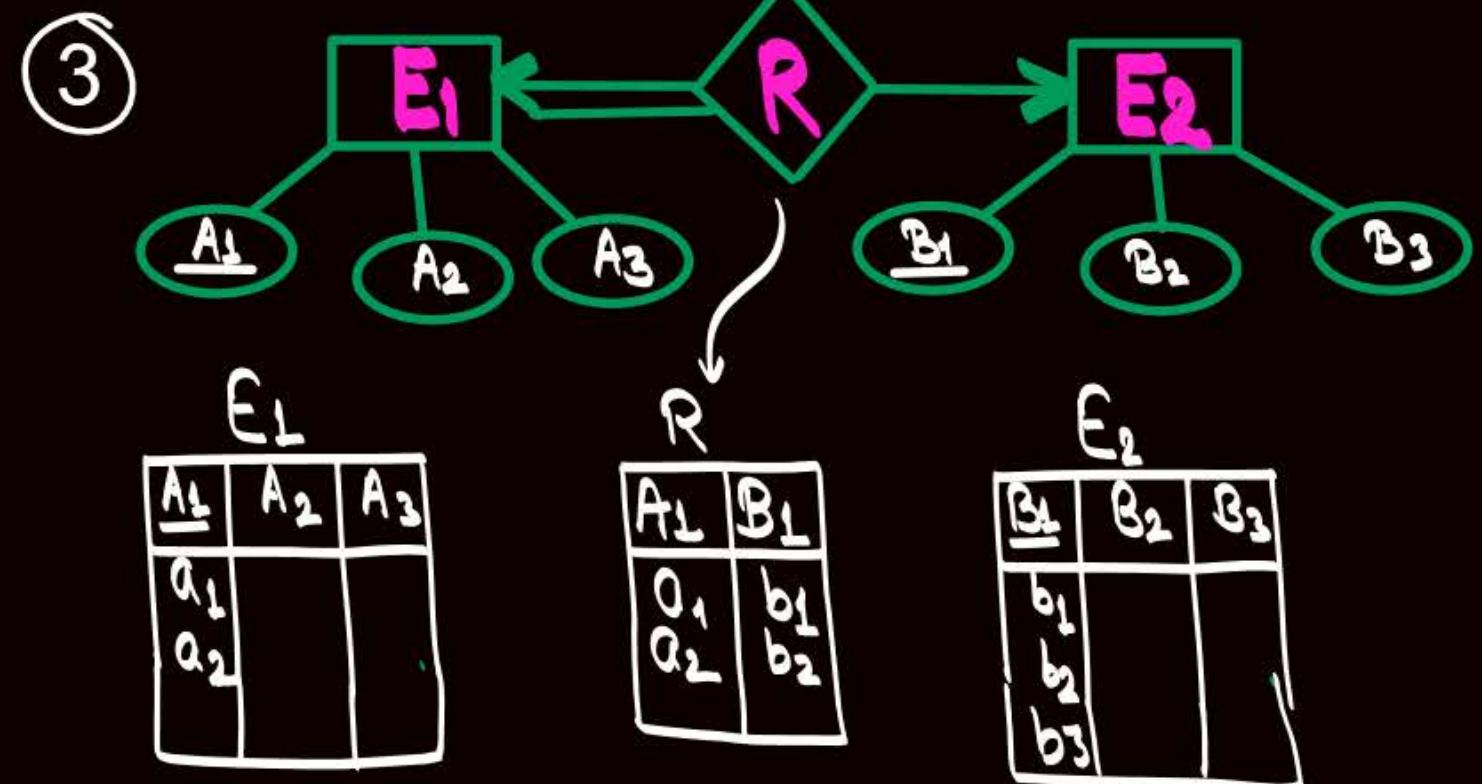
① One to One Relation { total participation of one entity set }

③



# ER Model to Relational Table

① One to One Relation { total participation of one entity set }



(E<sub>1</sub>E<sub>2</sub>R) P.K.

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	<u>B<sub>1</sub></u>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>	-	-
a <sub>2</sub>	-	-	b <sub>2</sub>	-	-
NULL	NULL	NULL	b <sub>3</sub>	-	-

All those  
tables can be  
merged into  
single table

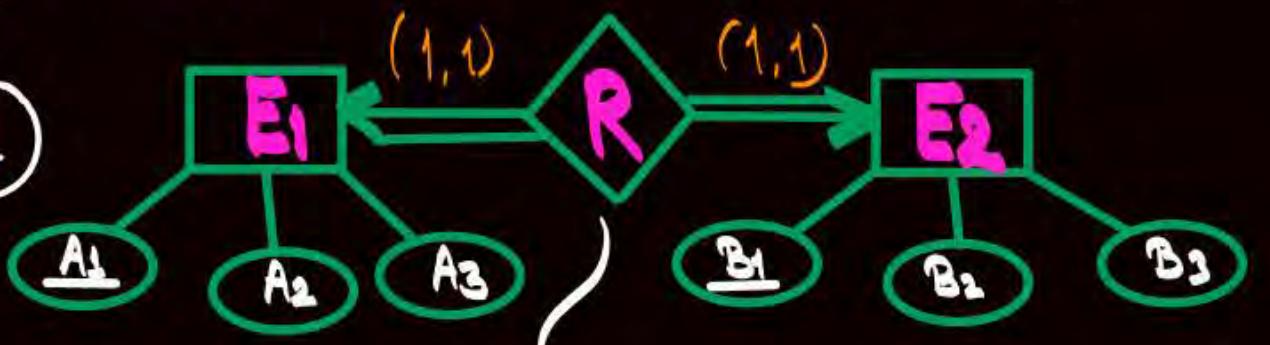
Primary key = B<sub>1</sub> } P.K. will be same as  
P.K. of Entity set  
with partial participation }

## ER Model to Relational Table

①

One to One Relation { total participation of both side entity set }

④



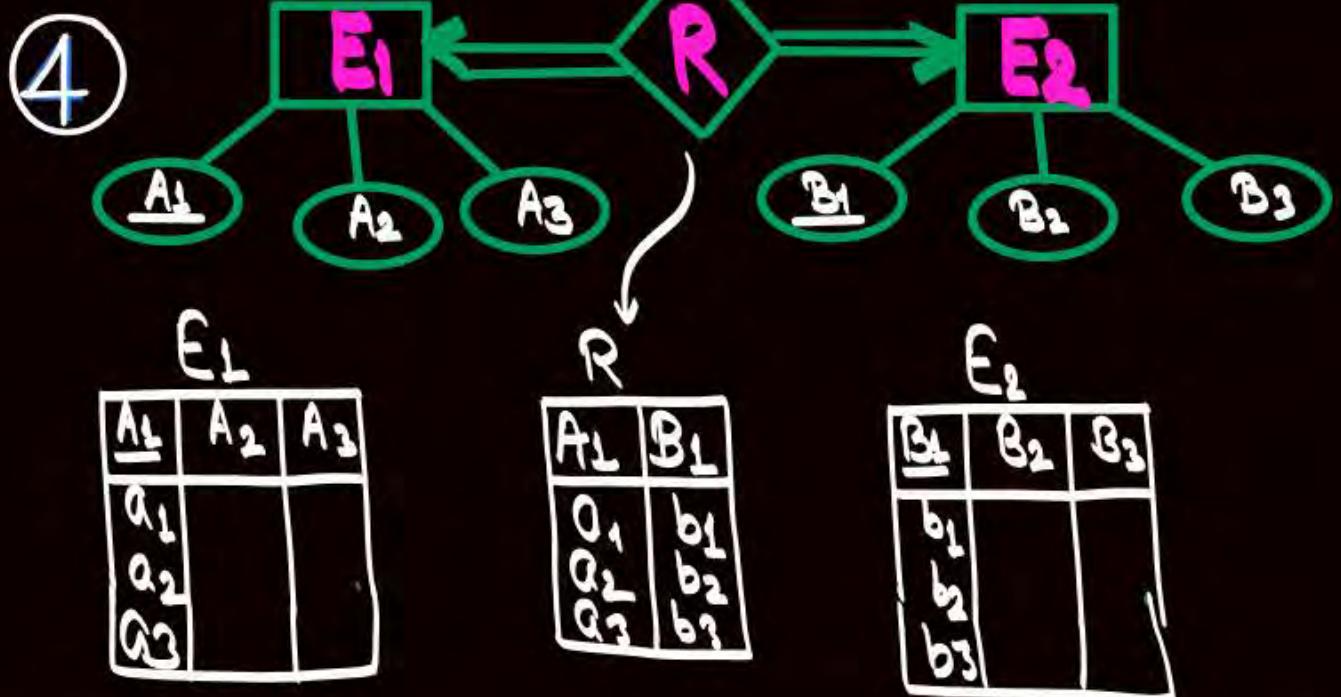
$A_1$	$A_2$	$A_3$
$a_1$		
$a_2$		
$a_3$		

$A_1$	$B_1$
$a_1$	$b_1$
$a_2$	$b_2$
$a_3$	$b_3$

$B_1$	$B_2$	$B_3$
$b_1$		
$b_2$		
$b_3$		

## ER Model to Relational Table

① One to One Relation { total participation of both side entity set }



$E_1 \ E_2 \ R$

$A_1$	$A_2$	$A_3$	$B_1$	$B_2$	$B_3$
$a_1$	-	-	$b_1$	-	-
$a_2$	-	-	$b_2$	-	-
$a_3$	-	-	$b_3$	-	-

All three tables can be merged into a single table  
(No foreign key)

Two candidate keys  
 $A_1$  and  $B_1$

Primary key =  $\underbrace{A_1 \text{ or } B_1}_{\text{We can choose}}$

any one of two

# ER Model to Relational Table

## ① One to One Relation

1



✓  
Minimum two tables are required  
P.K. of Merged relation will be same as P.K.  
of the Entity set with which relationship set  
is merged

2



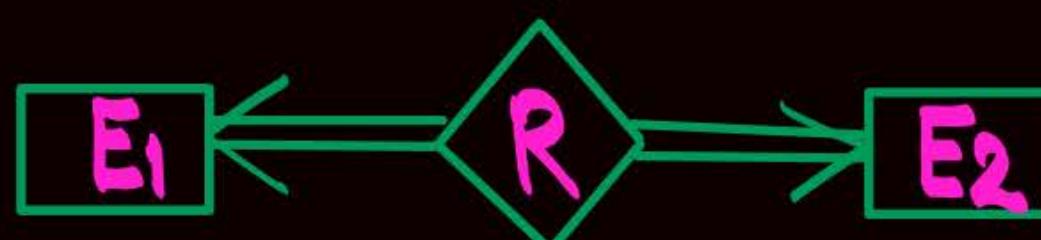
Only one table is required  
P.K. = Same as P.K. of Entity set  
with Partial Participation

3



Only one table is required  
P.K. = Same as P.K. of Entity set  
with Partial Participation

4



Only one table is required  
P.K. = P.K. of any side  
Entity set can be chosen  
as P.K. of merged reln

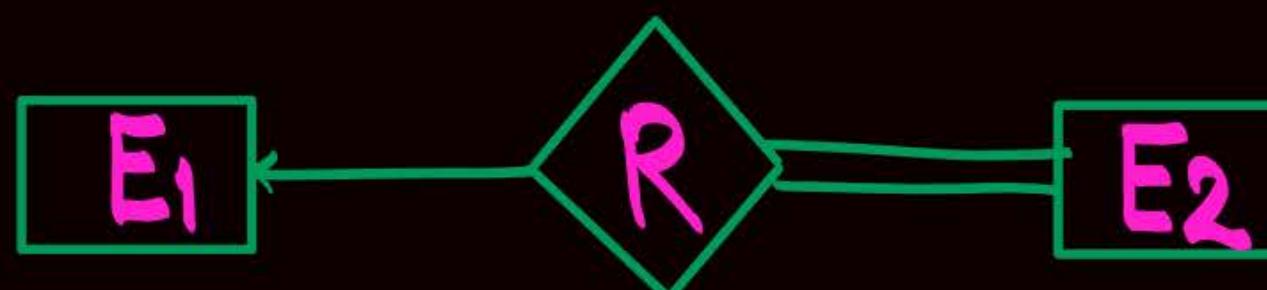
# ER Model to Relational Table

## ② One to Many Relation

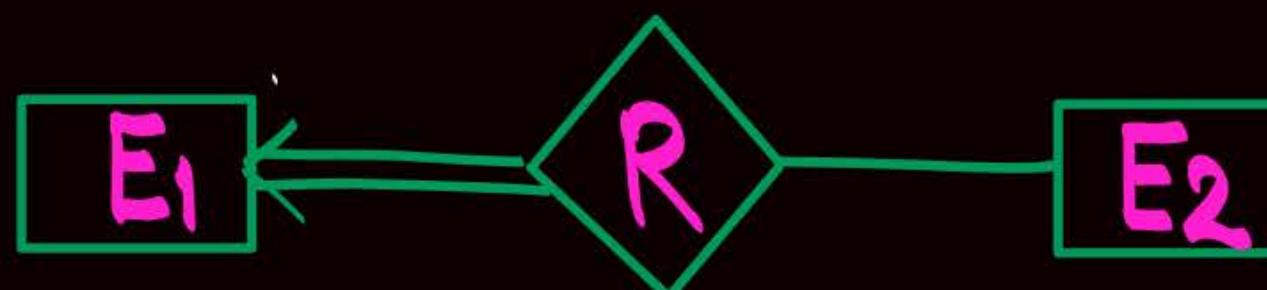
1



2



3

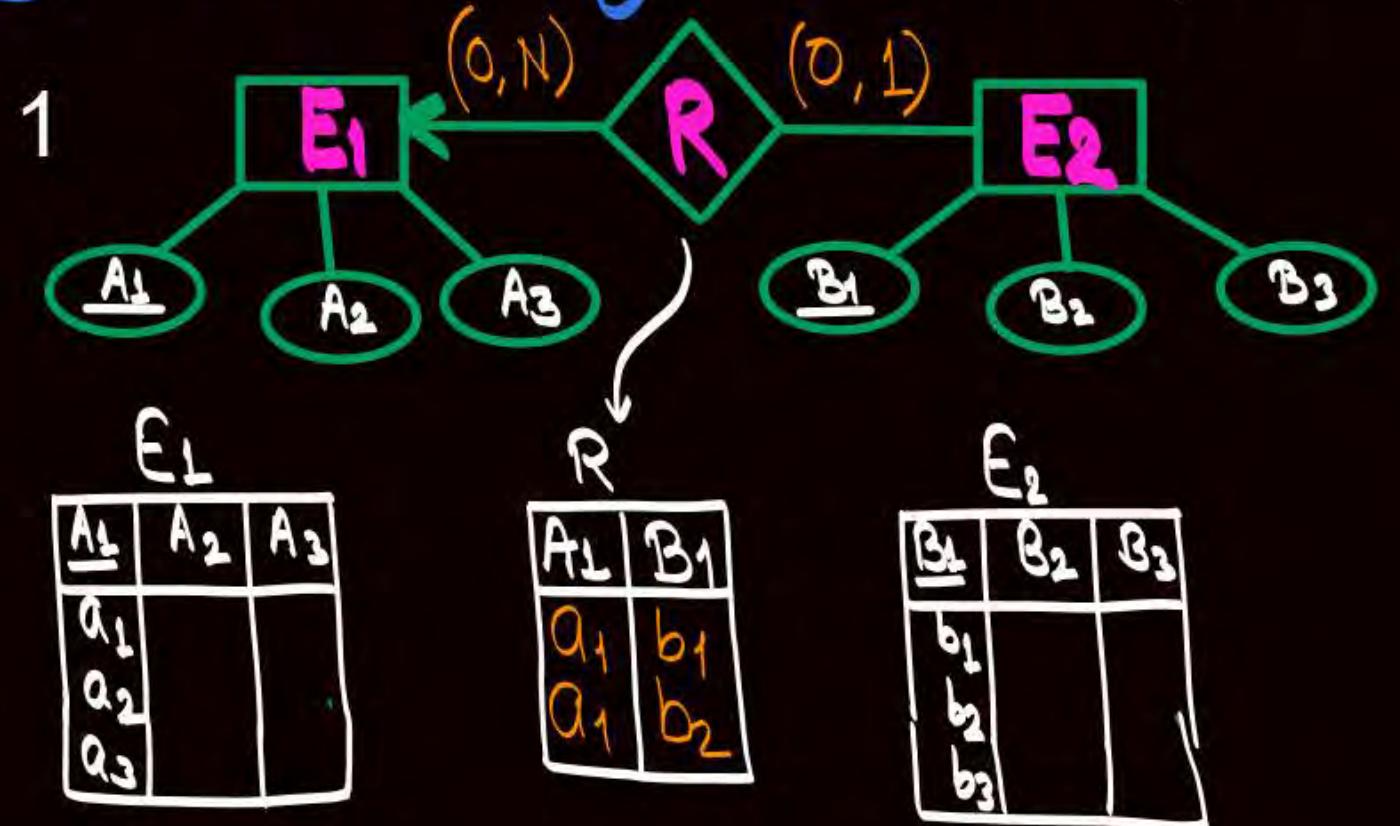


4



## ER Model to Relational Table

② One to Many Relation { Partial Participation of both side entities }



$E_1$

$A_1$	$A_2$	$A_3$
$a_1$		
$a_2$		
$a_3$		

$E_2$

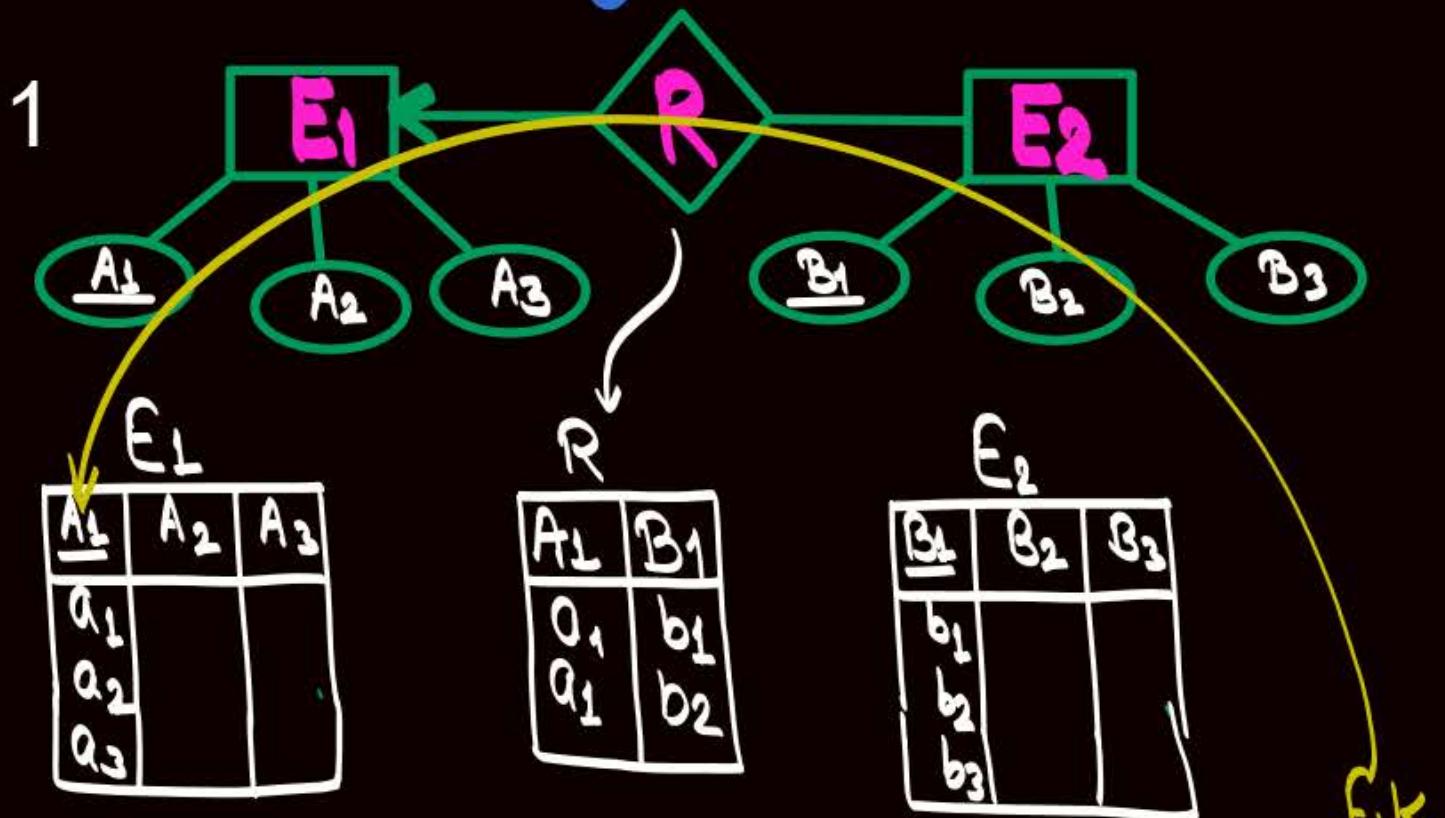
$B_1$	$B_2$	$B_3$
$b_1$		
$b_2$		

$R$

$A_1$	$B_1$
$a_1$	$b_1$
$a_1$	$b_2$

# ER Model to Relational Table

② One to Many Relation { Partial participation of both side entities }



duplicate       $E_1R$

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>2</sub>
a <sub>2</sub>	-	-	NULL
a <sub>3</sub>	-	-	NULL

P.K. Can not be defined  
 $\therefore R$  can not be merged with  $E_1$

$E_2R$

B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	A <sub>1</sub>
b <sub>1</sub>	-	-	a <sub>1</sub>
b <sub>2</sub>	-	-	a <sub>1</sub>
b <sub>3</sub>	-	-	NULL

P.K.      F.K.

$E_1, E_2, R$

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>

( $E_1R$ ) Can not be merged  
 $\therefore$  All three can not be merged into a single table

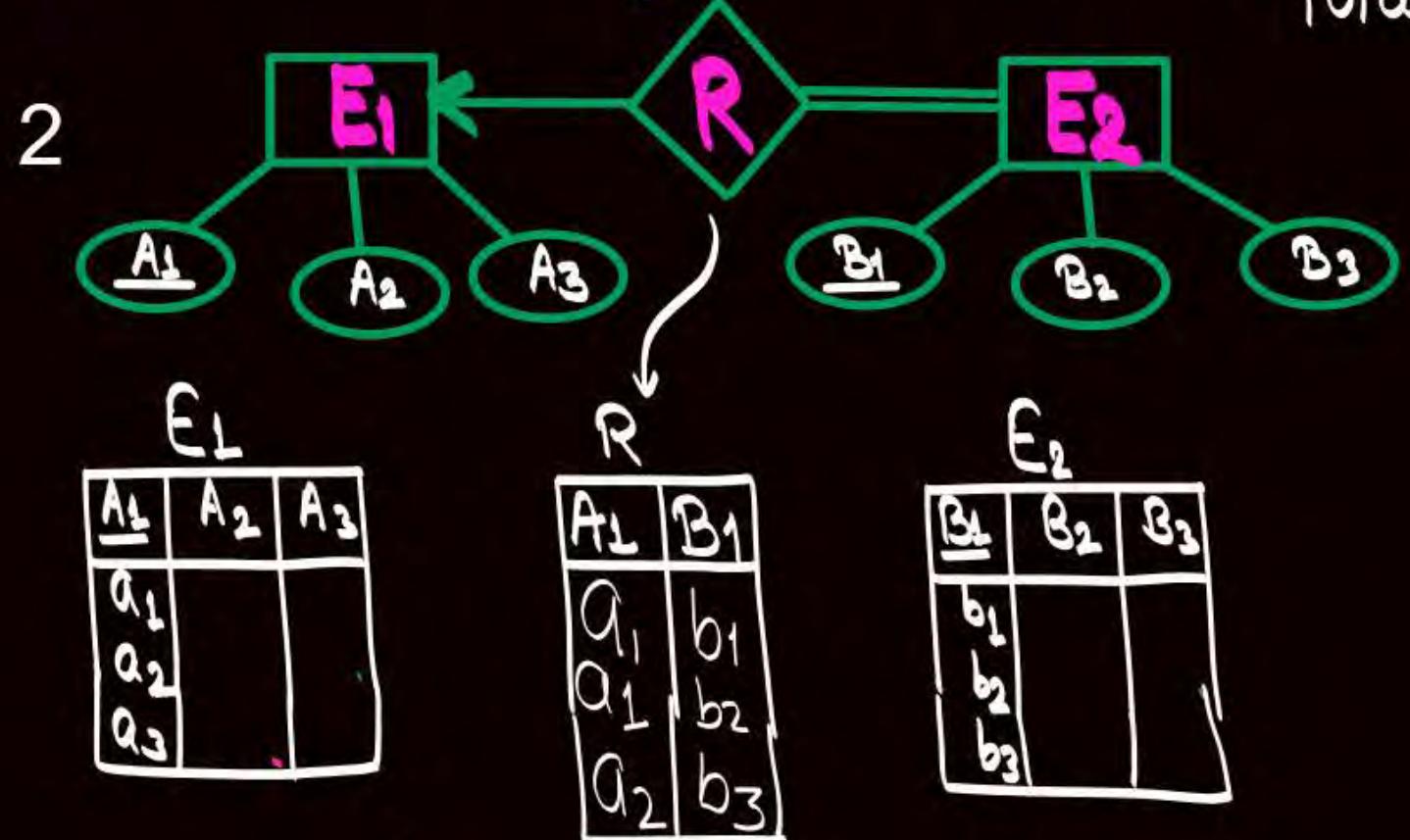
Two tables are required  
 $E_1(A_1, A_2, A_3)$  &  $E_2R(B_1, B_2, B_3, A_1)$

Relationship set will merge with many side entity set.

## ER Model to Relational Table

② One to Many Relation

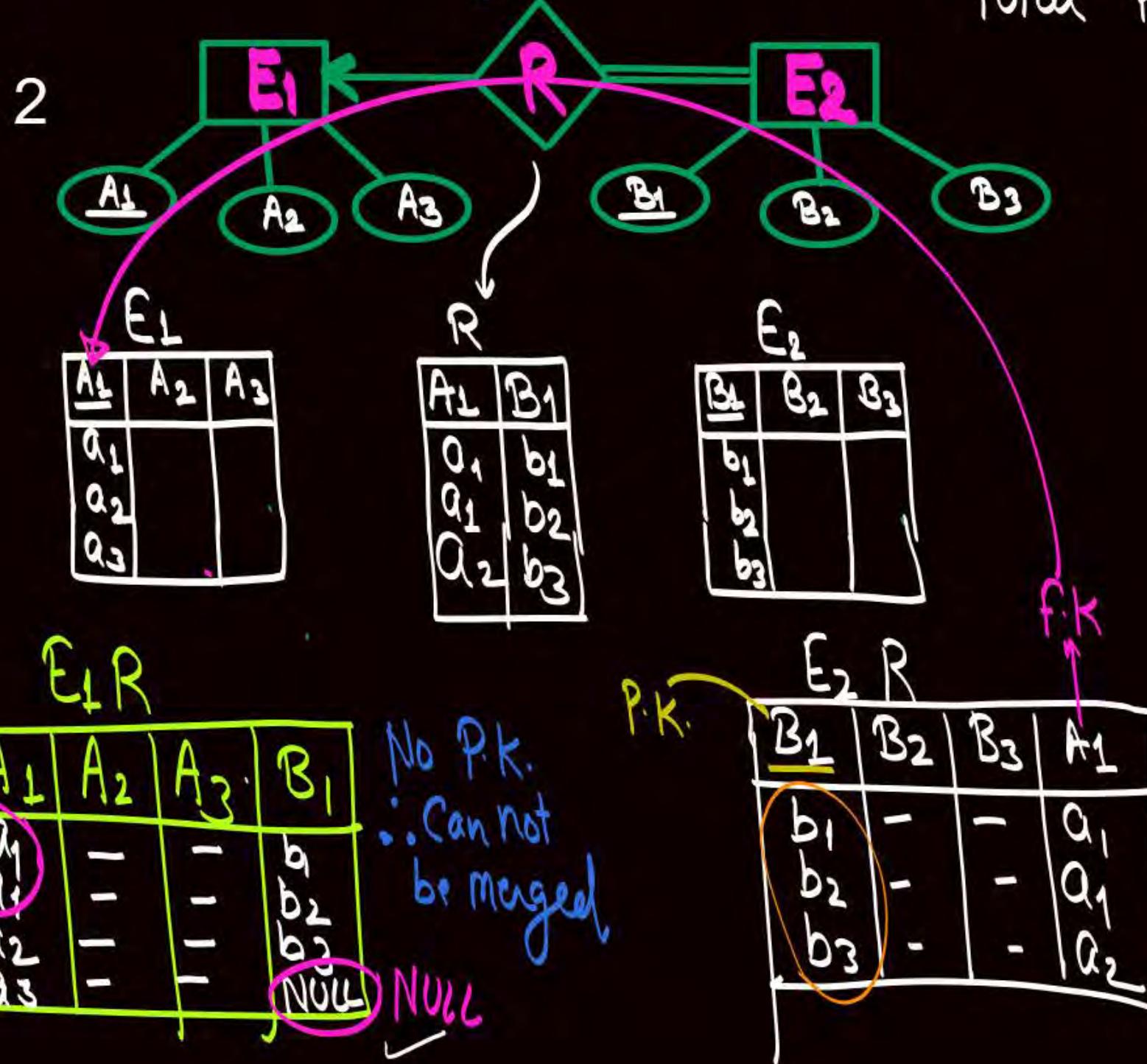
{ Partial participation of '1' side entity set,  
Total participation of 'Many' side entity set



## ER Model to Relational Table

### ② One to Many Relation

{ Partial participation of '1' side entity set,  
Total participation of 'Many' side entity set



Note:- • In One-to-many,

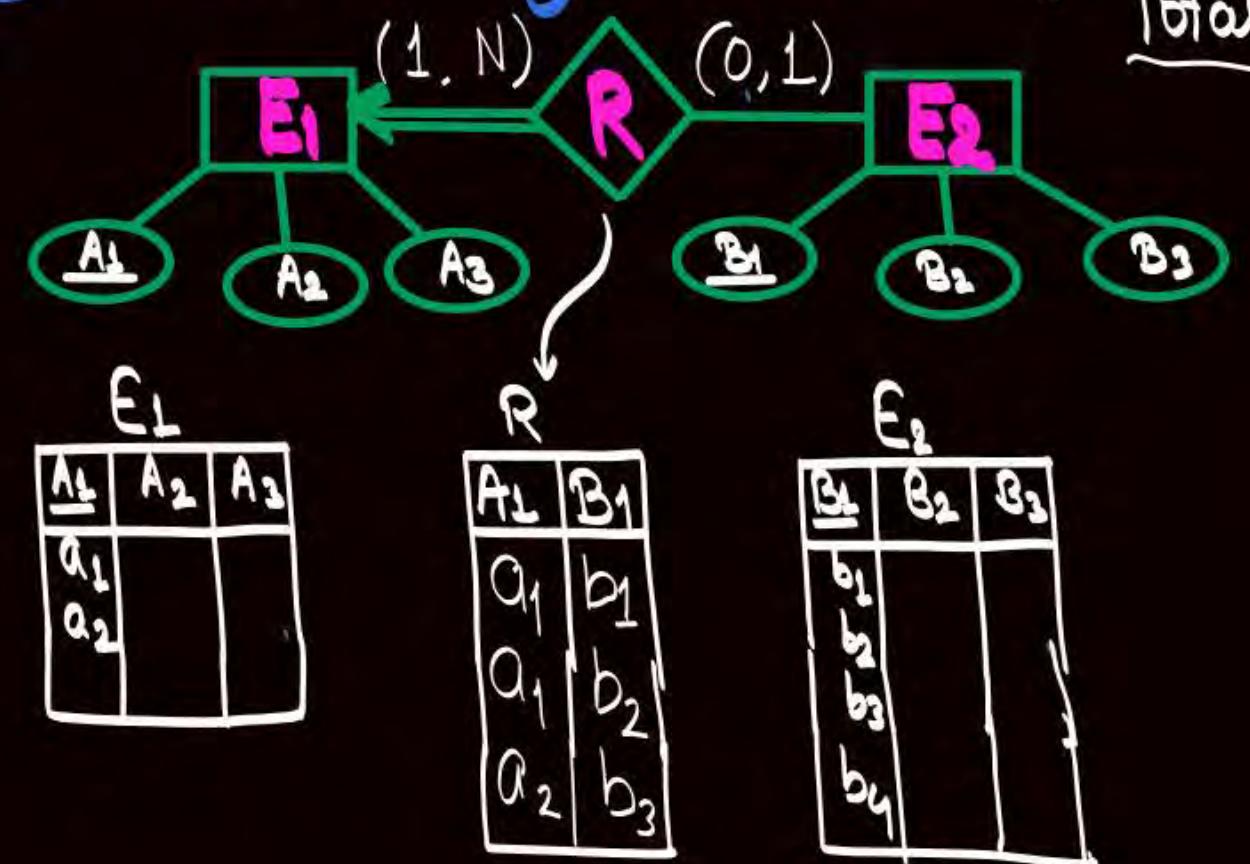
If participation of one side Entity set is partial,  
then minimum two tables are required, and  
relationship set will merge with Many side entity set

• Primary key of merged relation will be same as  
Primary key of many side Entity set

## ER Model to Relational Table

② One to Many Relation { Partial Participation of "Many" side entity set,  
Total Participation of "1" side Entity set }

3

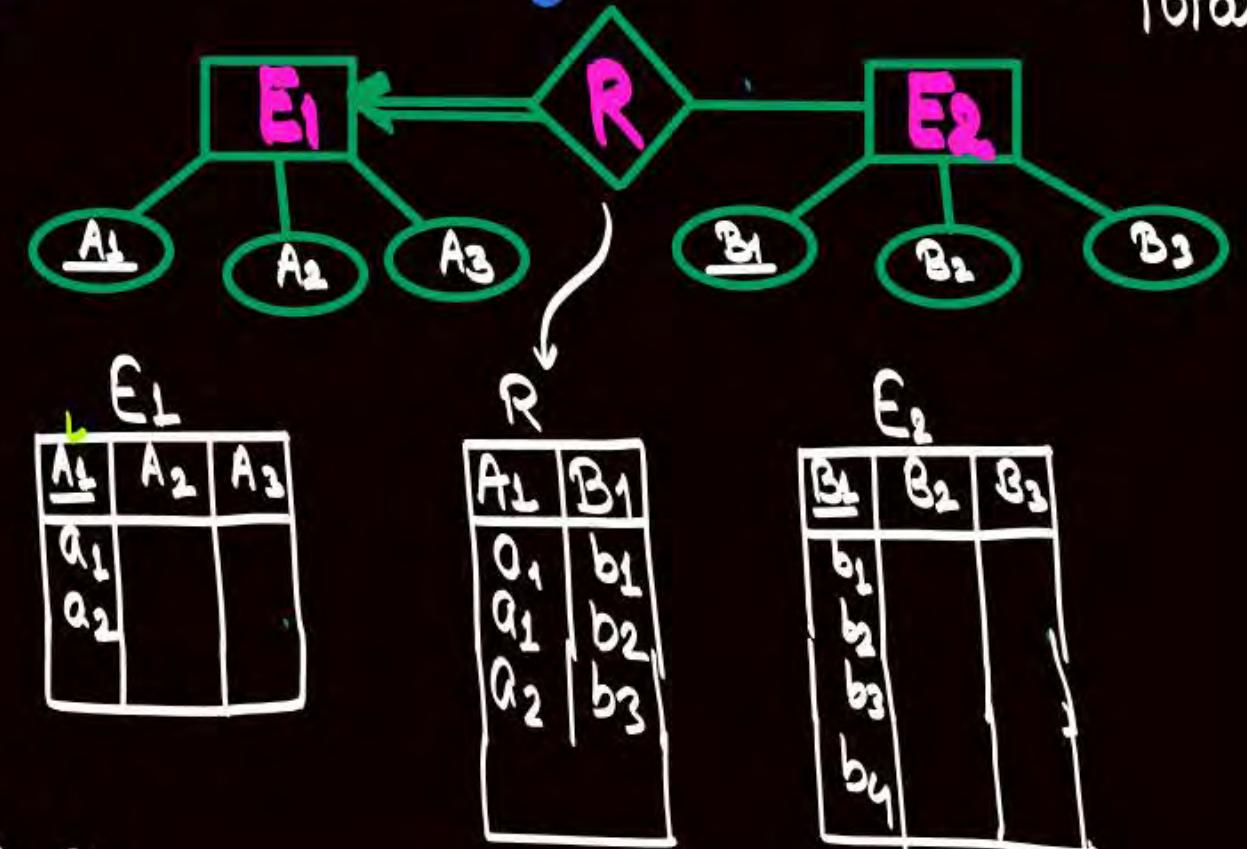


## ER Model to Relational Table

### ② One to Many Relation

{ Partial participation of "Many" side entity set,  
Total participation of "1" side entity set

3



$E_1 R$

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	<u>B<sub>1</sub></u>
a <sub>1</sub>	-	-	b <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>2</sub>
a <sub>2</sub>	-	-	b <sub>3</sub>

$E_2 R$

<u>B<sub>1</sub></u>	B <sub>2</sub>	B <sub>3</sub>	A <sub>1</sub>
b <sub>1</sub>	-	-	a <sub>1</sub>
b <sub>2</sub>	-	-	a <sub>1</sub>
b <sub>3</sub>	-	-	a <sub>2</sub>
b <sub>4</sub>	-	-	NULL

$E_1 E_2 R$

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	<u>B<sub>1</sub></u>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>	-	-
a <sub>1</sub>	-	-	b <sub>2</sub>	-	-
a <sub>2</sub>	-	-	b <sub>3</sub>	-	-
NULL	NULL	NULL	b <sub>4</sub>	-	-

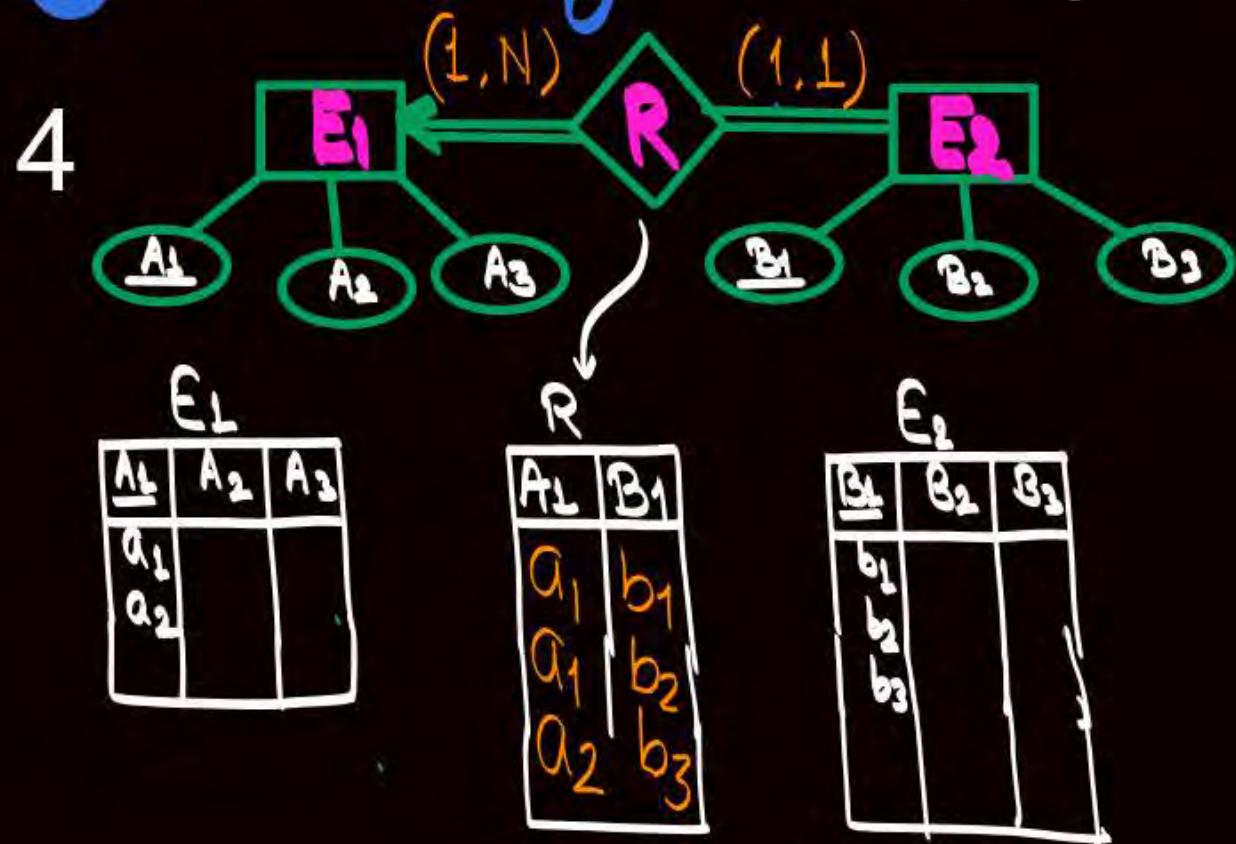
All those tables can be merged into a single table  
(No foreign key)

$E_1 E_2 R(A_1, A_2, A_3, \underline{B_1}, B_2, B_3)$

P.K. will be same as P.K. of many side Entity set.

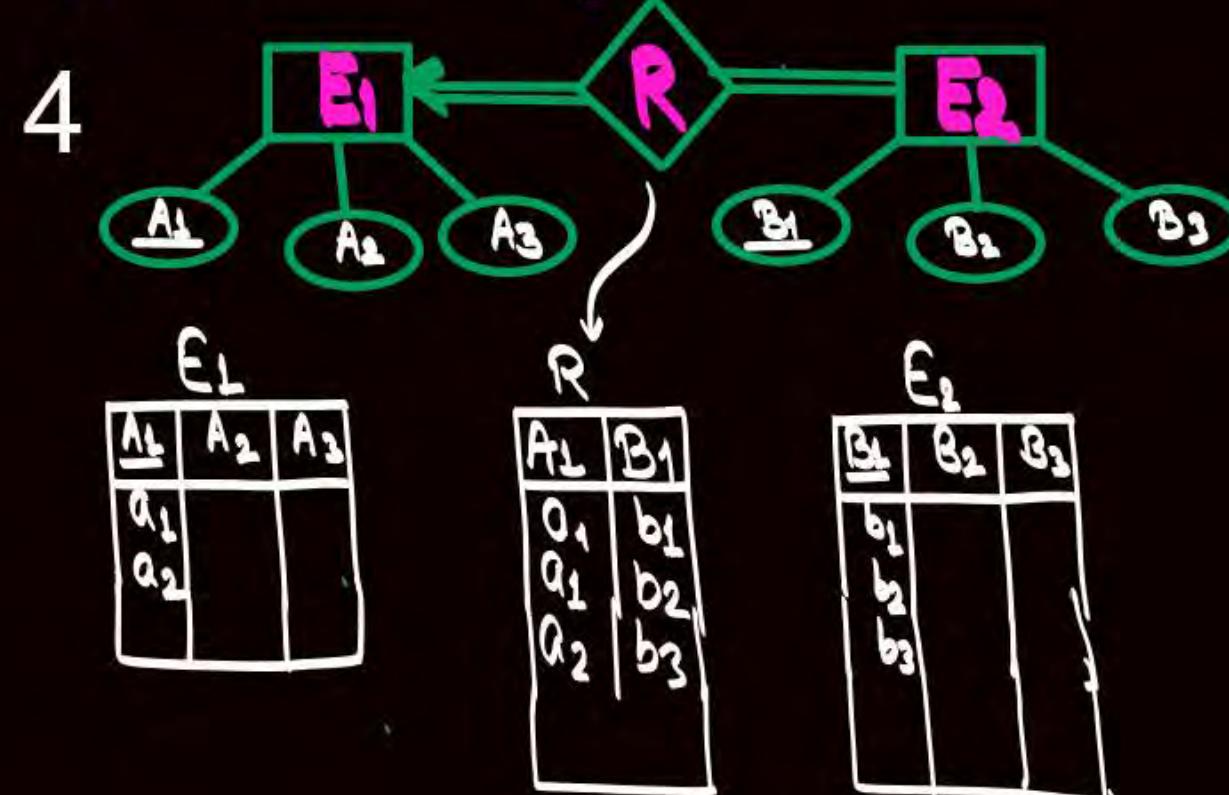
## ER Model to Relational Table

② One to Many Relation { Total participation of both entity set }



## ER Model to Relational Table

② One to Many Relation { Total participation of both entity set }



$E_1$	$E_2$	$R$	P.K.		
$A_1$	$A_2$	$A_3$	$B_1$	$B_2$	$B_3$
$a_1$					
$a_2$					
			$b_1$		
			$b_2$		
			$b_3$		

$E_1 E_2 R (A_1, A_2, A_3, \underline{B_1}, B_2, B_3)$

many side P.K. is same as P.K. of  
Entity set

Note:- • In One-to-many,

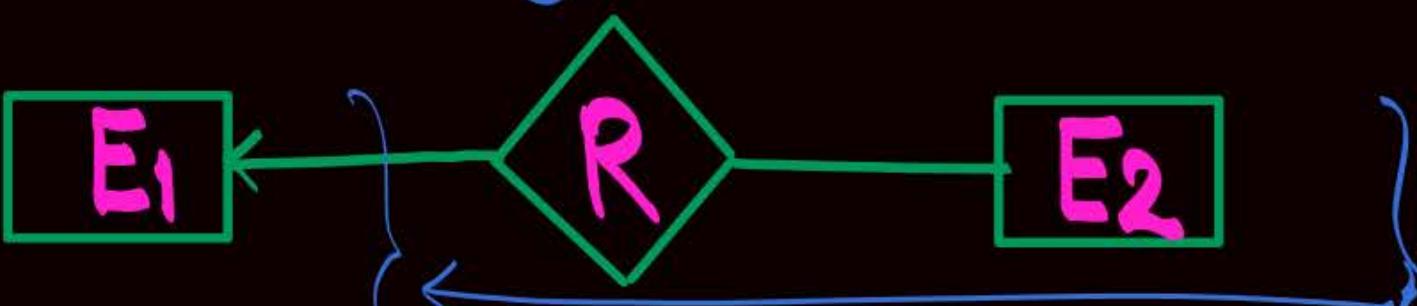
If participation of one side Entity set is "total"  
then Only one table is required, and

\* Primary key of merged relation will be same as  
Primary key of many side Entity set

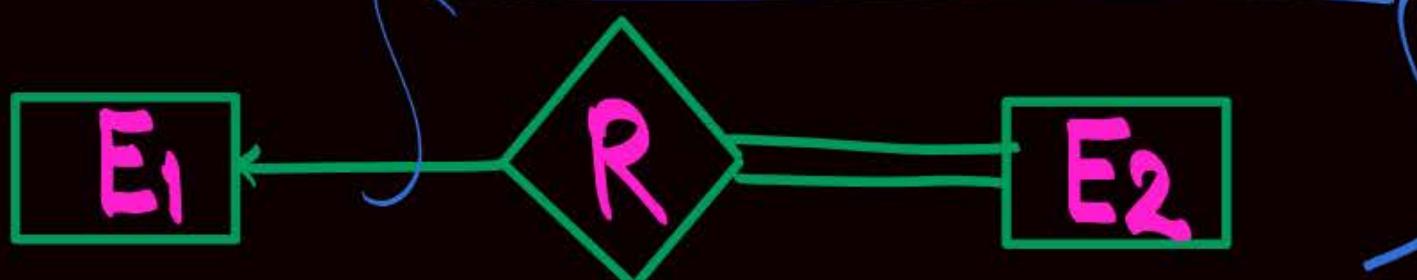
# ER Model to Relational Table

## ② One to Many Relation

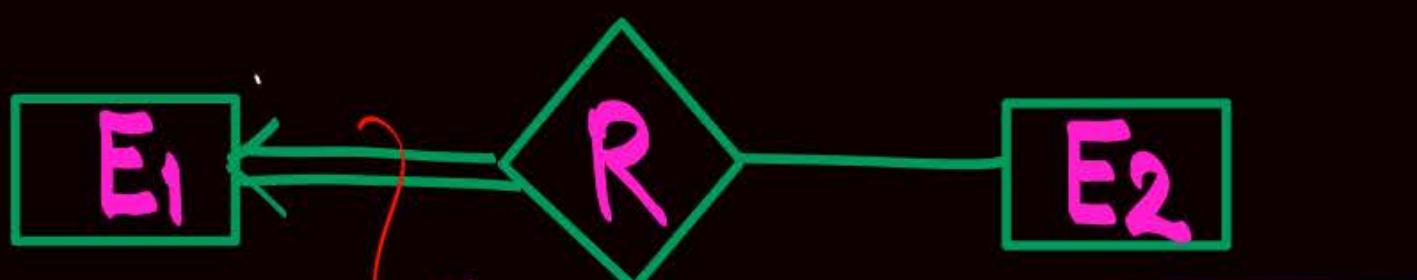
1



2



3



4



Partial Participation of "One" side Entity set.  
∴ Two tables are required  
→ Relationship set will merge with many side Entity set  
P.K: Same as P.K of many side Entity set.

Total Participation of one side Entity set.

∴ Only '1' table is required  
P.K: Same as P.K of many side Entity set

# ER Model to Relational Table

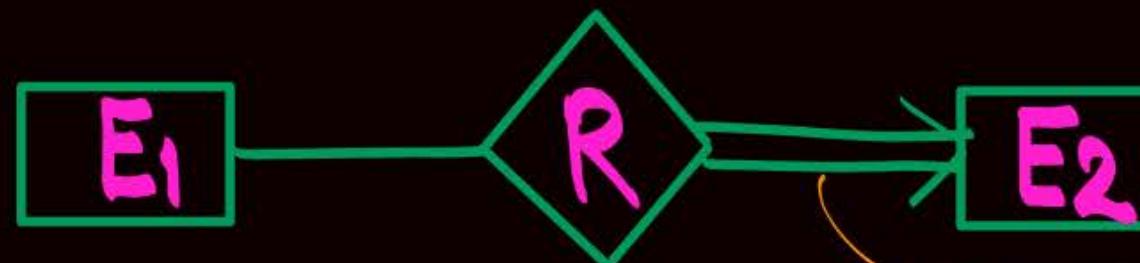
## ③ Many to One Relation

{ Exactly same as One-to-many }

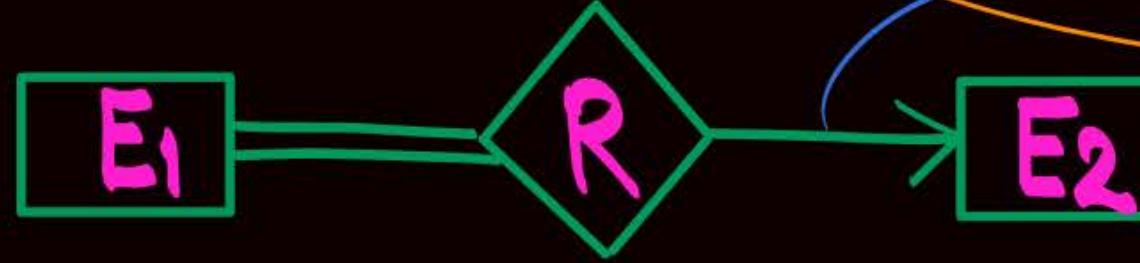
1



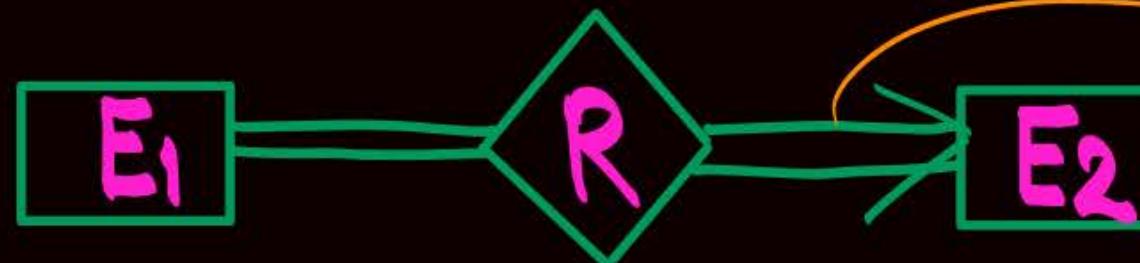
2



3



4



Partial participation of

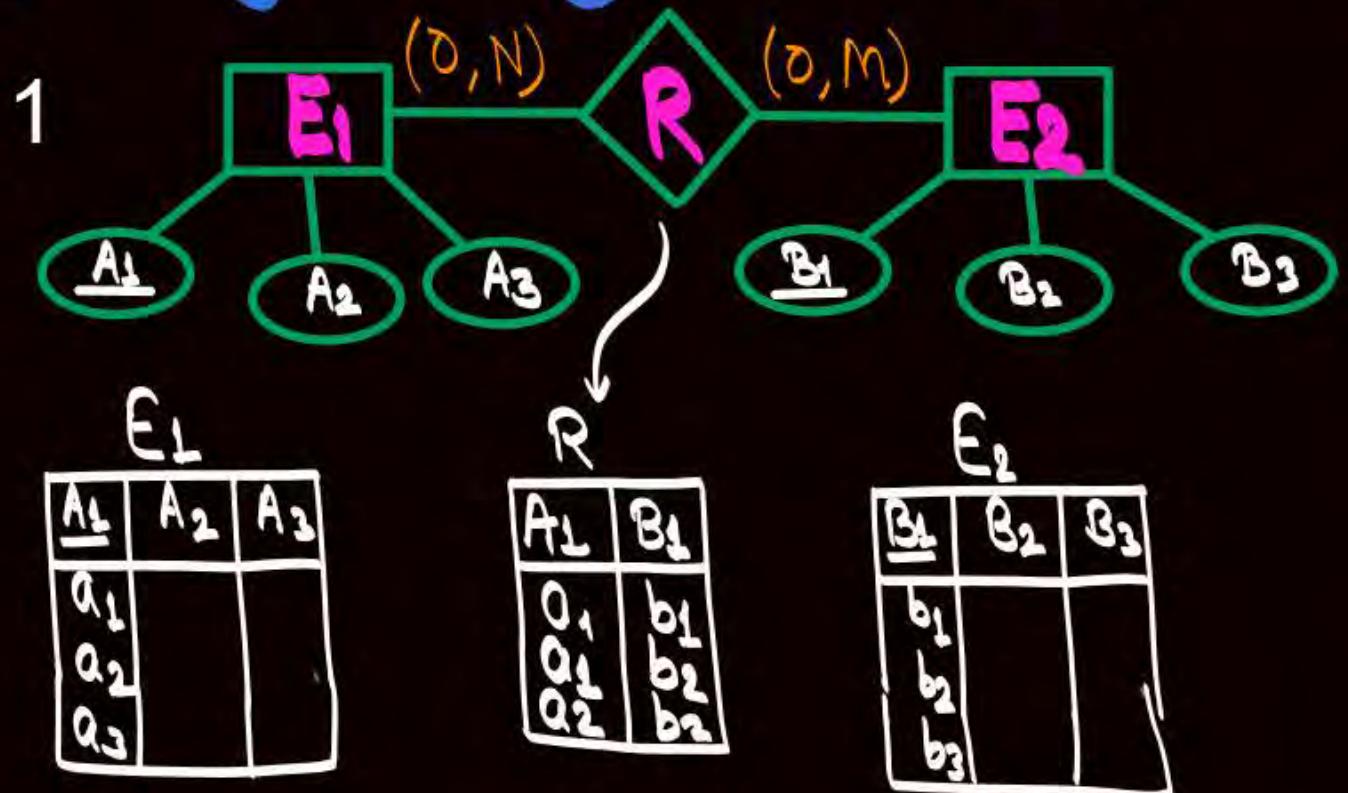
'1' side entity set  
i.e. Two tables are required

Total participation of

'1' side entity set  
i.e. Only one table is required

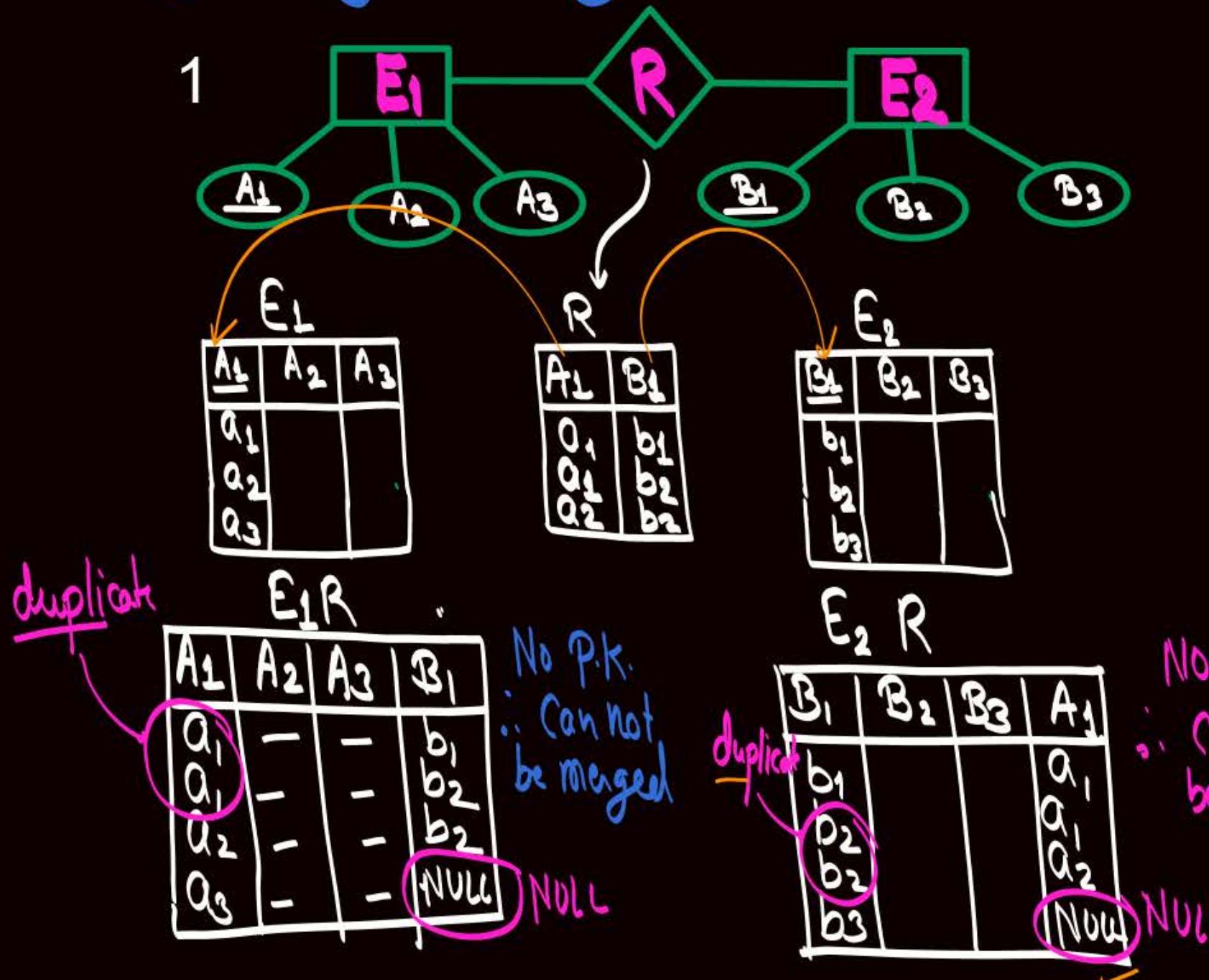
## ER Model to Relational Table

④ Many to Many Relation { Partial participation of both side entities }



# ER Model to Relational Table

④ Many to Many Relation { Partial participation of both side entities }



\* We will require minimum three tables in relational model.

E<sub>1</sub> (A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>)

P.K.

E<sub>2</sub> (B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>)

P.K.

R (A<sub>1</sub>, B<sub>1</sub>)

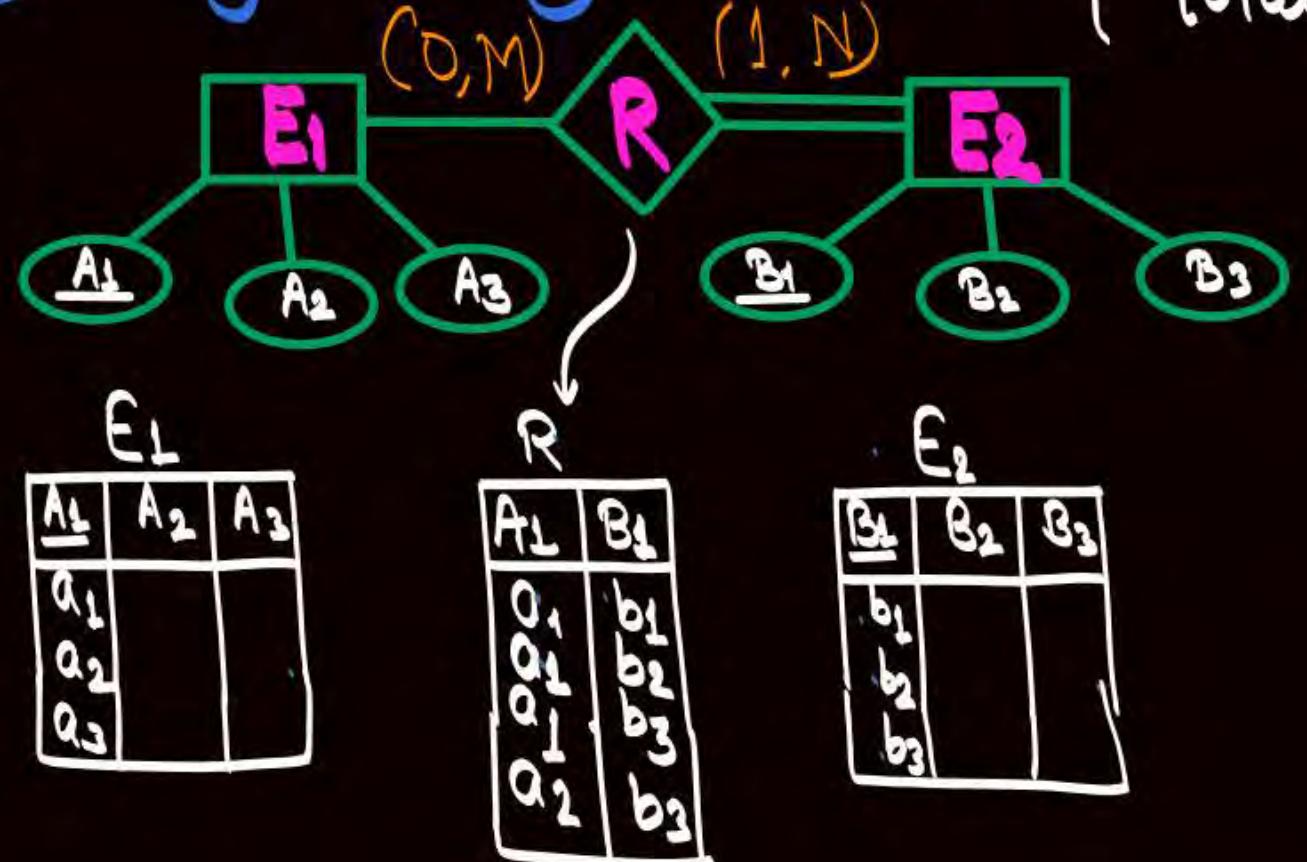
P.K. of R

will be (A<sub>1</sub>B<sub>1</sub>) together

## ER Model to Relational Table

④ Many to Many Relation { Partial Participation at one side, total participation at another side }

2

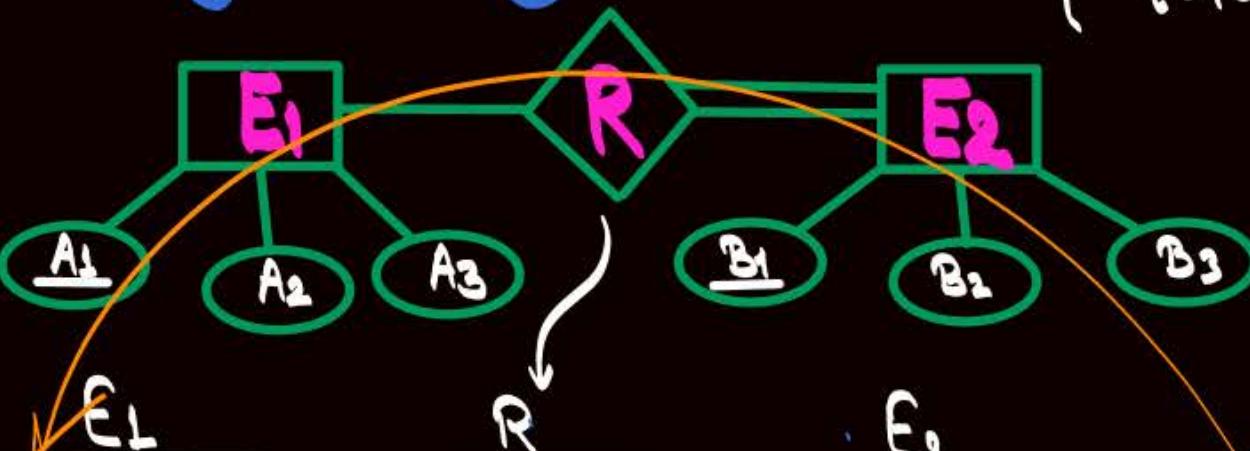


## ER Model to Relational Table

④ Many to Many Relation

{ Partial Participation at one side,  
total participation at another side }

2

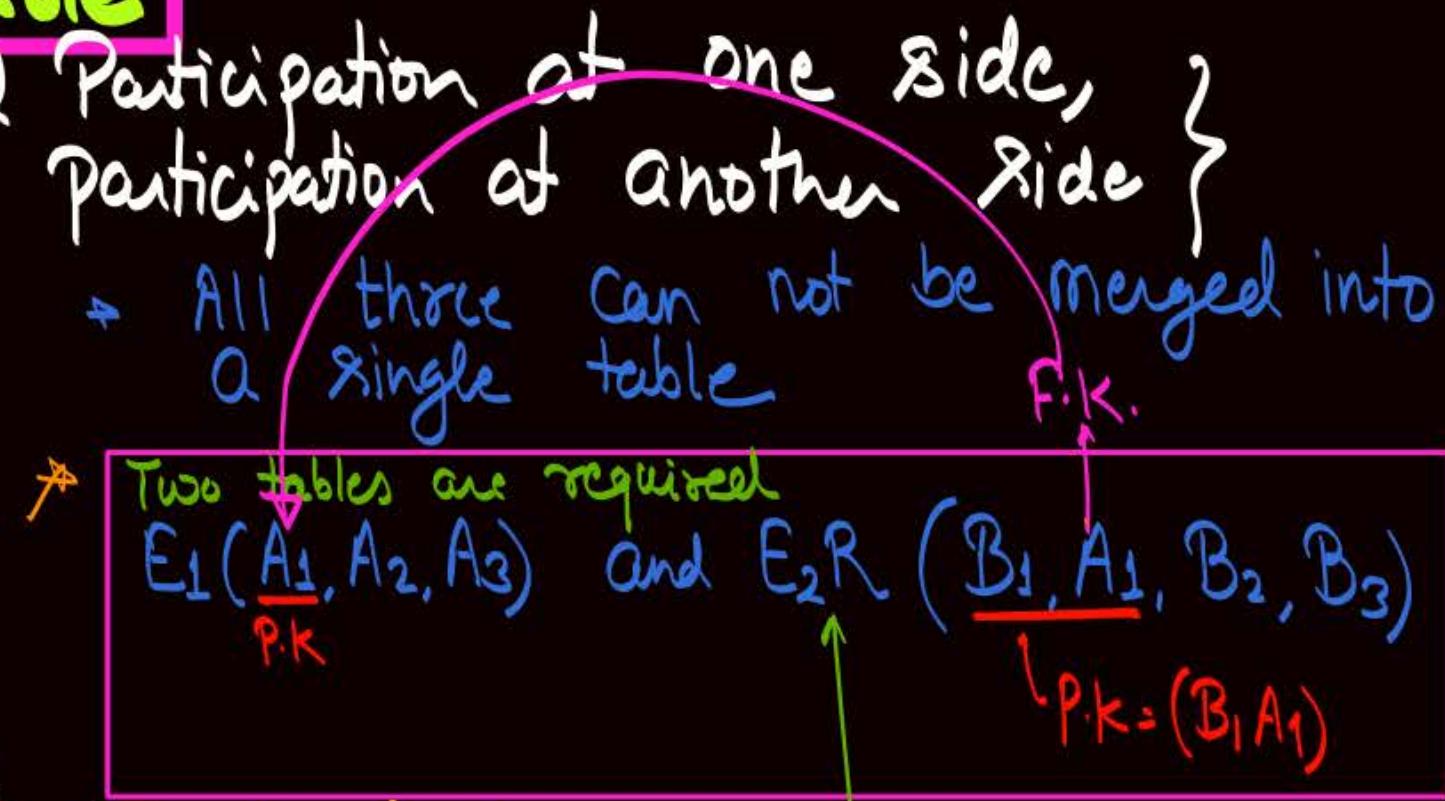


A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>
a <sub>1</sub>		
a <sub>2</sub>		
a <sub>3</sub>		

A <sub>1</sub>	B <sub>1</sub>
a <sub>1</sub>	b <sub>1</sub>
a <sub>2</sub>	b <sub>2</sub>
a <sub>3</sub>	b <sub>3</sub>
a <sub>2</sub>	b <sub>3</sub>

B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
b <sub>1</sub>		
b <sub>2</sub>		
b <sub>3</sub>		
b <sub>1</sub>		
b <sub>3</sub>		

B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	A <sub>1</sub>
b <sub>1</sub>			a <sub>1</sub>
b <sub>2</sub>			a <sub>1</sub>
b <sub>3</sub>			a <sub>1</sub>
b <sub>1</sub>			a <sub>2</sub>
b <sub>3</sub>			a <sub>2</sub>
b <sub>3</sub>			a <sub>3</sub>



Together (B<sub>1</sub>, A<sub>1</sub>) values will be unique

o. P.K. - (B<sub>1</sub>, A<sub>1</sub>) together

not unique

Relationship set will merge with the Entity set with "total participation"

not unique

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>
a <sub>1</sub>	-	-	b <sub>2</sub>
a <sub>1</sub>	-	-	b <sub>3</sub>
a <sub>2</sub>	-	-	b <sub>3</sub>
a <sub>3</sub>	-	-	NULL

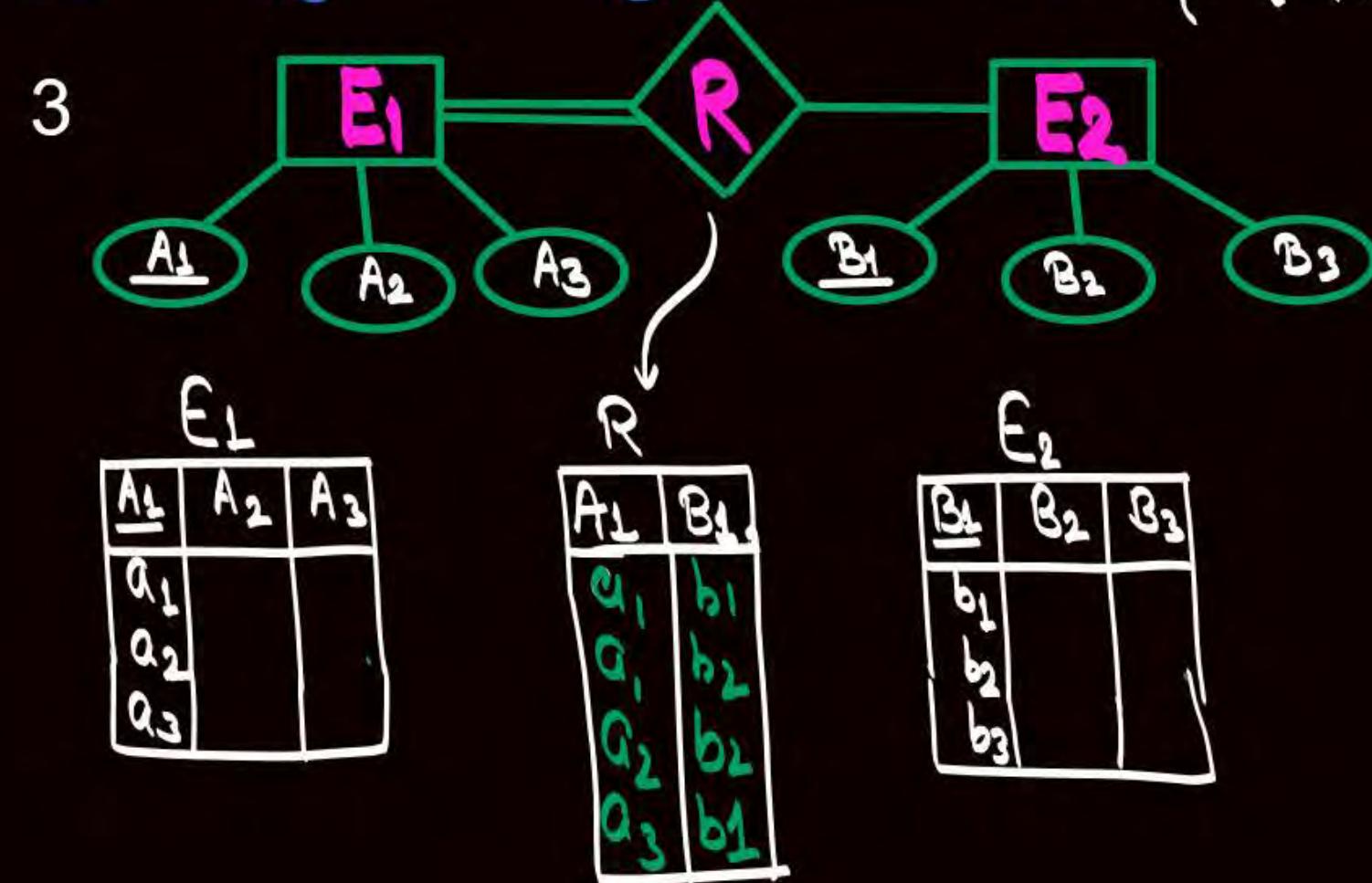
No. P.K.

∴ Can not be merged

NULL

## ER Model to Relational Table

④ Many to Many Relation



{ Partial Participation at one side,  
total participation at another side }

Same as previous case

Two tables are required

$E_2(\underline{B_1}, B_2, B_3)$  &  $E_1R(\underline{A_3}, \underline{B_1}, A_2, A_3)$

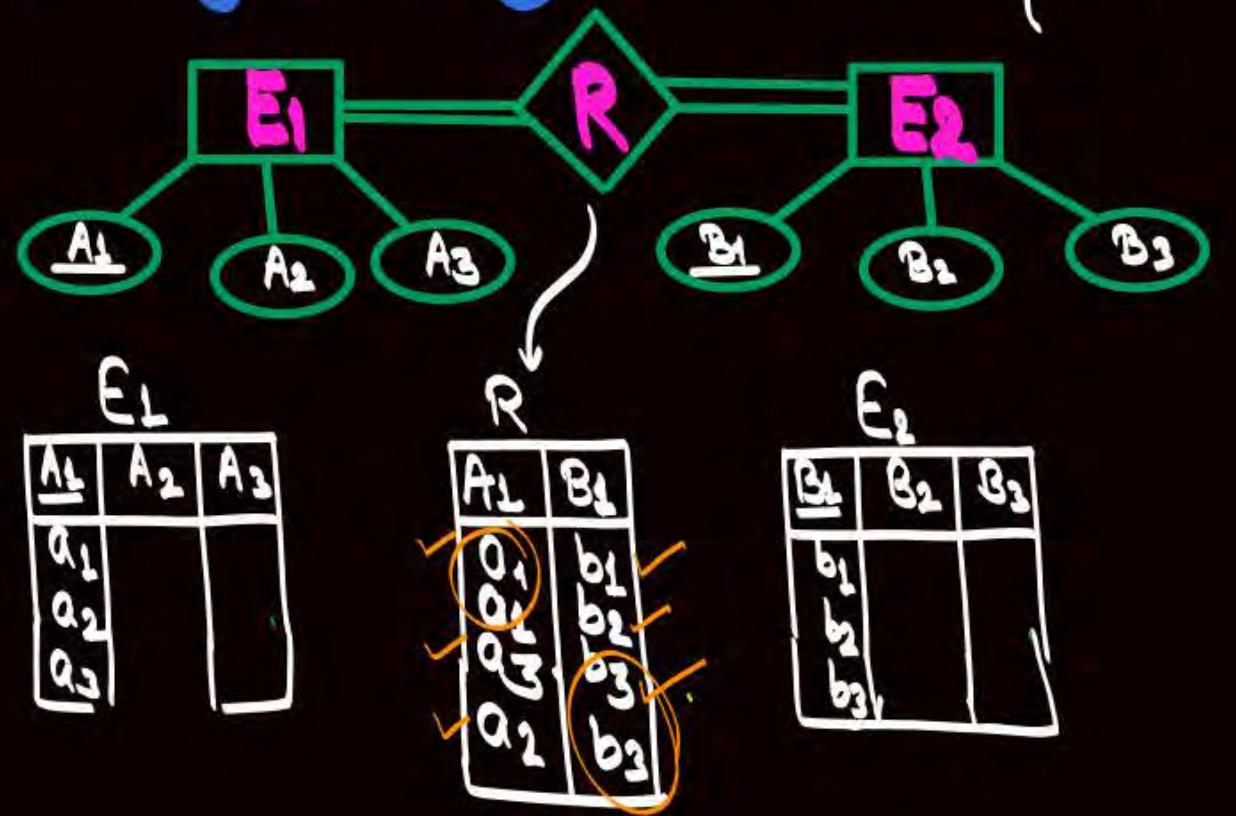
$\uparrow$   
 $\uparrow$   
 $\uparrow$   
 $\uparrow$

$F.K$   
 $P.K$   
 $P.K : (\underline{A_3}, \underline{B_1})$

Entity set with  
total participation

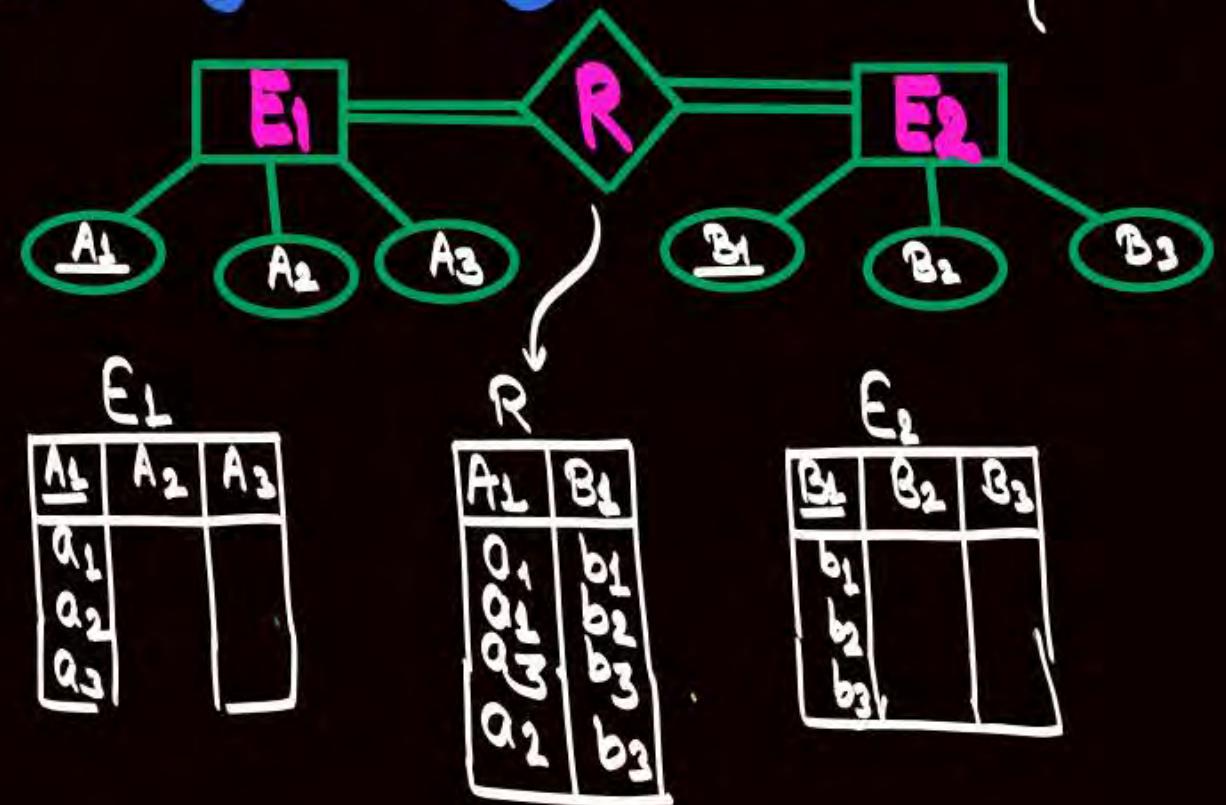
## ER Model to Relational Table

④ Many to Many Relation { Total participation at both side }



## ER Model to Relational Table

④ Many to Many Relation { Total participation at both sides }



A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>
a <sub>1</sub>		
a <sub>2</sub>		
a <sub>3</sub>		

A <sub>1</sub>	B <sub>1</sub>
a <sub>1</sub>	b <sub>1</sub>
a <sub>2</sub>	b <sub>2</sub>
a <sub>3</sub>	b <sub>3</sub>
a <sub>2</sub>	b <sub>3</sub>

B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
b <sub>1</sub>		
b <sub>2</sub>		
b <sub>3</sub>		
b <sub>3</sub>		

**E<sub>1</sub>E<sub>2</sub>R**

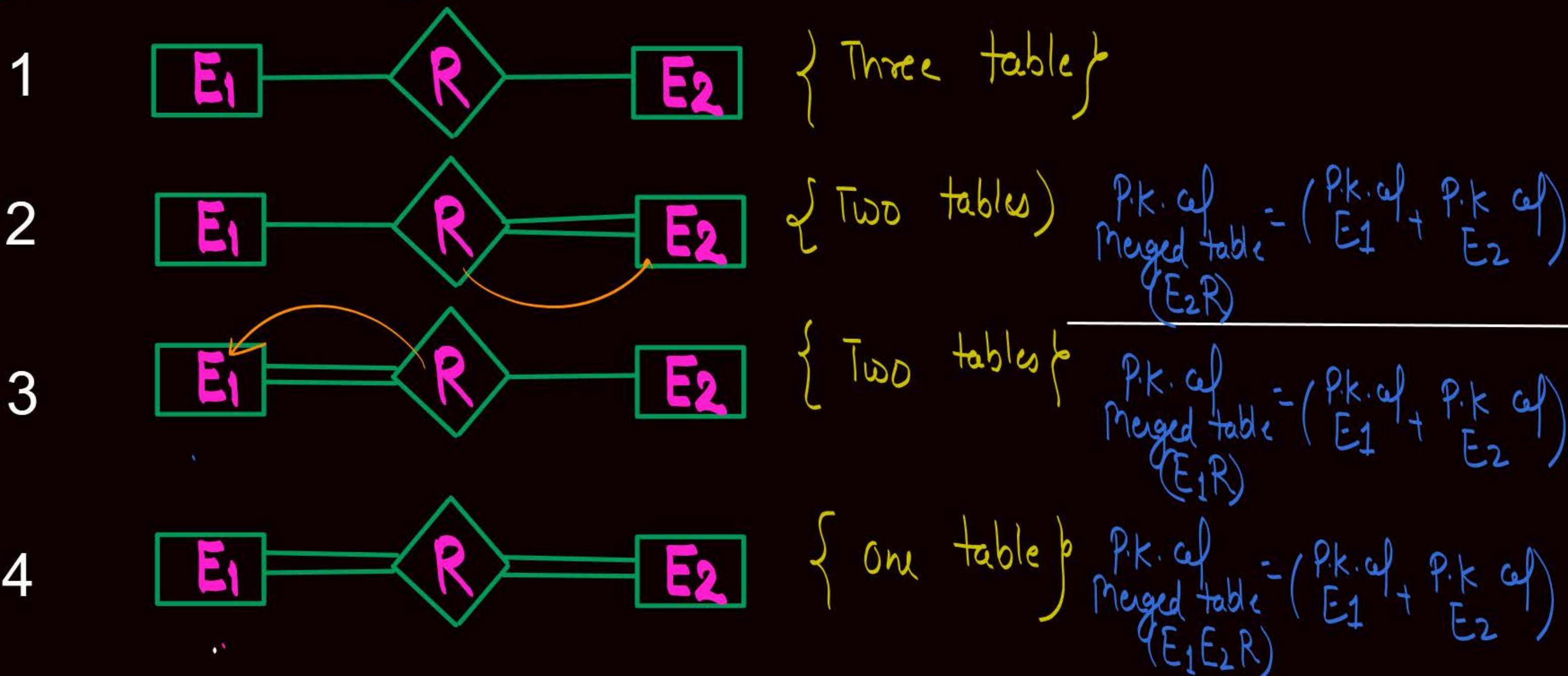
P.K = (A<sub>1</sub>B<sub>1</sub>)

A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
a <sub>1</sub>	-	-	b <sub>1</sub>	-	-
a <sub>1</sub>	-	-	b <sub>2</sub>	-	-
a <sub>2</sub>	-	-	b <sub>3</sub>	-	-
a <sub>3</sub>	-	-	b <sub>3</sub>	-	-

All three  
can be merged  
into a  
single table

# ER Model to Relational Table

## ④ Many to Many Relation





ER model to relational model w.r.t.

Weak entity set

eid

ename

Employee

takes-care

d-name

age

Dependent

Separate table will be required for Strong Entity Set

Employee (Eid, Ename)

P.K.

identifying relationship set will always merge with Weak Entity Set  
Relational table after merging

Taking-care-of-dependent (Eid, dname, age)

F.K.  
P.K.



## 2 mins Summary



- Topic** Relational table w.r.t. Entity type
- Topic** Conversion from ER model to relational table

# THANK - YOU