MAPPING ER DIAGRAM TO RELATION

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ER-to-Relational Mapping Algorithm

- **Step 1:** Mapping of Regular Entity Types.
- **Step 2:** Mapping of Weak Entity Types.
- **Step 3:** Mapping of Binary 1:1 Relationship.
- **Step 4:** Mapping of Binary 1:N Relationship.
- **Step 5:** Mapping of Binary M:N Relationship.
- **Step 6:** Mapping of N-ary Relationship.
- **Step 7:** Mapping ISA Relationship.
- **Step 8:** Mapping Aggregation Relationship.

Step 1: Mapping of Regular Entity Types

1. For each regular (**strong**) entity type **E** in the **ER** schema, create a **relation R** that includes all the simple attributes of E.

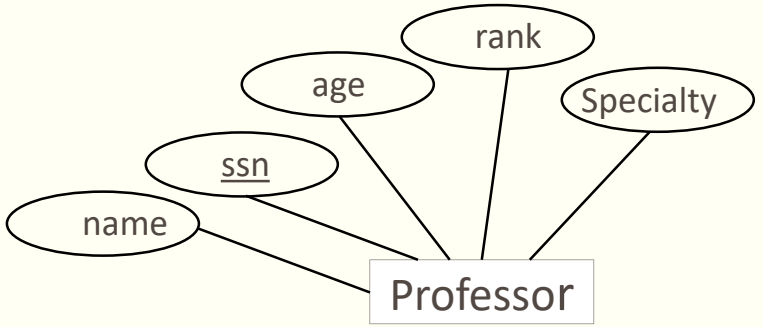
2. Choose one of the key attributes of E as the **primary key** for R.

3. If the chosen key of E is composite, the set of simple attributes that form it will **together** form the primary key of R.

Step 1: Mapping of Regular Entity Types

SSN	NAME	AGE	RANK	SPECIALITY
1	Ahmed	38	3	Web Design

```
CREATE TABLE  PROFESSOR
  (
    SSN NUMBER(30,0),
     NAME VARCHAR2(20) NOT NULL,
     AGE NUMBER(30,0) NOT NULL,
    RANK VARCHAR2(20) NOT NULL ,
    SPECIALITY VARCHAR2(20) NOT NULL ,
     CONSTRAINT SSN_PK PRIMARY KEY ("SSN")
  )
```



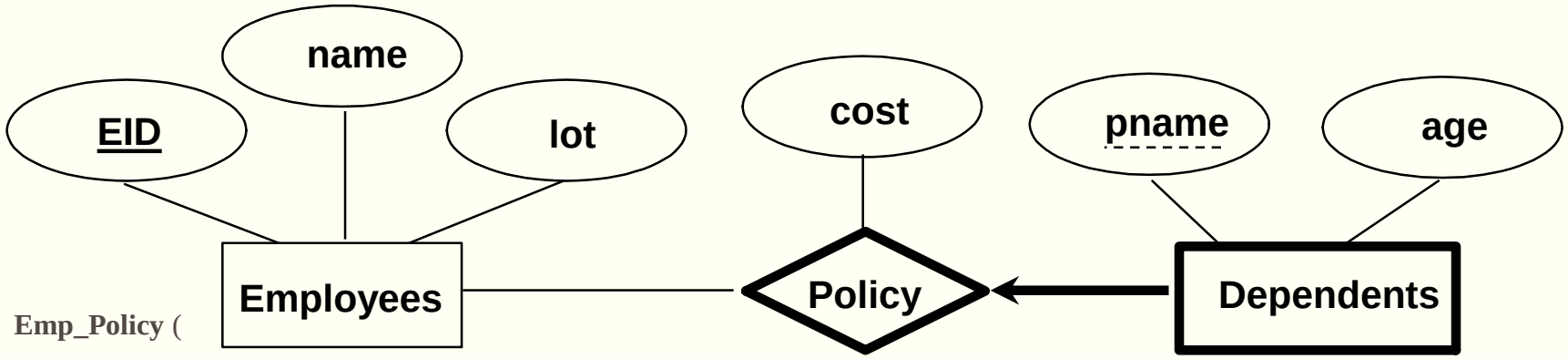
Step 2: Mapping of Weak Entity Types

1. For each **weak** entity type **W** in the ER schema with **owner** entity type **E**, **create a relation** R & include all simple attributes (or simple components of composite attributes) of W as attributes of R.

2. Include as **foreign key** attributes of R the primary key attribute(s) of the relation(s) that correspond to the **owner** entity type(s).

3. The primary key of R is the *combination of the* ***primary key(s) of*** **the owner(s)** and the **partial key of the weak entity** type W, if any.

Step 2: Mapping of Weak Entity Types




```
CREATE TABLE  Emp_Policy (
   PNAME VARCHAR2(20) NOT NULL,
   AGE NUMBER(30,0) NOT NULL,
   COST NUMBER(30,0) NOT NULL,
   EID NUMBER(4,2) ,
   PRIMARY KEY (pname, EID),
   FOREIGN KEY (EID) REFERENCES Employee ON DELETE CASCADE
)
```

PNAME	AGE	COST	EID
Aland	15	100000	1

Step 3: Mapping of Binary 1:1 Relation Types.

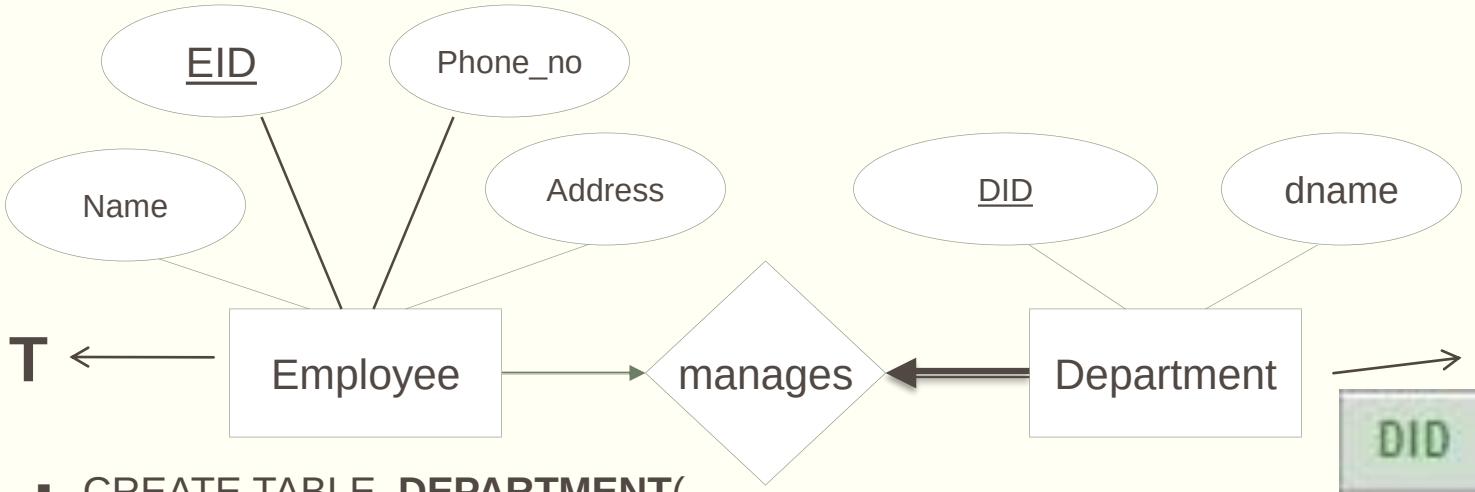
- For each binary 1:1 relationship type **R** in the ER schema, identify the relations **S** and **T** that correspond to the entity types participating in **R**.

- **There are three possible approaches:**

1. **Foreign Key approach:** Choose one of the relations say **S** and include a **foreign key** in **S** the **primary key** of **T**. It is **better** to choose an entity type with **total participation** in R in the role of **S**.

- **Example:** 1:1 relation **MANAGES** is mapped by choosing the participating entity type **DEPARTMENT** to serve in the role of **S**, because its participation in the MANAGES relationship type is **total**.

Foreign Key approach



DID	DNAME	MANAGER_ID
1	Computer Science	1

- CREATE TABLE **DEPARTMENT**(

  DID NUMBER(4,0),

  DNAME VARCHAR2(30) CONSTRAINT D_NAME_NN NOT NULL,

  MANAGER_ID NUMBER(6,0) unique,

  CONSTRAINT D_ID_PK PRIMARY KEY ("DID"),

  CONSTRAINT D_MGR_FK FOREIGN KEY ("MANAGER_ID") REFERENCES "EMPLOYEE" ("EID"))

Merged relation option

2. **Merged relation option:** An alternate mapping of a 1:1 relationship type is possible by **merging** the two entity types and the relationship into a **single** relation. This maybe **Merged relation option** when **both** participations are **total**.

CREATE TABLE **Student**(

ID NUMBER(4,0) PRIMARY KEY,

FNAME VARCHAR2(30) NOT NULL,

LNAME VARCHAR2(30) NOT NULL,

MAJOR VARCHAR2(30) NOT NULL

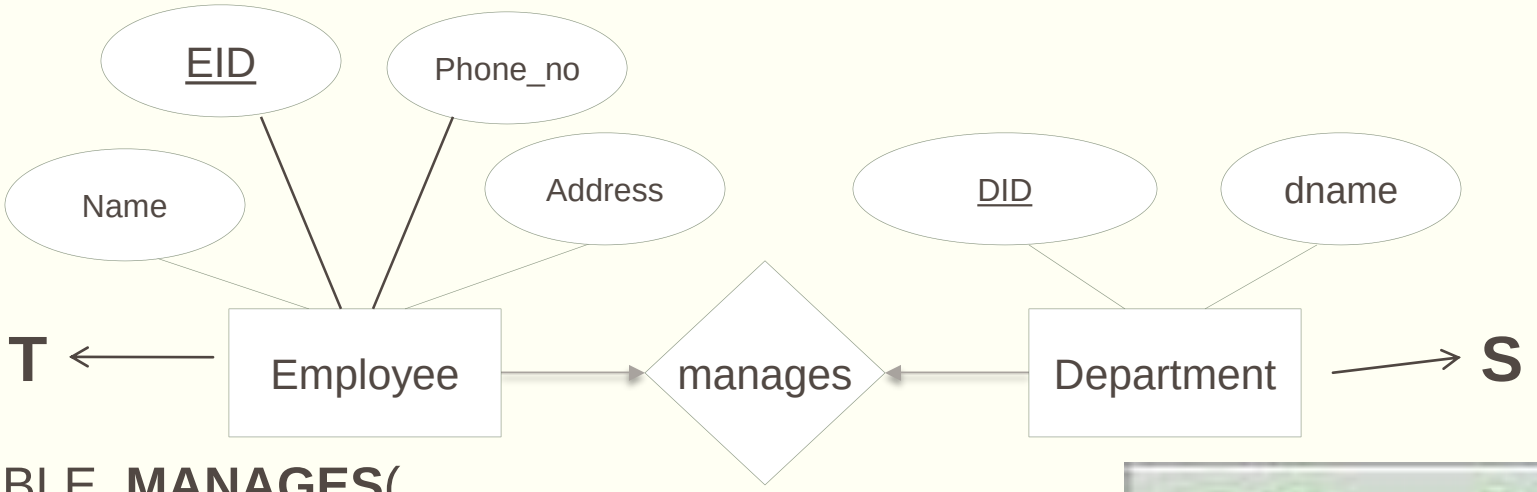
)

ID	FNAME	LNAME	MAJOR
1	Azad	Ali	Computer Science

Cross-reference or relationship relation option

3. **Cross-reference or relationship relation option:** Is to set up a **third** relation **R** for the purpose of cross-referencing the primary keys of the two relations **S** and **T** representing the entity types. This approach is better when the two relations **S** and **T** are **partially participate** in the relationship.

Cross-reference or relationship relation option



CREATE TABLE **MANAGES**(
DID NUMBER(4,0),
EID NUMBER(4,0) unique,
CONSTRAINT MNG_PK PRIMARY KEY ("DID"),
CONSTRAINT MGR_D_FK FOREIGN KEY ("DID") REFERENCES DEPARTMENT ("DID"),
CONSTRAINT MGR_E_FK FOREIGN KEY ("EID") REFERENCES EMPLOYEE ("EID"))

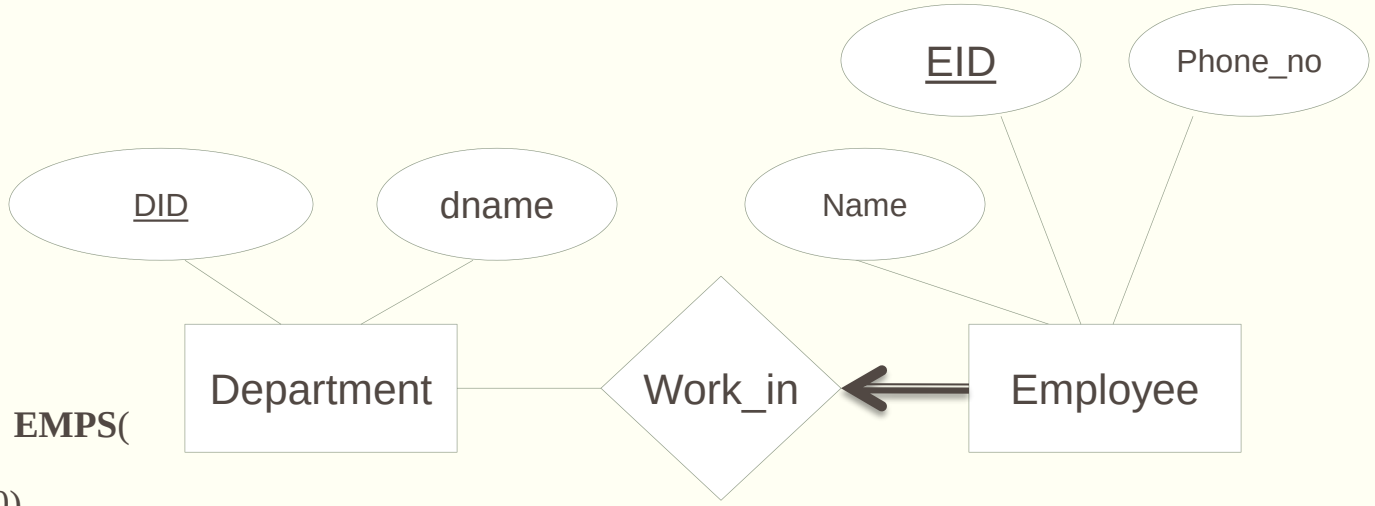
DID	EID
1	1

Step 4: Mapping of Binary 1:N Relationship Types (Total Participation)

For each regular binary **1:N** relationship type **R**, identify the relation **S** that represent the participating entity type at the **N-side** of the relationship type.

- Include as **foreign key** in **S** the **primary key** of the relation **T** that represents the other entity type participating in R.
- Include any simple attributes of the 1:N relation type as attributes of **S**.

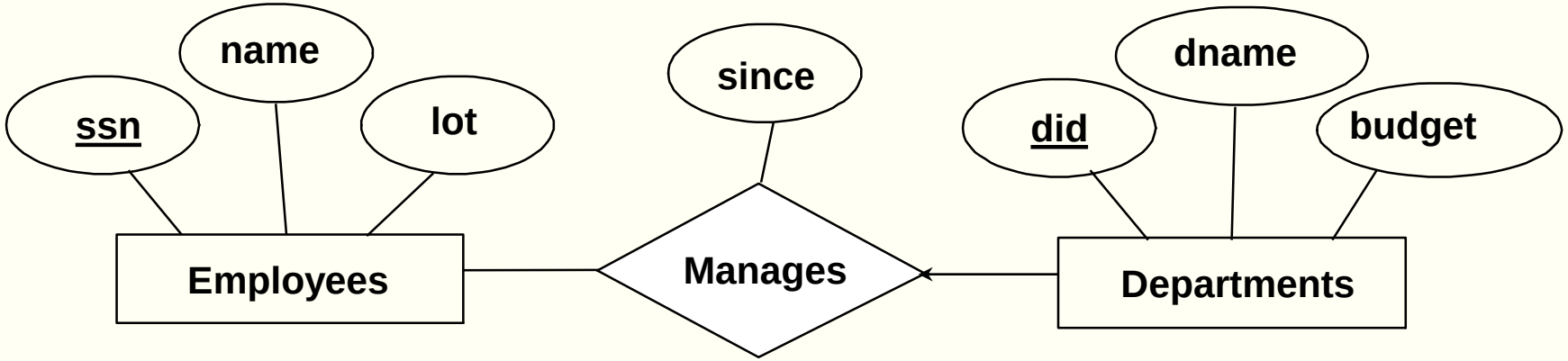
Step 4: Mapping of Binary 1:N Relationship Types Total Participation




```
CREATE  TABLE  EMPS(
EID NUMBER(4,0),
NAME VARCHAR2(20),
PHONE NUMBER(5,0),
DID NUMBER(4,0),
CONSTRAINT EMP_PK PRIMARY KEY ("EID"),
 CONSTRAINT EMP_FK FOREIGN KEY ("DID") REFERENCES  DEPARTMENT ("DID"))
```

EID	NAME	PHONE	DID
1	Azad	7707700770	1

Step 4: Mapping of Binary 1:N Relationship Types Partial Participation

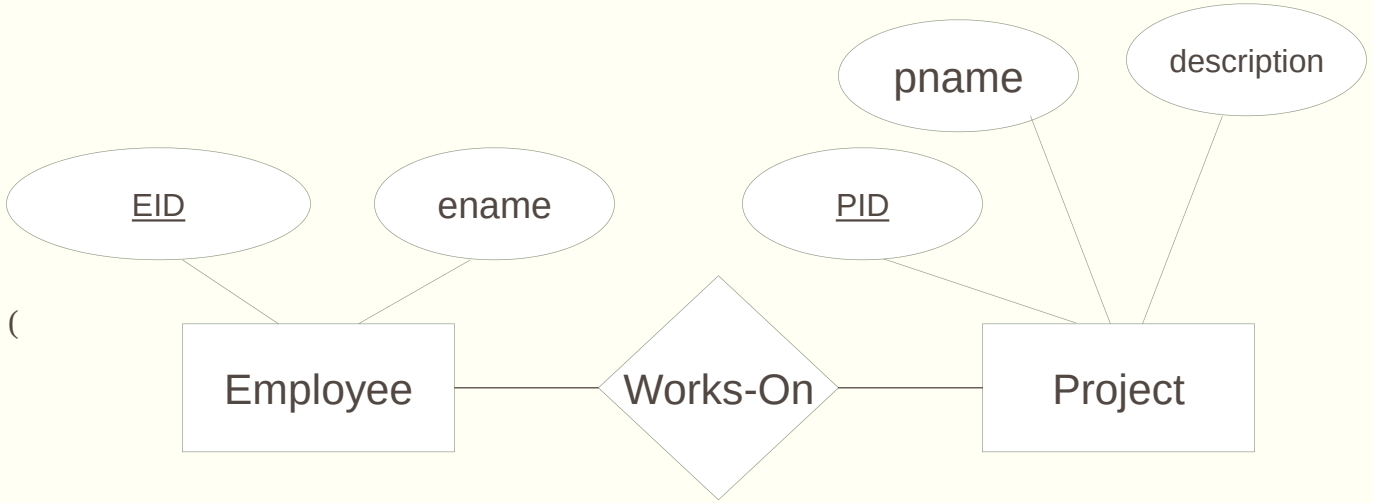



```
CREATE TABLE  Dept_Mgr(
   DID  INTEGER(4,0),
   SSN  INTEGER(4,0),
   SINCE  DATE,
 CONSTRAINT MGR_PK PRIMARY KEY (“DID“),
 CONSTRAINT MGR_FK FOREIGN KEY ("DID") REFERENCES DEPARTMENT ("DID"),
CONSTRAINT MGR_FK FOREIGN KEY (“SSN") REFERENCES EMPLOYEES (“SSN"))
```

Step 5: Mapping of Binary M:N Relationship Types

- For each regular binary **M:N** relationship type **R**, *create a new relation **S** to represent **R**.*
- Include as **foreign key** attributes in **S** the **primary keys** of the relations that represent the participating entity types; *their **combination will form the primary key of S**.*
- Also include any simple attributes of the M:N relationship type (or simple components of composite attributes) as attributes of S.

Step 5: Mapping of Binary M:N Relationship Types



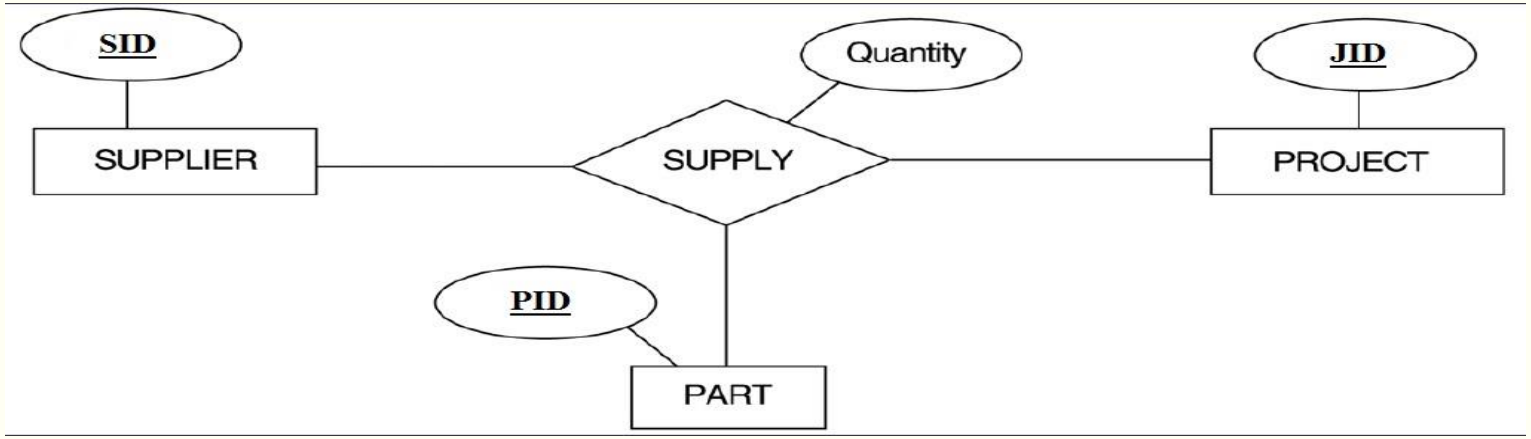

```
CREATE TABLE  WORKS_ON (
EID NUMBER(4,0),
PID NUMBER(4,0),
CONSTRAINT WRK_PK PRIMARY KEY ("EID","PID"),
CONSTRAINT EID_FK FOREIGN KEY ("EID")
REFERENCES  EMPLOYEE ("EID"),
CONSTRAINT PID_FK FOREIGN KEY ("PID")
REFERENCES  PROJECT ("PID"))
```

EID	PID
1	1

Step 6: Mapping of N-ary Relationship Types.

- For each **n-ary** relationship type **R**, where **n>2**, create a new relationship **S** to represent **R**.
- Include as foreign key attributes in S the primary keys of the relations that represent the participating entity types.
- Also include any simple attributes of the n-ary relationship type.

Step 6: Mapping of N-ary Relationship Types.



CREATE TABLE **SUPPLY**

(SID NUMBER(4,0),

PID NUMBER(4,0),

JID NUMBER(4,0),

QUANTITY NUMBER(4,0),

CONSTRAINT S_PK PRIMARY KEY ("SID","PID","JID"),

FOREIGN KEY ("SID") REFERENCES SUPPLIER ("SID"),

FOREIGN KEY ("PID") REFERENCES PART ("PID"),

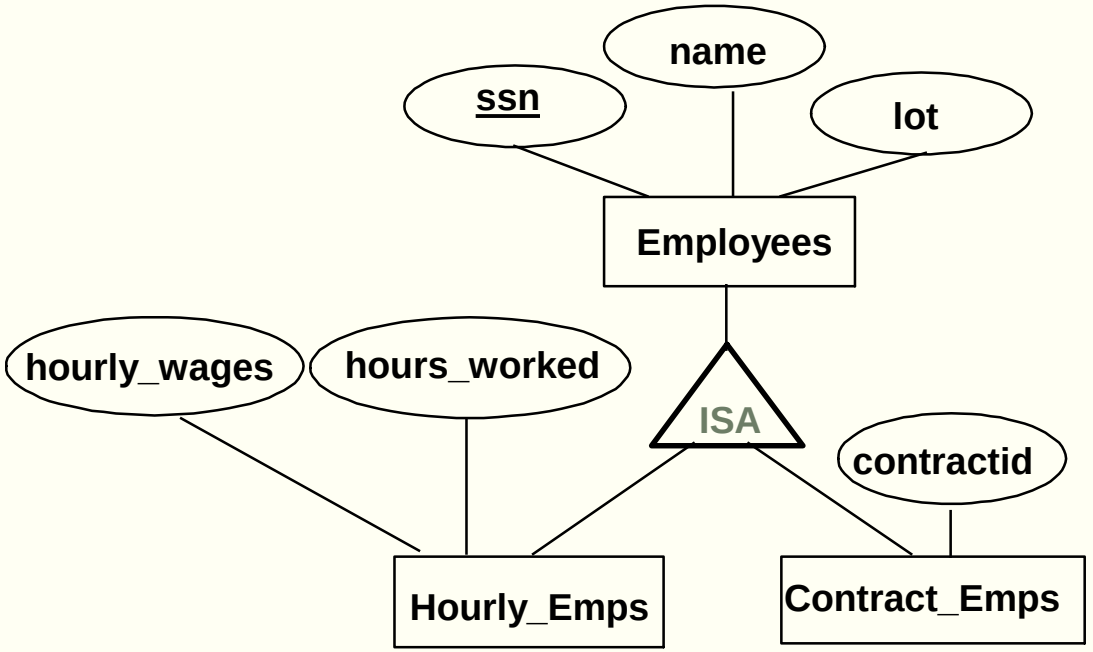
FOREIGN KEY ("JID") REFERENCES PROJECT ("JID"))

SID	PID	JID	QUANTITY
1	1	1	10

Step 7: Mapping ISA Relationship.

Two approaches:

- Using three tables
- Using two tables



Mapping Using Three Relations

Employees

ssn	name	lot

Every employee is recorded in Employees

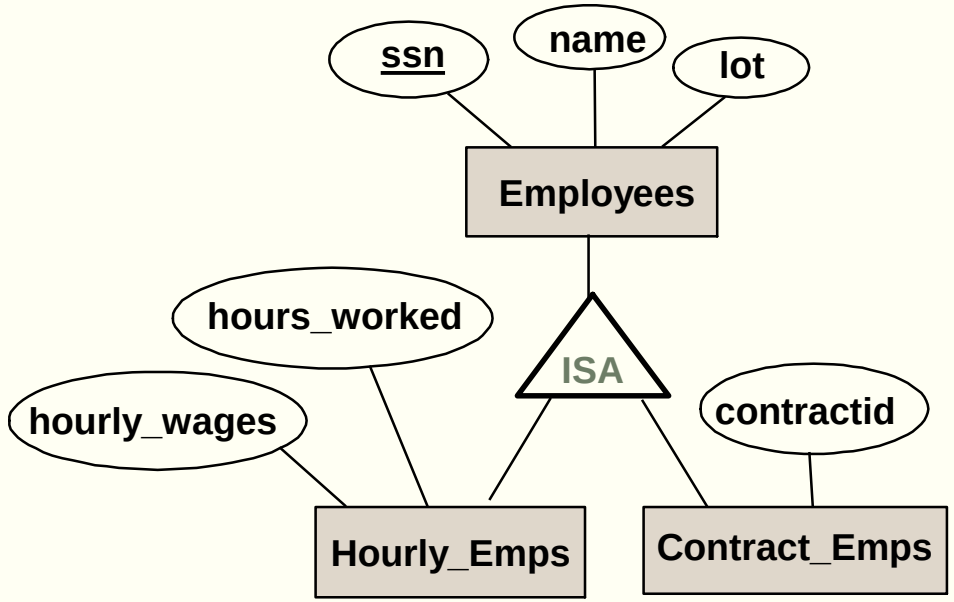
Contract_Emps

ssn	contratid

Hourly_Emps

ssn	Hourly_wages	Hours_worked

For hourly employees, extra information recorded in Hourly_Emps



- must delete Hourly_Emps tuple if referenced Employees tuple is deleted.

Mapping Using Three Relations

Employees

ssn	name	lot

Every employee is recorded in Employees

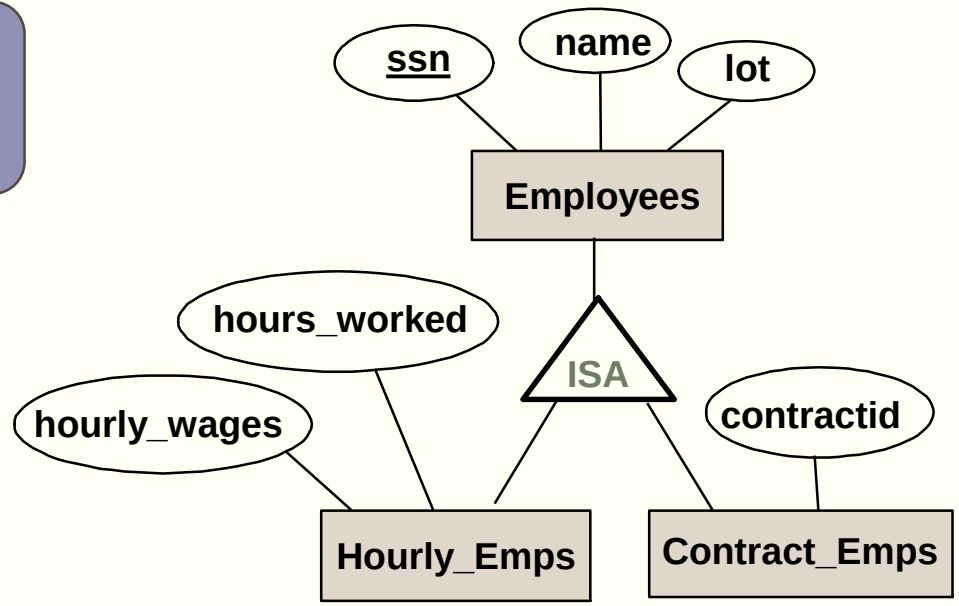
Contract_Emps

ssn	contratid

Hourly_Emps

ssn	Hourly_wages	Hours_worked

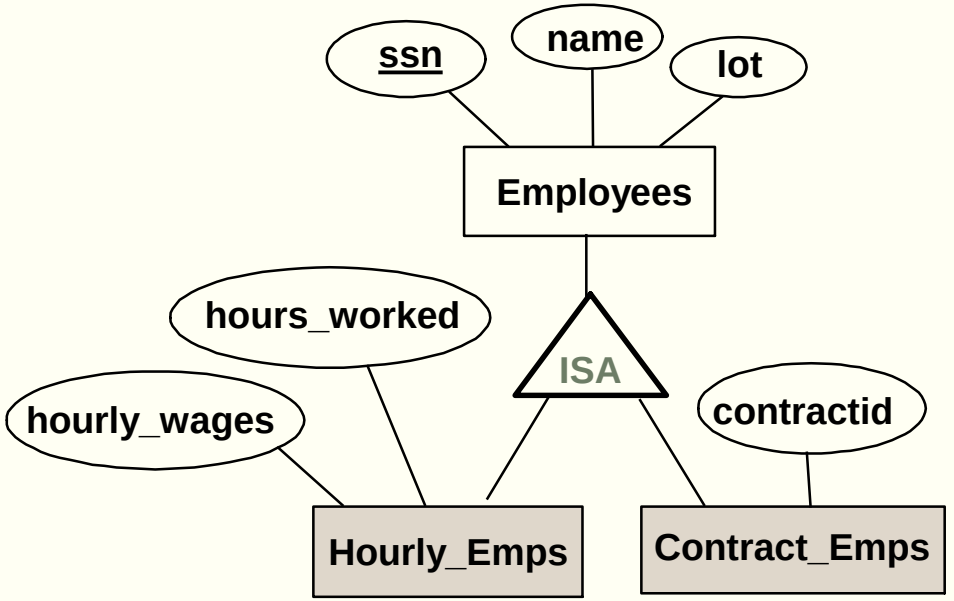
For hourly employees, extra information recorded in Hourly_Emps



- Queries involving all employees easy,
- those involving just Hourly_Emps require a join to get some attributes (e.g., name).

ISA Mapping Using Two Relations

Each employee must be in one of these two relations



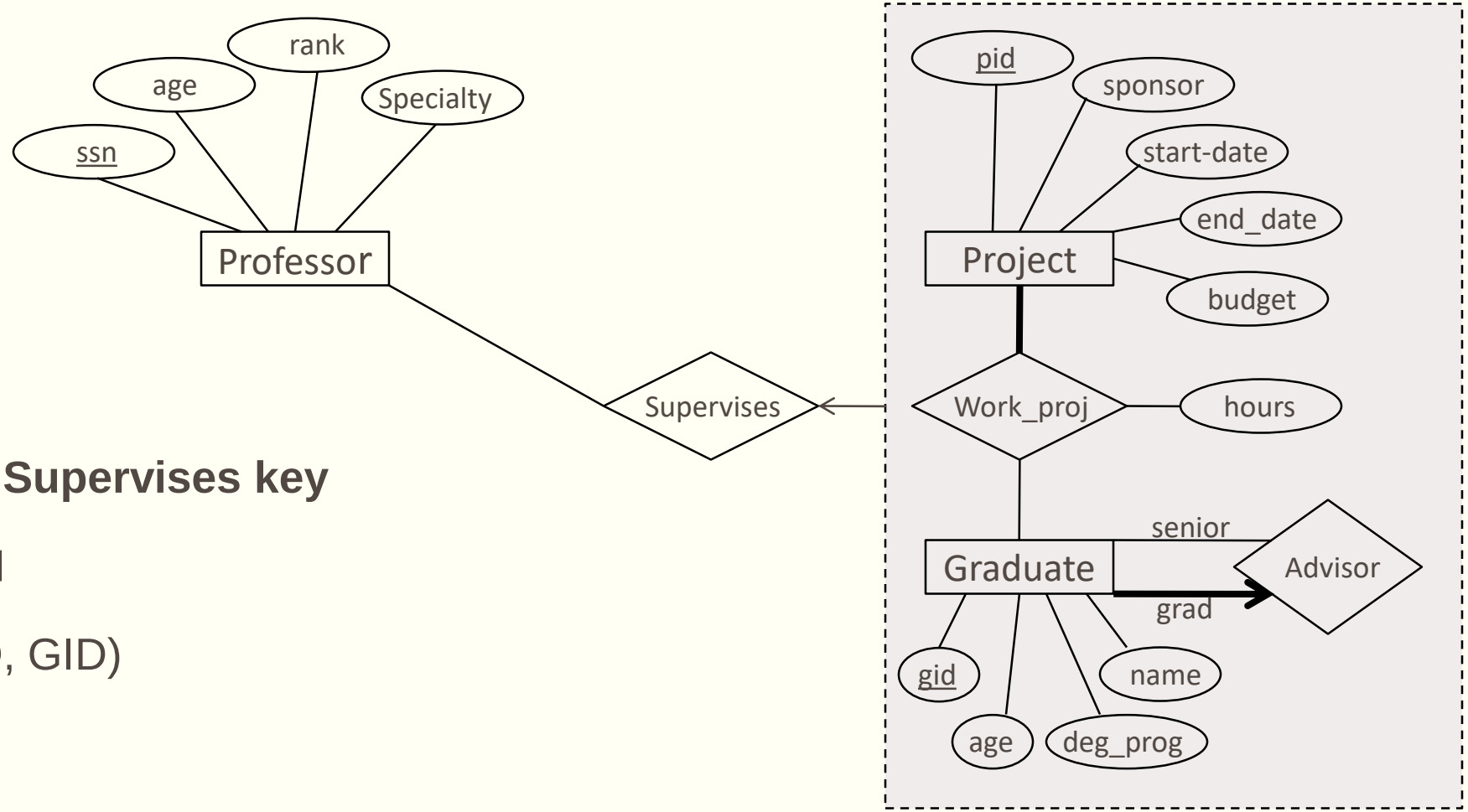
Hourly_Emps

ssn	name	lot	hourly_wages	hours_worked

Contract_Emps

ssn	name	lot	Contractid

Step 8: Mapping Aggregation Relationship.



- The **Supervises key**
  - ➢ SSN
  - ➢ (PID, GID)

Step 8: Mapping Aggregation Relationship.

- What if Work_proj has no descriptive attributes AND total participation in Supervises?
- Fold Work_proj and Supervises into 1 table

Preferred resources

1) ***Fundamentals of Relational Database Management Systems*** by S. Sumathi

2) ***Database Management System*** by Raghu Ramakrishnan & Johannes Gehrke

3) ***Fundamentals of Database Systems*** by Ramez Elmasri & Shamkant B. Navathe

4) Solution Manuals for ***Database Management System*** by Raghu Ramakrishnan & Johannes Gehrke

5) **Mohammed, M. A.**, Abdullah, J. M., & Muhammed, D. A. **Practical Approaches of Transforming Entity Relationship Diagram into Tables**. *International Journal of Multidisciplinary and Scientific Emerging Research,* 4(2) (September/October 2015), 1106-1110.

Any Question ?