

E-R Diagram Mapping

Database System Concepts

1. Logical Design

❑ What is schema?

- ❑ The overall logical structure of the database, also called metadata
 - ❑ Ex: department(dept_name, building, budget)

<i>dept_name</i>	<i>building</i>	<i>budget</i>
Comp. Sci.	Taylor	100000
Biology	Watson	90000
Elec. Eng.	Taylor	85000
Music	Packard	80000
Finance	Painter	120000
History	Painter	50000
Physics	Watson	70000

The *department* table

2. E-R Diagram Mapping

☐ E-R Diagram Mapping Steps

- ☐ Step 1: Regular entity types and single valued attributes
- ☐ Step 2: Weak Entity Type and Single Value Attribute
- ☐ Step 3: Binary 1:1 Relationship Type
- ☐ Step 4: Regular binary 1:N relationship type
- ☐ Step 5: Binary M:N relationship type
- ☐ Step 6: Ternary or higher relationship types
- ☐ Step 7: Multi-valued attribute

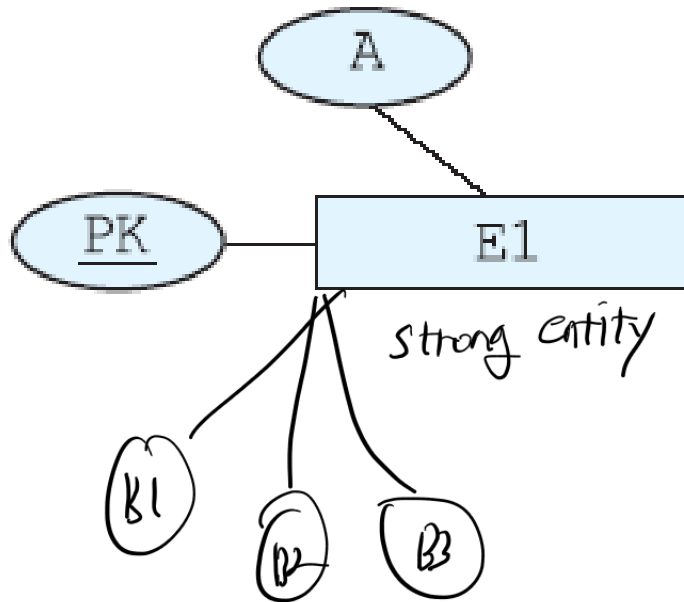
2. E-R Diagram Mapping

- ❑ Step 1: Regular entity types and single valued attributes
 - ✓ One relation R is created for each regular entity type E
 - ✓ Include all simple attributes in E in relation R
 - ✓ For composite attributes, include all simple attributes of compound attributes from E to relation R
 - ✓ E's key attribute becomes relation R's primary key

2. E-R Diagram Mapping

❑ Step 1: Regular entity types and single valued attributes

Step 1. 엔티티의 성질 속성 추가 (강제화)
(strong)



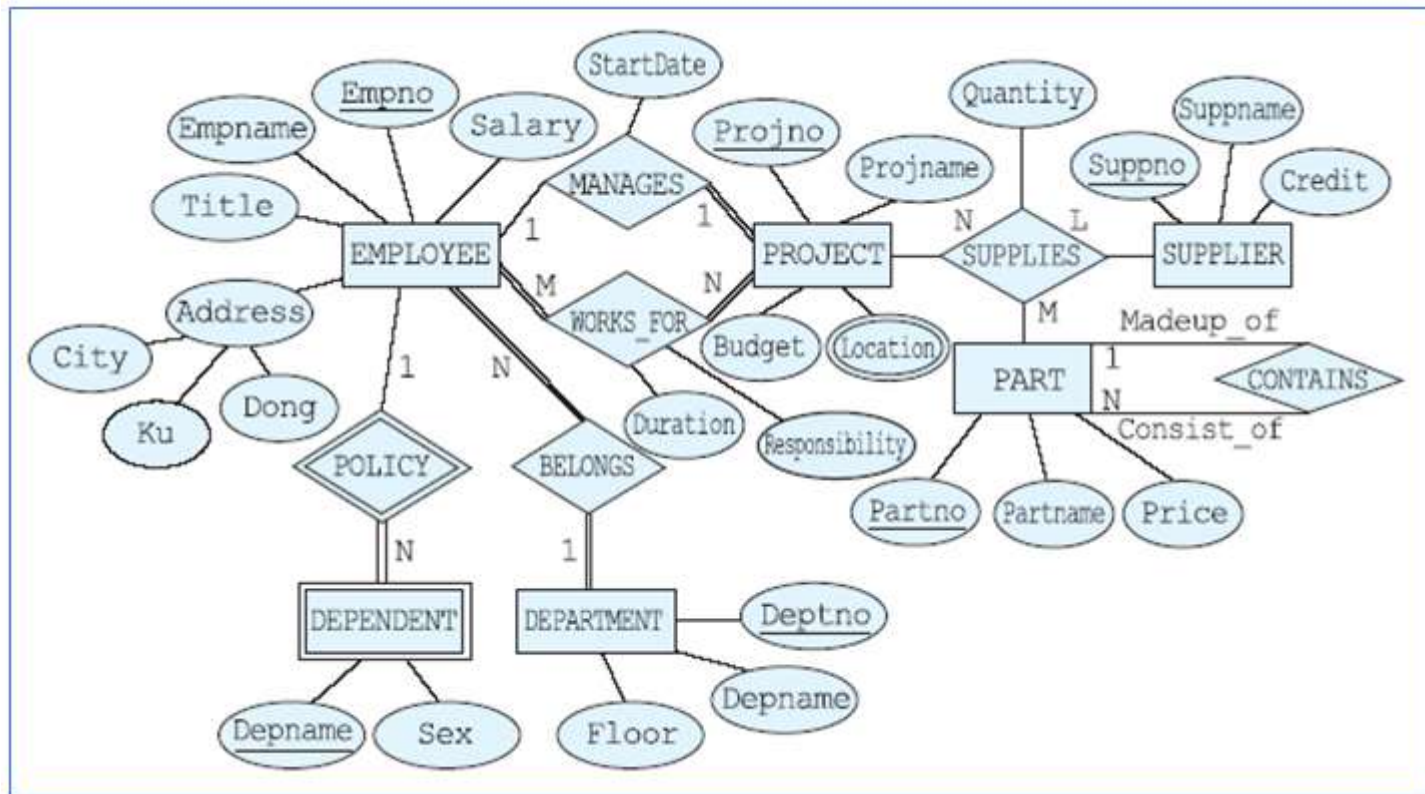
E1

<u>PK</u>	A	B1	B2	B3

$E1(PK, A, B1, B2, B3)$

2. E-R Diagram Mapping

❑ Step 1: Regular entity types and single valued attributes



2. E-R Diagram Mapping

- ❑ Step 1: Regular entity types and single valued attributes

EMPLOYEE (Empno, Empname, Title, City, Ku, Dong,
Salary)

PROJECT (Projno, Projname, Budget)

DEPARTMENT (Deptno, Deptname, Floor)

SUPPLIER (Suppno, Suppname, Credit)

PART (Partno, Partname, Price)

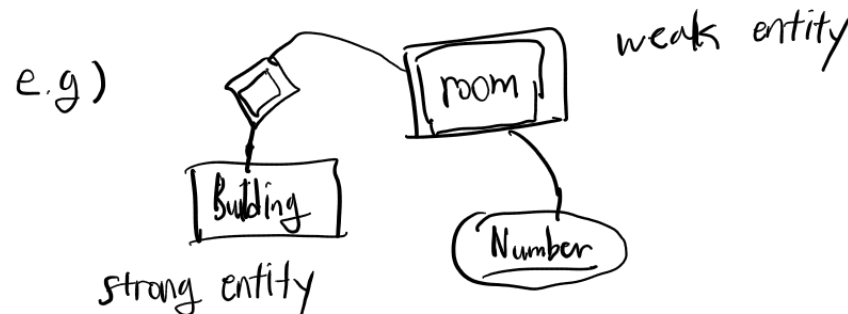
location ° |
multi-value attribute라
정규화 하기 안됨.

① 엔티티 별로 실속을 추가.
(엔티 속성은 필레 전세기 말 것)

2. E-R Diagram Mapping

❑ Step 2: Weak Entity Type and Single Value Attribute

- ✓ Weak entity is dependent on strong entity
 - ✓ Cannot exist without a corresponding strong entity
 - ✓ Weak entity type does not have enough attributes to form a key
- ✓ Marked as Double Line Rectangle in ER Diagram
- ✓ Note that weak entity is connected to owner strong entity through Double Line Diamond



2. E-R Diagram Mapping

❑ Step 2: Weak Entity Type and Single Value Attribute

✓ A relation W is created for each weak entity

✓ All simple attributes in a weak entity type is included in relation W



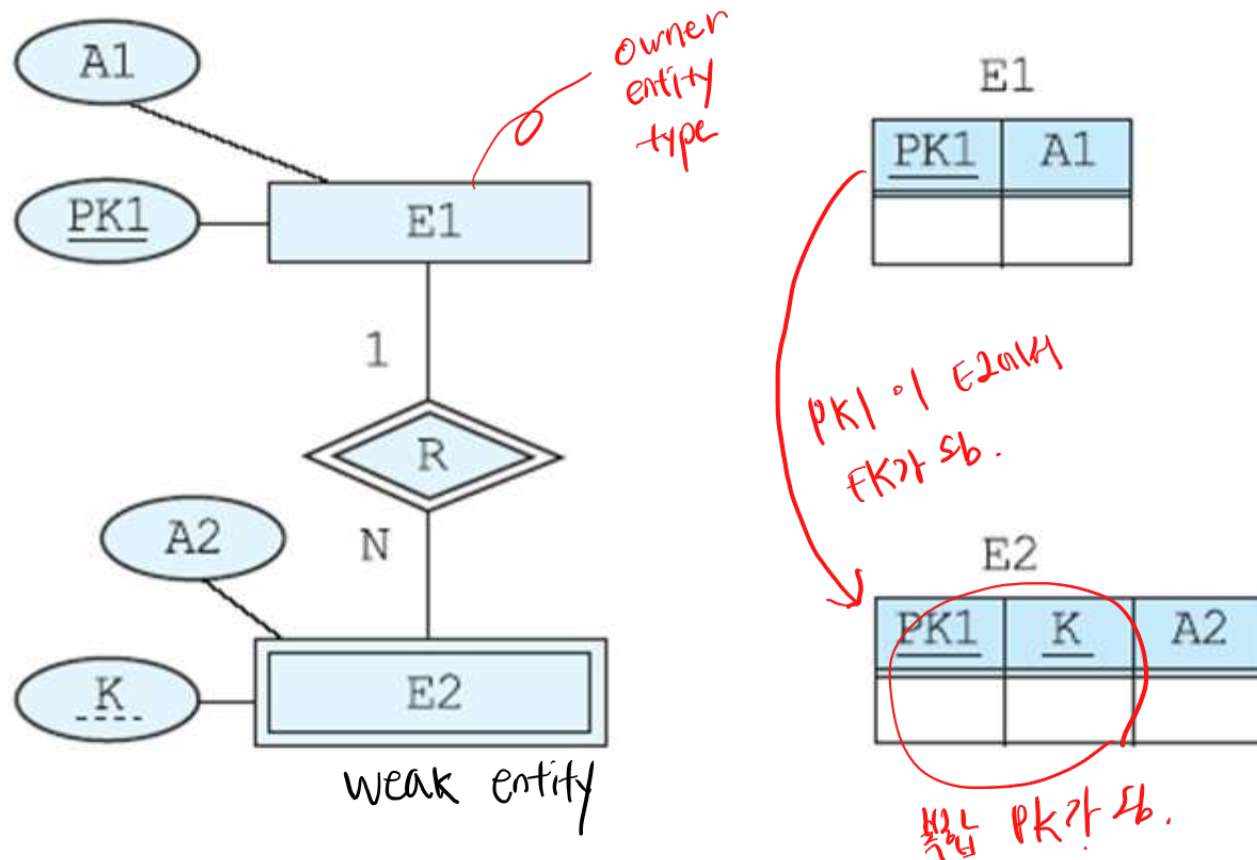
~~✓~~ The primary key of the relation corresponding to the owning entity type E is included as a foreign key in the relation W

PK → FK
(strong) (weak)

✓ The primary key of relation W is a combination of a partial key of the weak entity type and a foreign key that refers to the relation corresponding to the owning entity type

2. E-R Diagram Mapping

❑ Step 2: Weak Entity Type and Single Value Attribute

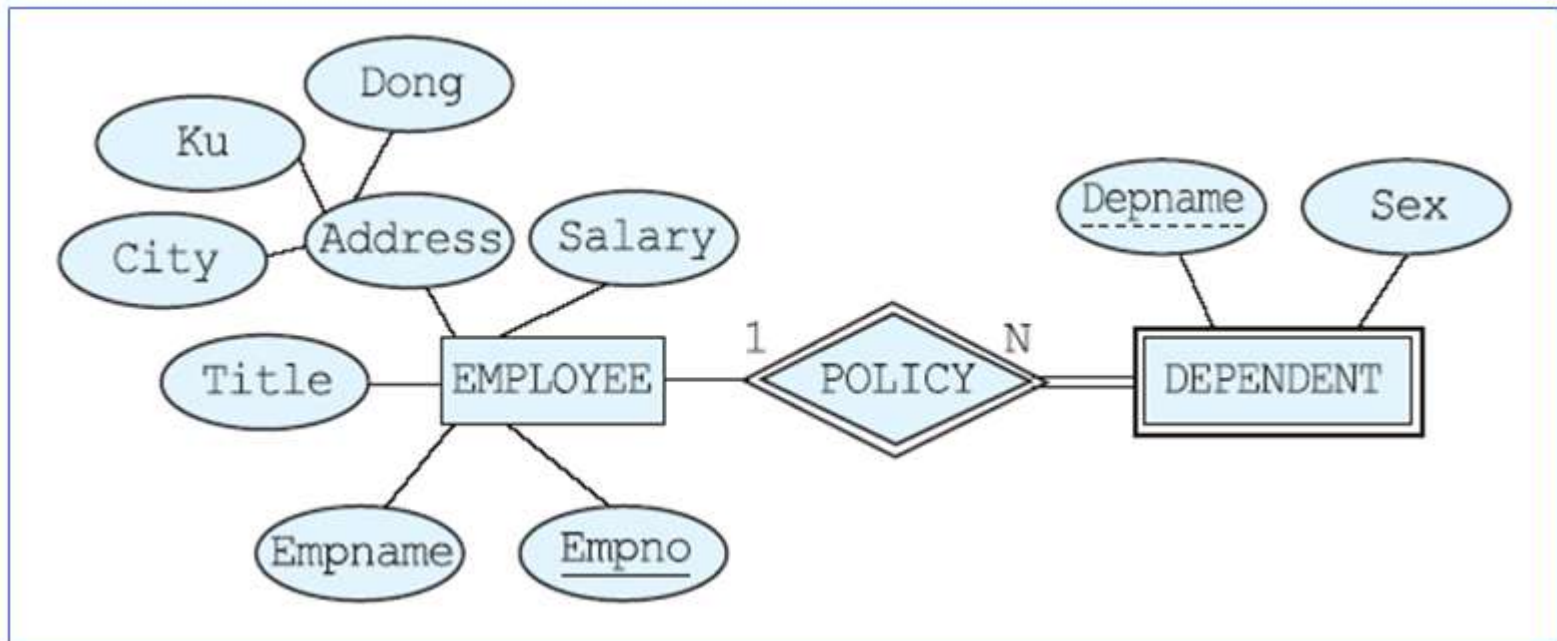


2. E-R Diagram Mapping

- ❑ Step 2: Weak Entity Type and Single Value Attribute

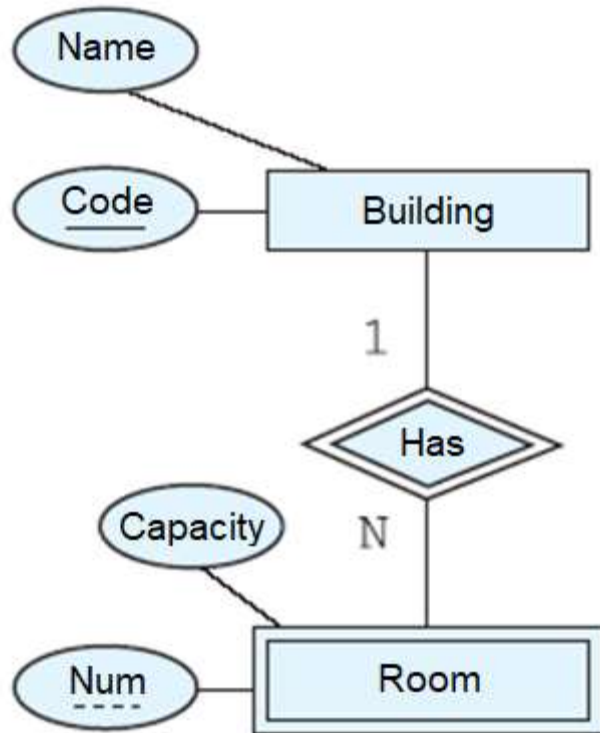
DEPENDENT (Empno, Depname, Sex)

composite primary key



2. E-R Diagram Mapping

❑ Step 2: Weak Entity Type and Single Value Attribute



Building

<u>Code</u>	<u>Name</u>

Code는 FK로 가져다와서
Composite PK가 돼.

Room

<u>Code</u>	<u>Num</u>	Capacity

2. E-R Diagram Mapping

Cardinality

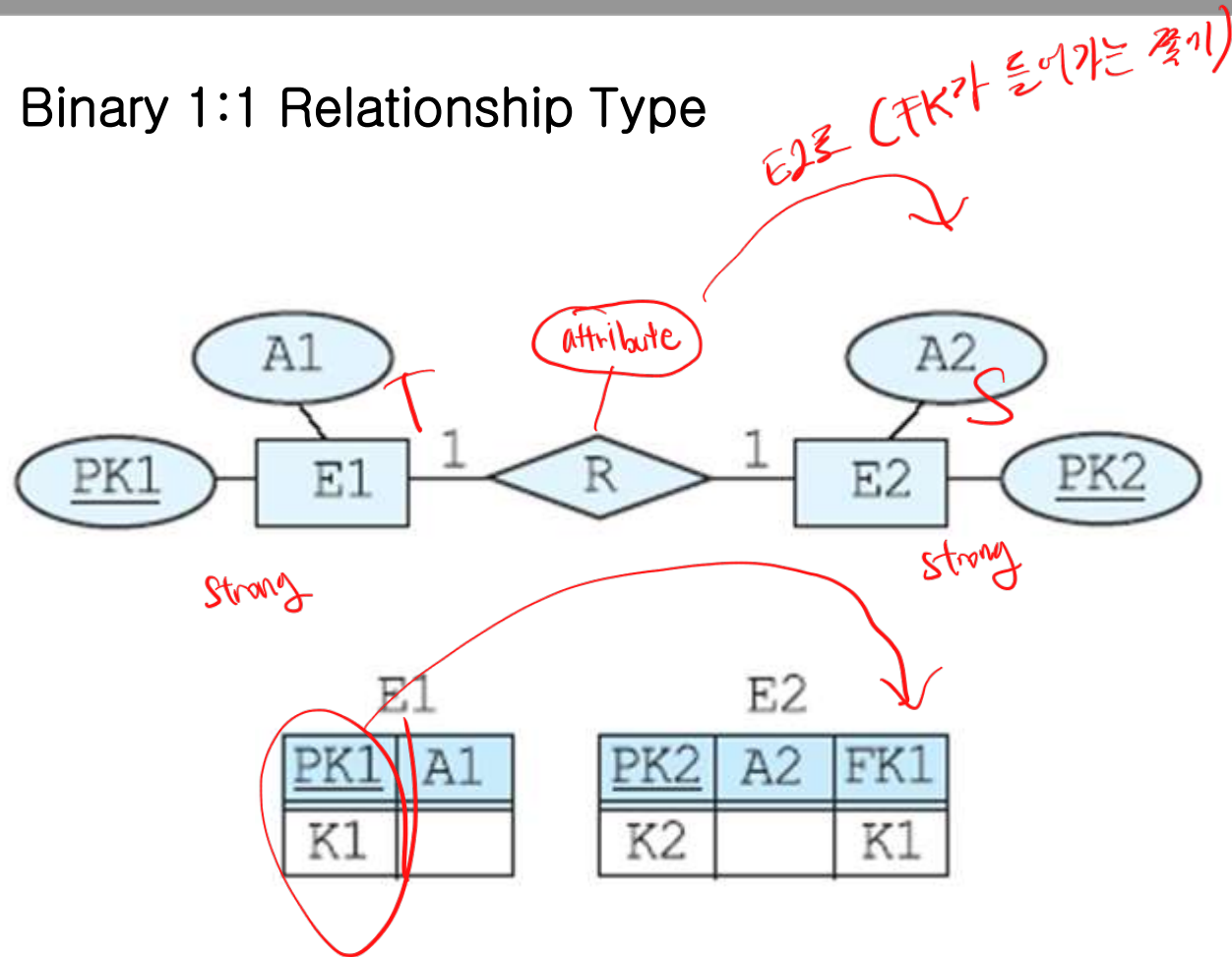
❑ Step 3: Binary 1:1 Relationship Type

- ✓ For each binary 1:1 relationship type R in the ER schema, the relations S and T corresponding to the entity types participating in R are found
- ✓ Select one relation between S and T, and if S is selected, the primary key of T is included in S as a foreign key
- ✓ All simple attributes of the relationship type R (if they have a compound attribute, the simple attributes constituting the compound attribute) are included in the relation corresponding to S
- ✗ ✓ Among S and T, the relation that fully participates in the relationship type is selected as the relation that plays the role of S



2. E-R Diagram Mapping

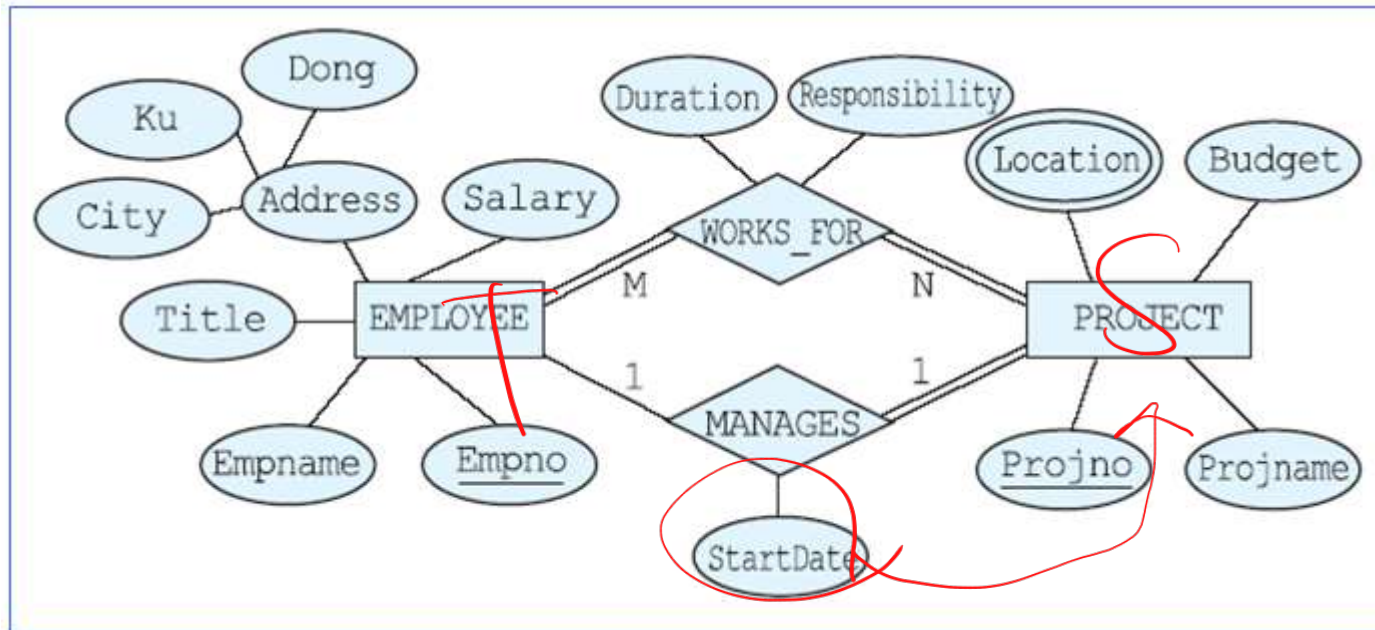
□ Step 3: Binary 1:1 Relationship Type



2. E-R Diagram Mapping

❑ Step 3: Binary 1:1 Relationship Type

PROJECT(Projno, Projname, Budget, Manager, MStartDate)



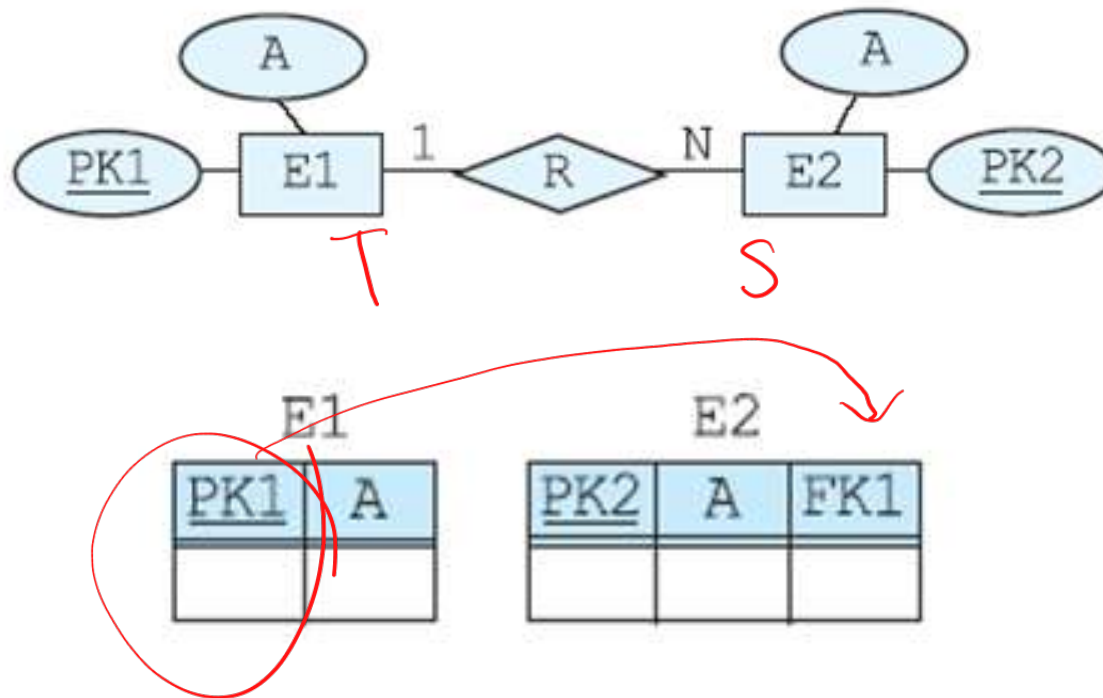
2. E-R Diagram Mapping

❑ Step 4: Regular binary 1:N relationship type

- ✓ For the regular binary 1:N relationship type R, find the relation S corresponding to the participating entity type on the N side
- ✓ The primary key of relation T is included in relation S as a foreign key
- ✓ All simple attributes of the relation type R (if they have a compound attribute, the simple attributes that make up the compound attribute) are included in the relation corresponding to S

2. E-R Diagram Mapping

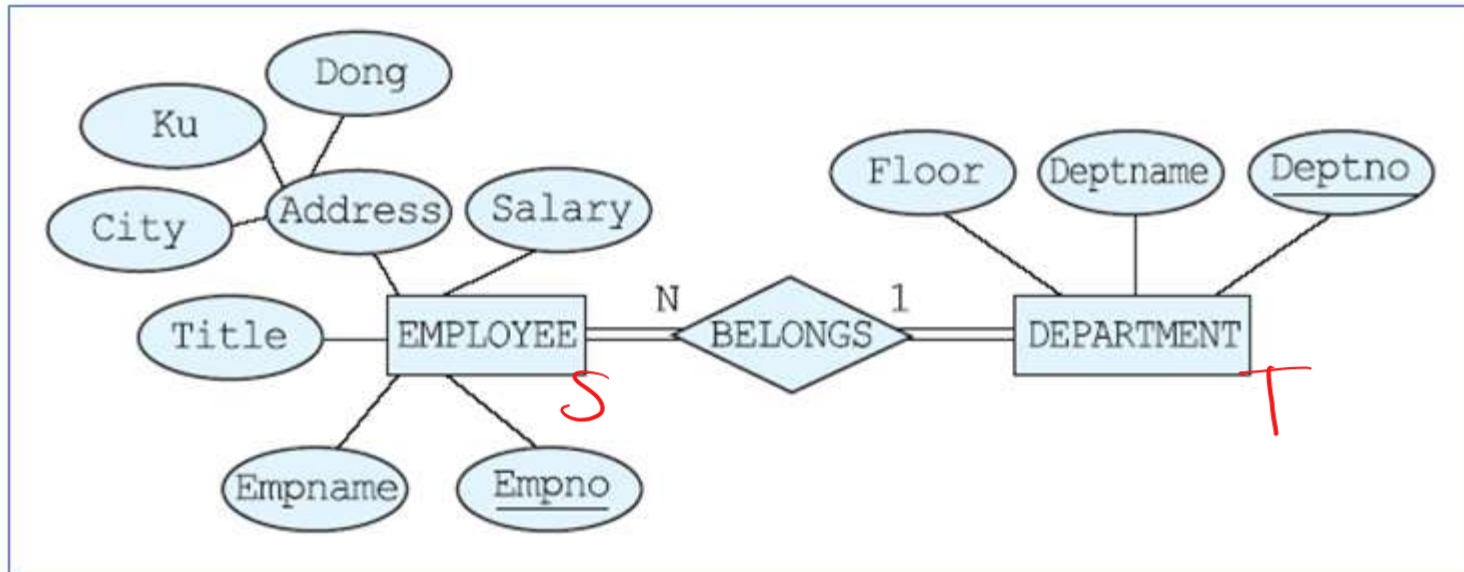
❑ Step 4: Regular binary 1:N relationship type



2. E-R Diagram Mapping

- ❑ Step 4: Regular binary 1:N relationship type

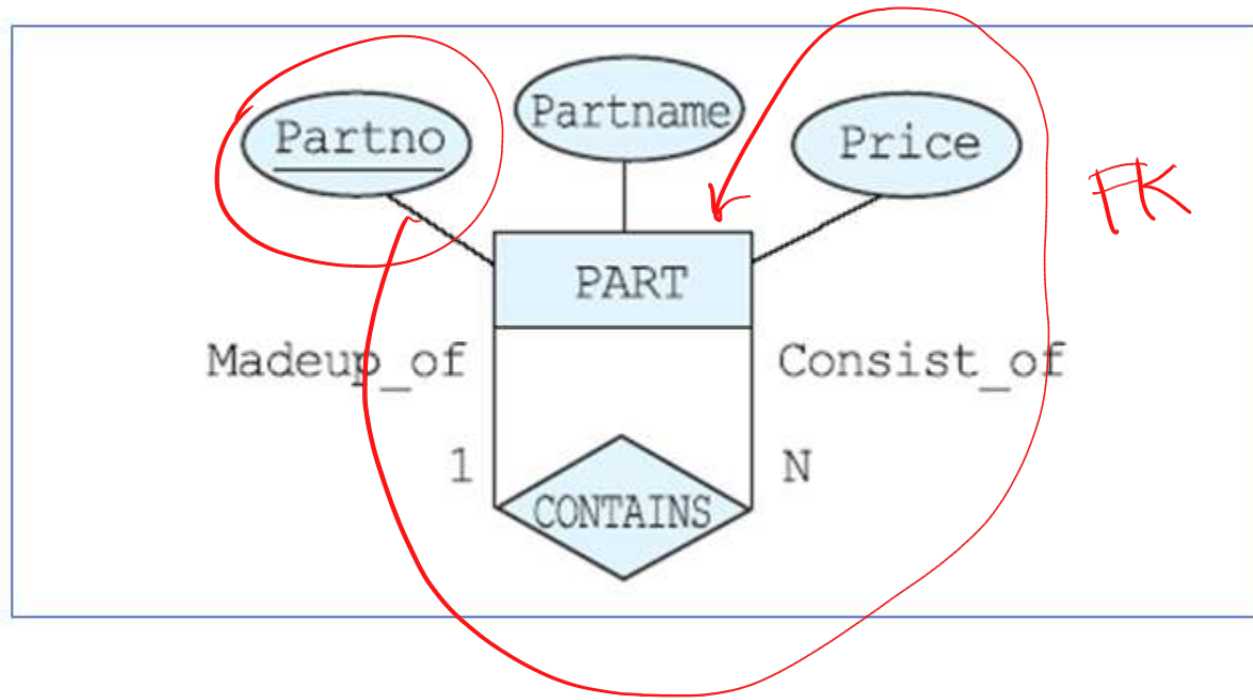
EMPLOYEE (Empno, Empname, Title, City, Ku, Dong, Salary, **Dno**)



2. E-R Diagram Mapping

- ❑ Step 4: Regular binary 1:N relationship type

PART (Partno, Partname, Price, Subpartno)



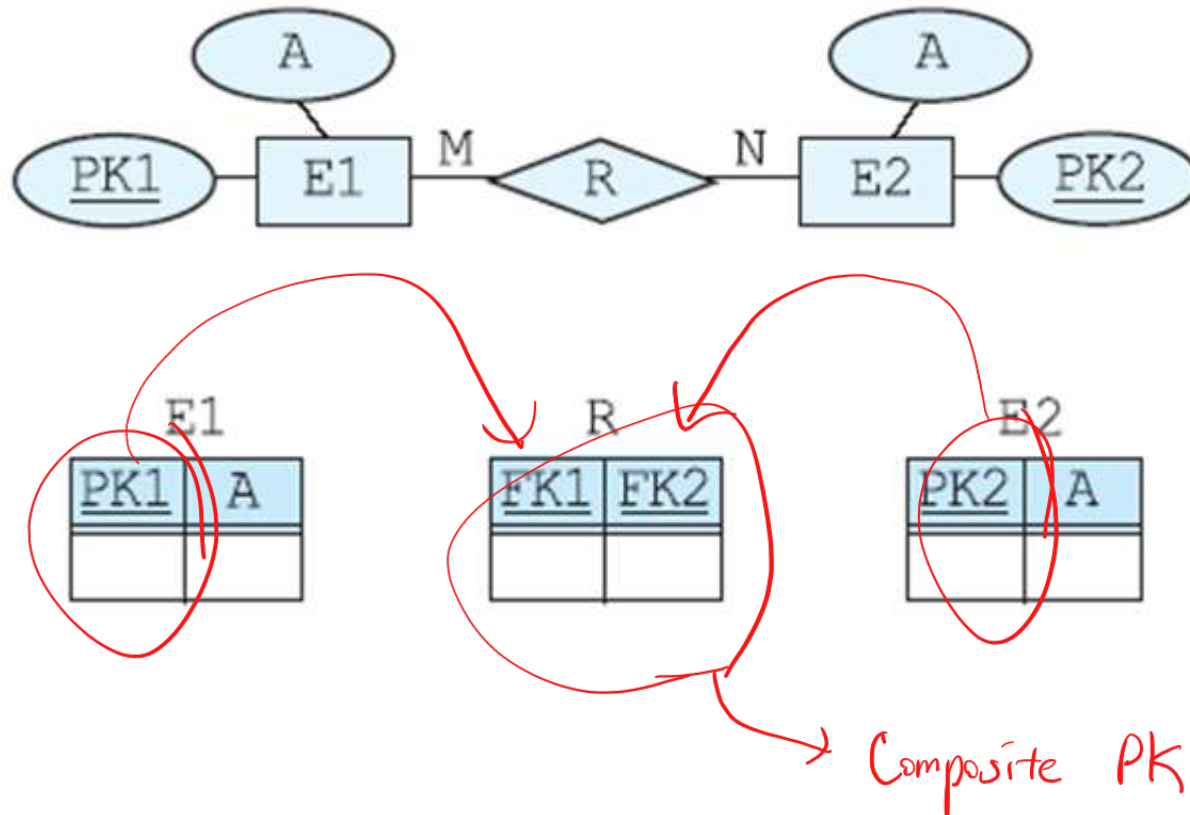
2. E-R Diagram Mapping

❑ Step 5: Binary M:N relationship type

- ✓ For binary M:N relationship type R, create relation R
- ✓ Primary keys of relations corresponding to the participating entity type are included in relation R as foreign keys, and a combination of these becomes the primary key of relation R
- ✓ All simple attributes of the relationship type R (if they have a compound attribute, the simple attributes that make up the compound attribute) are included in relation R
- ✓ If primary keys of relations corresponding to the participating entity type cannot uniquely identify the rows, then a combination of keys, including simple attributes of relation R, are used to form the primary key

2. E-R Diagram Mapping

❑ Step 5: Binary M:N relationship type

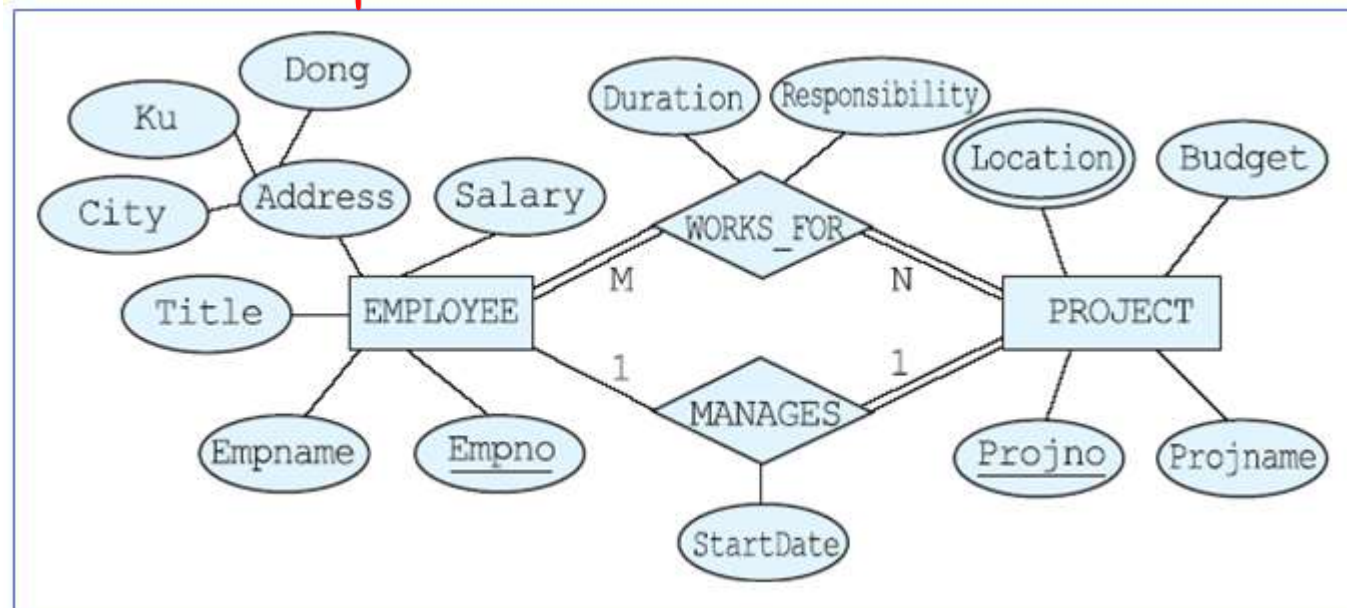


2. E-R Diagram Mapping

❑ Step 5: Binary M:N relationship type

WORKS_FOR (Empno, Projno, Duration, Responsibility)

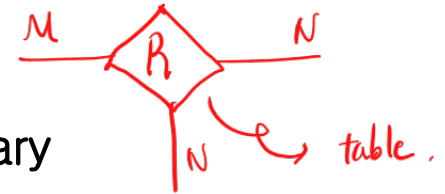
Composite PK



2. E-R Diagram Mapping

❑ Step 6: Ternary or higher relationship types

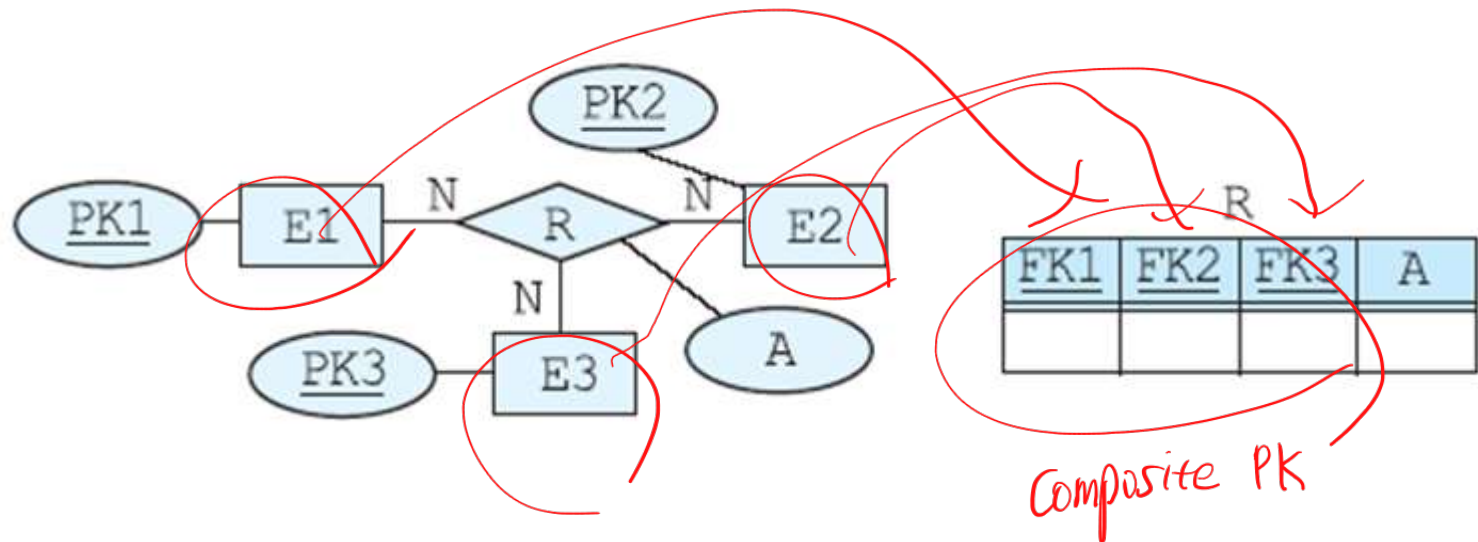
- ✓ Relation R is created for each relation type R of ternary
- ✓ Include primary keys of relations corresponding to all entity types participating in relation type R as foreign keys in relation R
- ✓ All simple attributes of the relation type R (if they have a compound attribute, the simple attributes that make up the compound attribute) are included in relation R



2. E-R Diagram Mapping

❑ Step 6: Ternary or higher relationship types

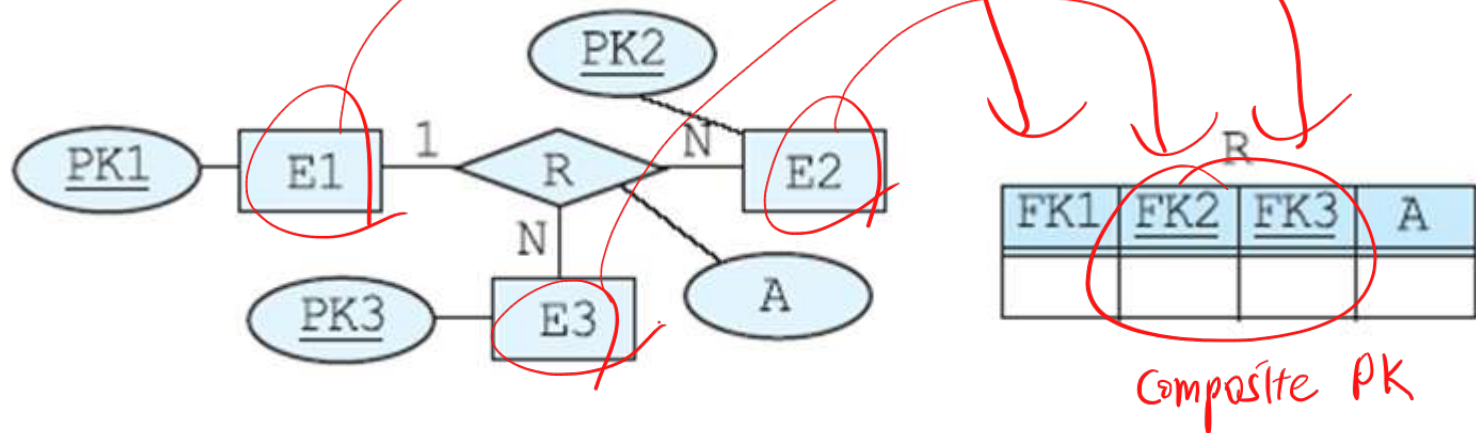
- ✓ In general, a combination of foreign keys becomes the primary key of relation R



2. E-R Diagram Mapping

❑ Step 6: Ternary or higher relationship types

- ✓ If the cardinality of the entity types participating in the relationship type R is 1:N:N, the combination of the remaining foreign keys except for the foreign key referring to the primary key of the relation with cardinality of 1 becomes the primary key of relation R

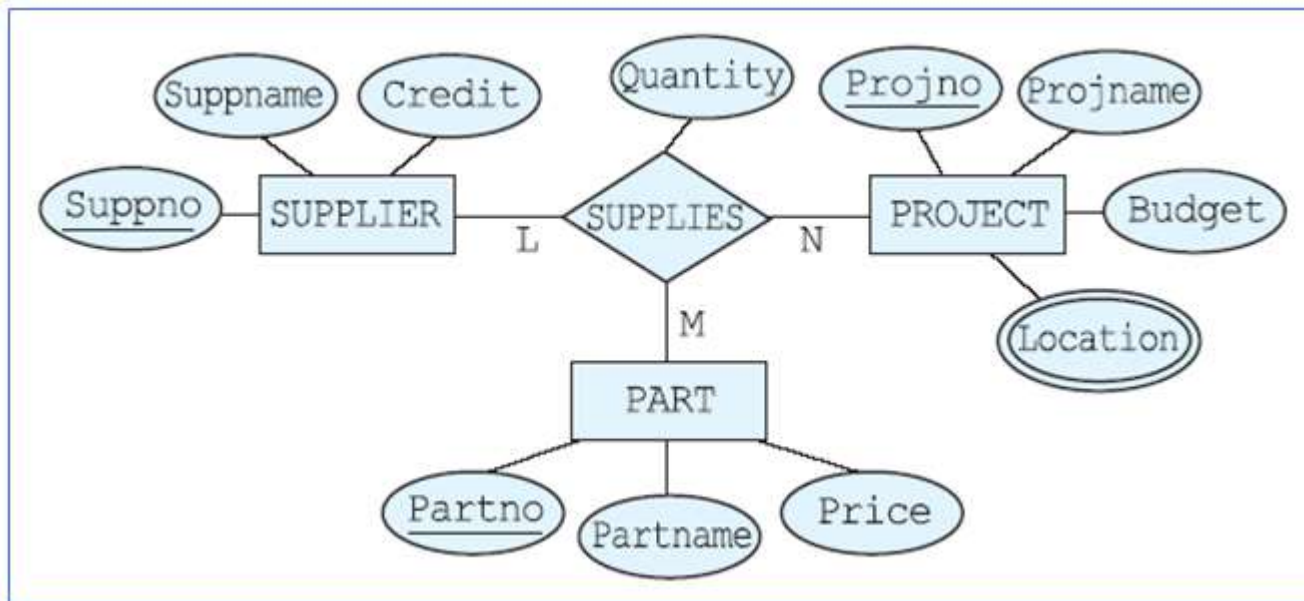


2. E-R Diagram Mapping

- ❑ Step 6: Ternary or higher relationship types

SUPPLY (Suppno, Projno, Partno, Quantity)

FK FK FK → PK



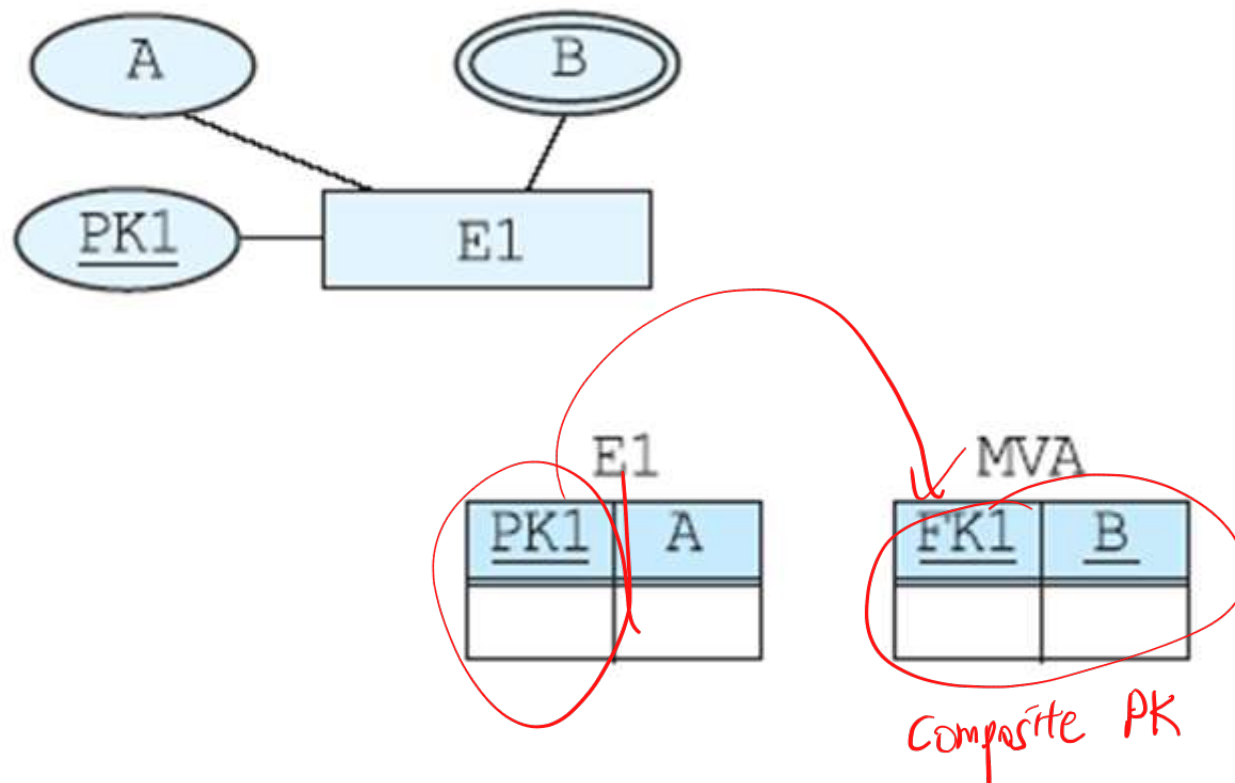
2. E-R Diagram Mapping

❑ Step 7: Multi-valued attribute

- ✓ Create a relation R for each multivalued attribute
- ✓ Include the attribute corresponding to the multi-valued attribute in relation R
- ✓ Include the primary key of the relation corresponding to the entity type or relation type having the multi-valued attribute as an attribute in relation R as a foreign key
- ✓ The primary key of R in the relation is a combination of a multi-valued attribute and a foreign key

2. E-R Diagram Mapping

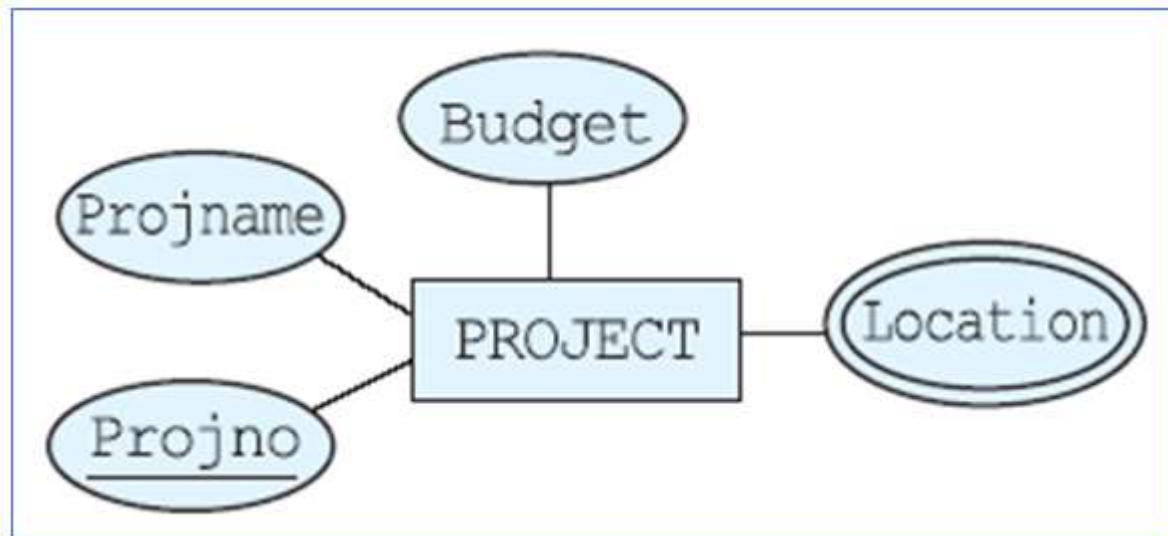
❑ Step 7: Multi-valued attribute



2. E-R Diagram Mapping

- ❑ Step 7: Multi-valued attribute

PROJ_LOC (Projno, Location)



2. E-R Diagram Mapping

- ❑ Applying the algorithm to the database design case

Step 1: Regular entity types and single valued attributes

EMPLOYEE (Empno, Empname, Title, City, Ku, Dong,
Salary)

PROJECT (Projno, Projname, Budget)

DEPARTMENT (Deptno, Deptname, Floor)

SUPPLIER (Suppno, Suppname, Credit)

PART (Partno, Partname, Price)

2. E-R Diagram Mapping

- ❑ Applying the algorithm to the database design case

Step 2: Weak Entity Type and Single Value Attribute

DEPENDENT (Empno, Depname, Sex)

Step 3: Binary 1:1 Relationship Type

PROJECT (Projno, Projname, Budget, Manager, MStartDate)

Step 4: Regular binary 1:N relationship type

EMPLOYEE (Empno, Empname, Title, City, Ku, Dong,
Salary, Dno)

PART (Partno, Partname, Price, Subpartno)

2. E-R Diagram Mapping

- ❑ Applying the algorithm to the database design case

Step 5: Binary M:N relationship type

`WORKS_FOR(Empno, Projno, Duration, Responsibility)`

Step 6: Ternary or higher relationship types

`SUPPLY(Suppno, Projno, Partno, Quantity)`

Step 7: Multi-valued Attribute

`PROJ_LOC(Projno, Location)`

2. E-R Diagram Mapping

- ❑ The company ER schema was mapped into a total of 9 relations in the relational database

EMPLOYEE(Empno, Empname, Title, City, Ku, Dong,
Salary, Dno)

PROJECT(Projno, Projname, Budget, Manager, MStartDate)

DEPARTMENT(Deptno, Deptname, Floor)

SUPPLIER(Suppno, Suppname, Credit)

PART(Partno, Partname, Price, Subpartno)

DEPENDENT(Empno, Depname, Sex)

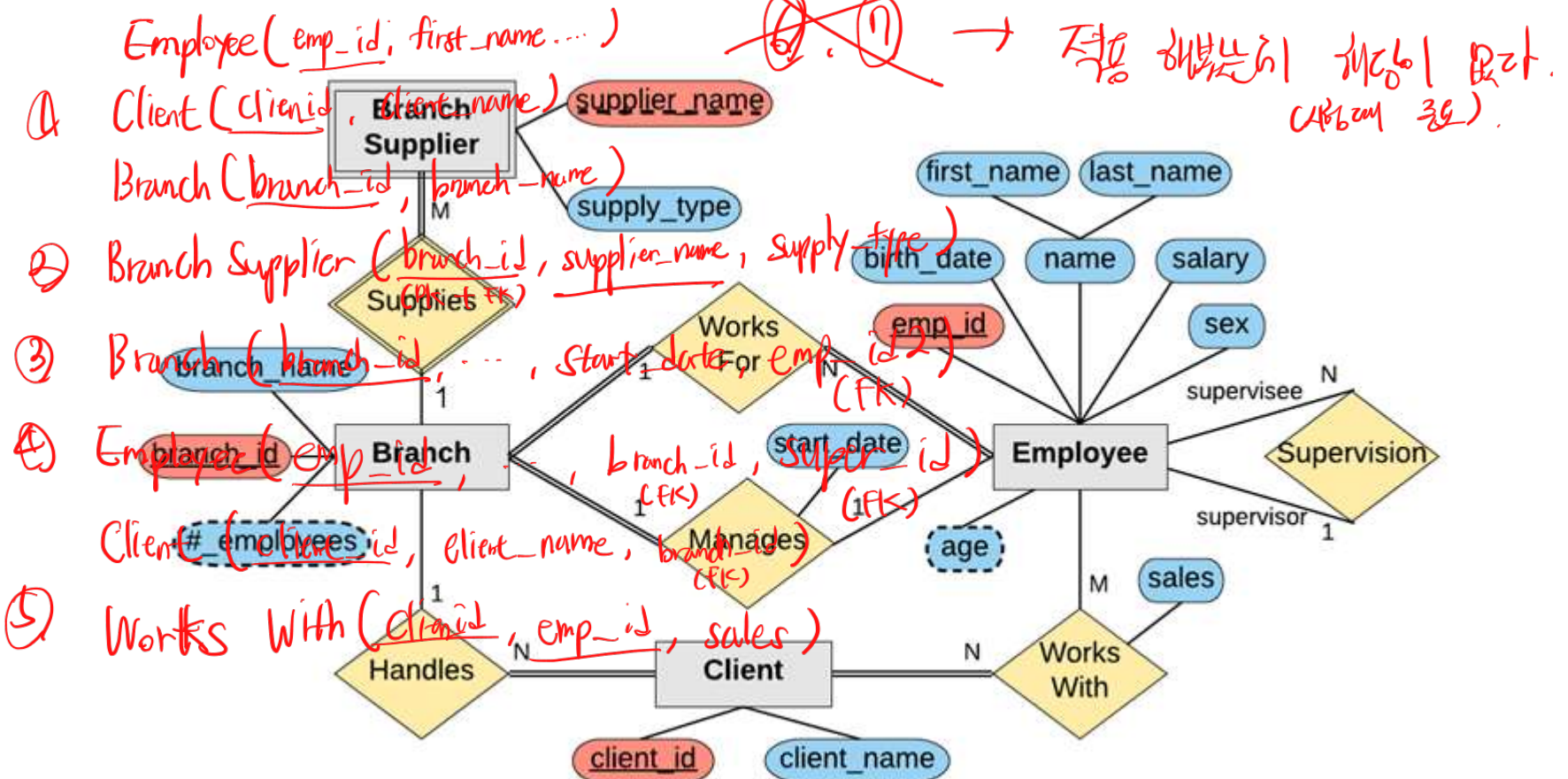
WORKS_FOR(Empno, Projno, Duration, Responsibility)

SUPPLY(Suppno, Projno, Partno, Quantity)

PROJ_LOC(Projno, Location)

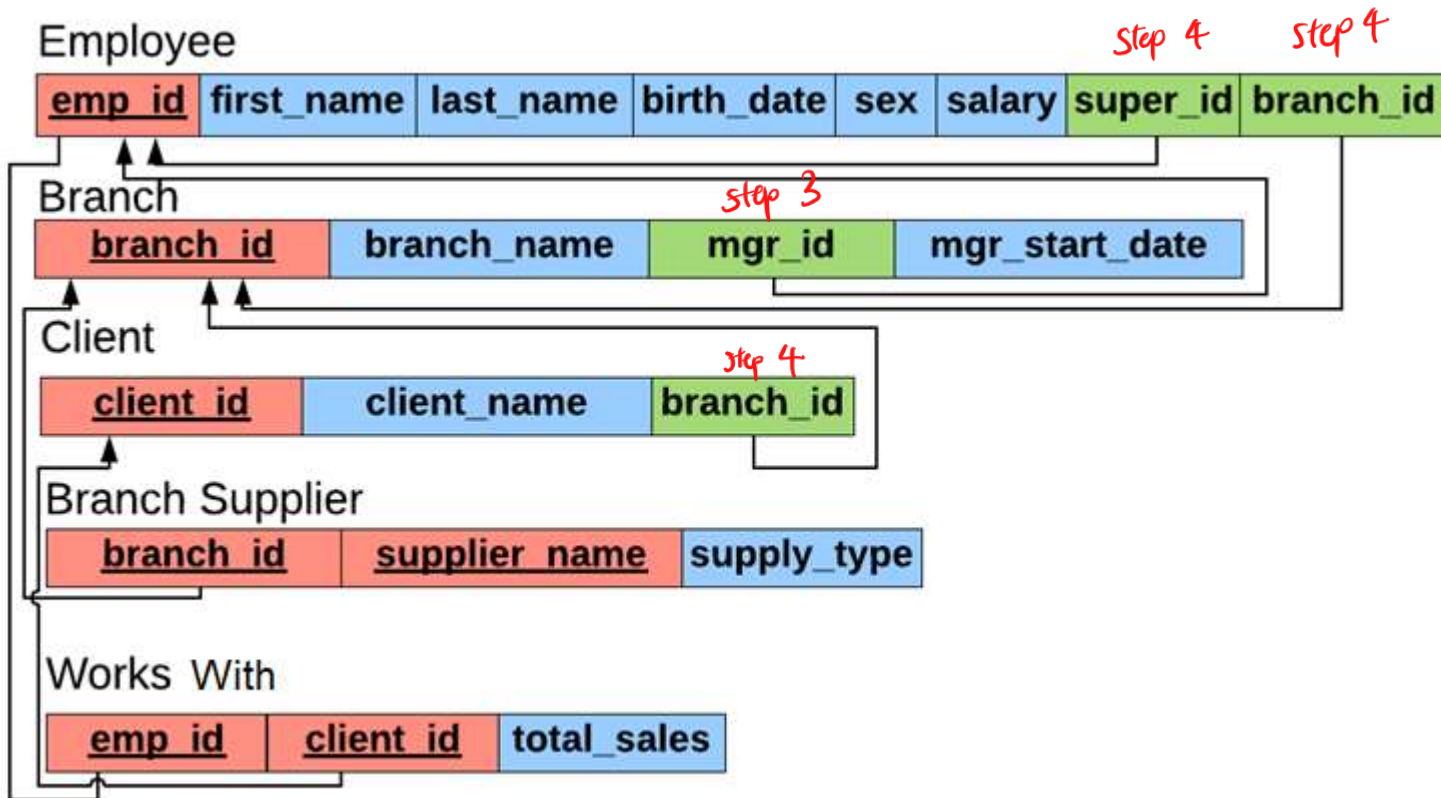
3. Exercise

❑ Given the following ER Diagram, map it into logical schemas



3. Exercise

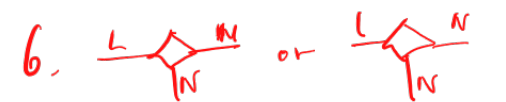
□ Result of mapping



4. Summary and Discussions

❑ E-R Diagram Mapping Steps

- ❑ Step 1: Regular entity types and single valued attributes
- ❑ Step 2: Weak Entity Type and Single Value Attribute
- ❑ Step 3: Binary 1:1 Relationship Type
- ❑ Step 4: Regular binary 1:N relationship type
- ❑ Step 5: Binary M:N relationship type
- ❑ Step 6: Ternary or higher relationship types
- ❑ Step 7: Multi-valued attribute

1. 인스턴스 ← 속성
2. 강엔티리 약엔티리
3. 1:1
4. 1:N
5. M:N
6. 
7. MVA