



# Entity-Relationship model Weaknesses

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# Contents



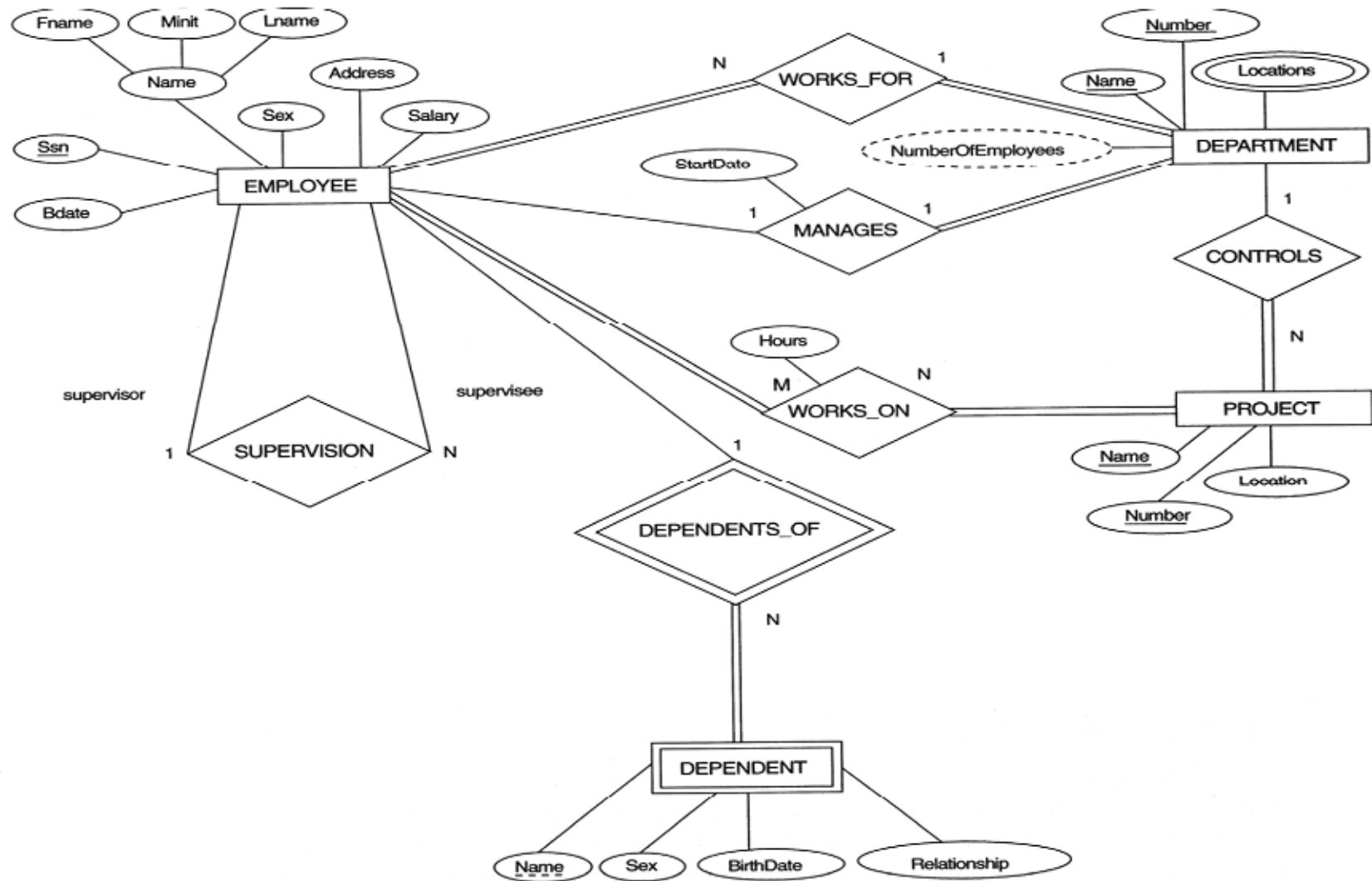
## 1. Introduction

## 2. Relation Constraints

## 3. Attribute Constraints

## 4. Conclusion

# 1. ER model - An example



# 1. ER model

## ❖ What ? Why?

- A basic tool in database design : a conceptual data model is independent of physical or implemental details.
- Easily understood by ordinary users : capturing the basic semantics
- Limited expressive power vs formality, simplicity and wide application

# 1. ER model

## ❖ Database requirements

- Supporting more complex applications.
- Capturing more domain semantics.

→ **Enhancements and extensions to ER model : very important.**

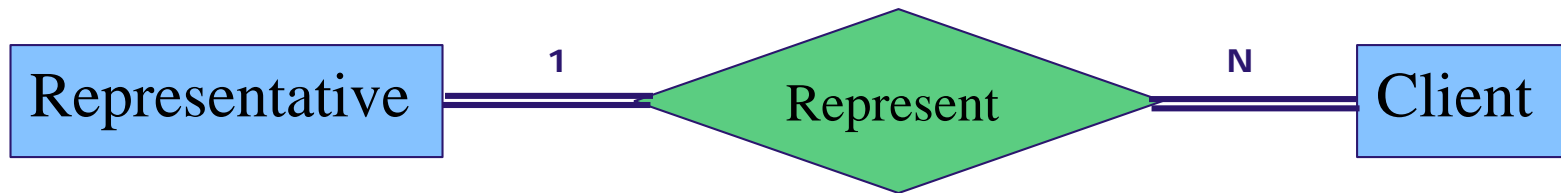
## ❖ Addition properties :

- Motivated
- Minimal
- At the conceptual level
- Powerful

# 1. ER model weaknesses

- ❖ **ER model = Entities + Relationships + Attributes**
  - Combined in certain ways, not freely
- ❖ **Relation constraints** : information expressed by relationships on relationships. (e.g connection traps)
- ❖ **Attribute constraints** : information expressed by relationships on attributes.
- ❖ **Lack of information** about entities and relationships.

# 1. Lack of information



## ❖ Rules :

- Every client must have a representative.
- Every representative must assist several clients.

## ❖ Not express :

- Representative must have the same number of clients.

# Contents



**1. Introduction**

**2. Relation Constraints**

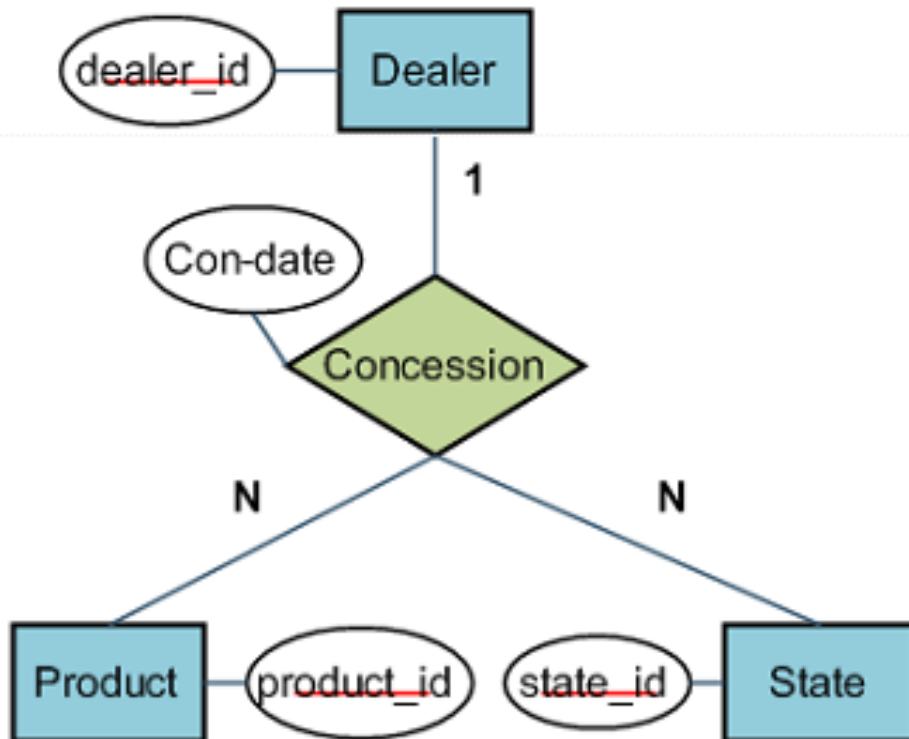
**3. Attribute Constraints**

**4. Conclusion**



## 2. Example 1

Ternary relation

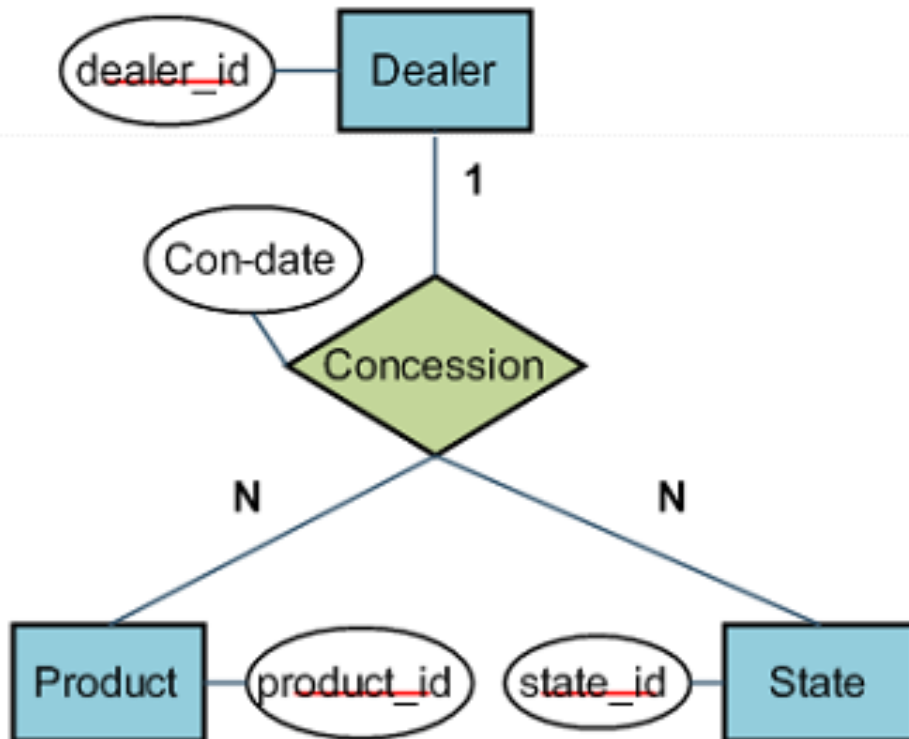


❖ **Meaning :**

- A dealer can distribute several products in several states.
- A product can be sold by many dealers, but in **each** state, **a** product must be sold by **only one** dealer.

## 2. Example 1

Ternary relation



### ❖ Mapping:

- State(Sta-id, Sta-capital)
- Product(Pro-id, Pro-type)
- Dealer(Dea-id, Dea-address)
- Concession(Pro-id, Sta-id, Dea-id, Con-date)

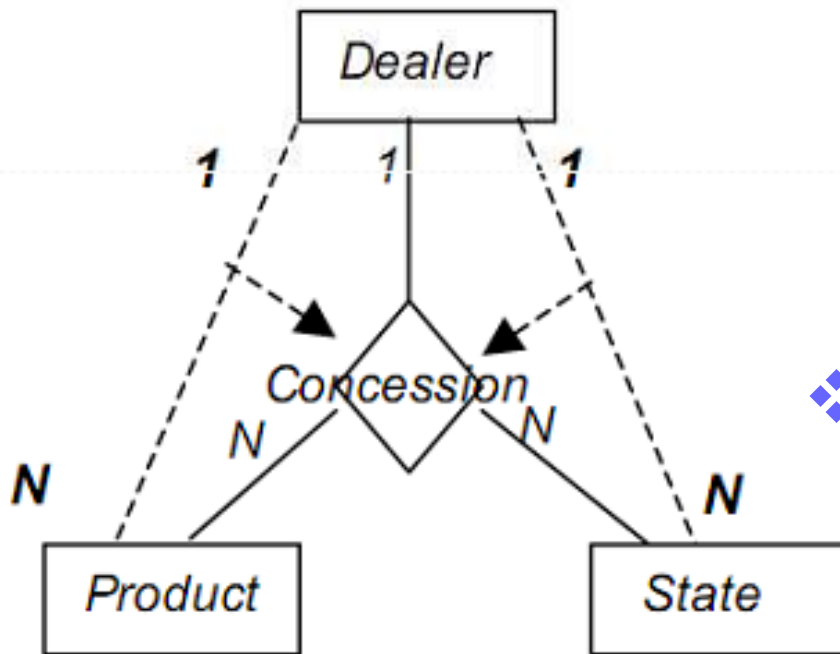
## 2. Example 1

### ❖ Add 2 new rules :

- Each product is distributed by a single dealer. (Pro-id  $\rightarrow$  Dea-id)
- Only one dealer in each state. (Sta-id  $\rightarrow$  Dea-id)

### ❖ Availabe :

- A product can still be sold in several states.
- A state can be distributed several products.



## 2. Example 1

### ❖ A valid set of instances :

- Sprite : FreeDrink (only one)
- Kansas : FreeDrink (only one)

<u>Pro-id</u>	<u>Sta-id</u>	Dea-id	Con-date
Cocacola	Idaho	Smith&Sons	1996
Cocacola	Texas	Smith&Sons	1994
Fanta	Idaho	Smith&Sons	1994
Sprite	Kansas	FreeDrink	1998
<del>Cocacola</del>	<del>Kansas</del>	<del>Smith&amp;Sons</del>	<del>2000</del>
<del>Sprite</del>	<del>Idaho</del>	<del>Smith&amp;Sons</del>	<del>2000</del>

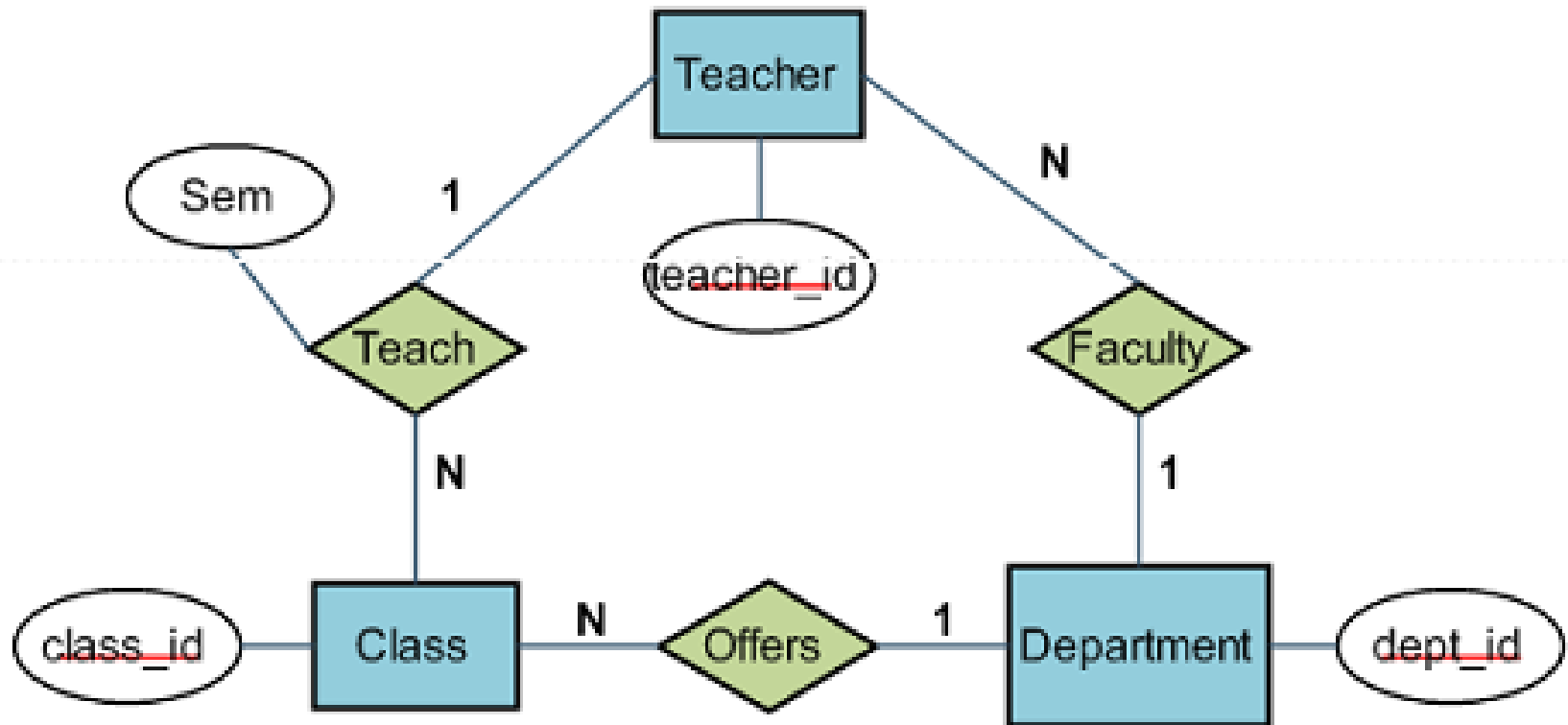
## 2. Example 1

### ❖ A solution :

```
■ CHECK (  
    (UNIQUE (SELECT Pro-id FROM  
              (SELECT DISTINCT Pro-id, Dea-id  
                FROM Concession)          )      )  
AND  
    (UNIQUE (SELECT Sta-id FROM  
              (SELECT DISTINCT Sta-id, Dea-id  
                FROM Concession)          )      )  
)
```

## 2. Example 2

### ❖ An university



## 2. Example 2

### ❖ Add a rule :

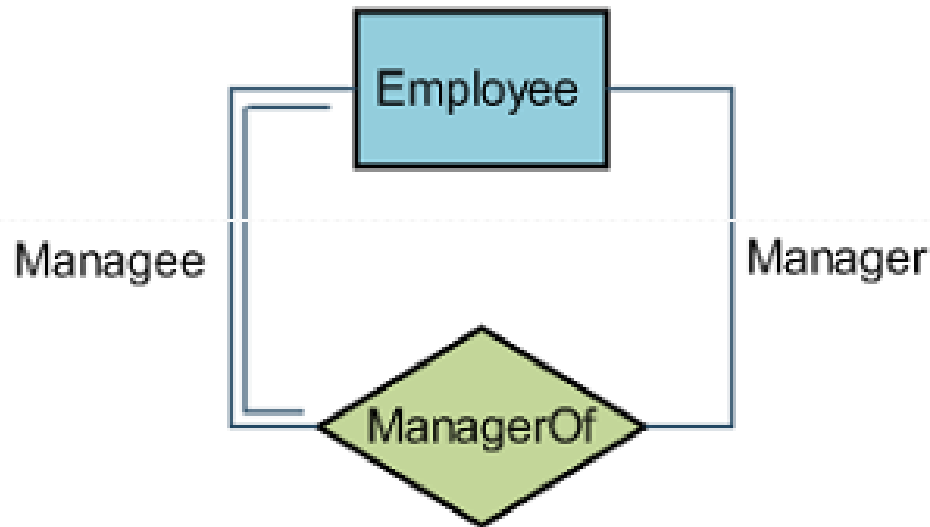
- Teachers can only teach classes offered by department in which they are faculty.

### ❖ Solution :

- NOT EXISTS (SELECT \*  
FROM Teacher T, Class C  
WHERE T.Teacher-id = C. Teacher-id  
AND T.Dept-id <> C.Dept-id )

## 2. Example 3

### ❖ Recursive relationship



### ❖ Rules :

- Not all employees are managers.
- All employees have a manager.

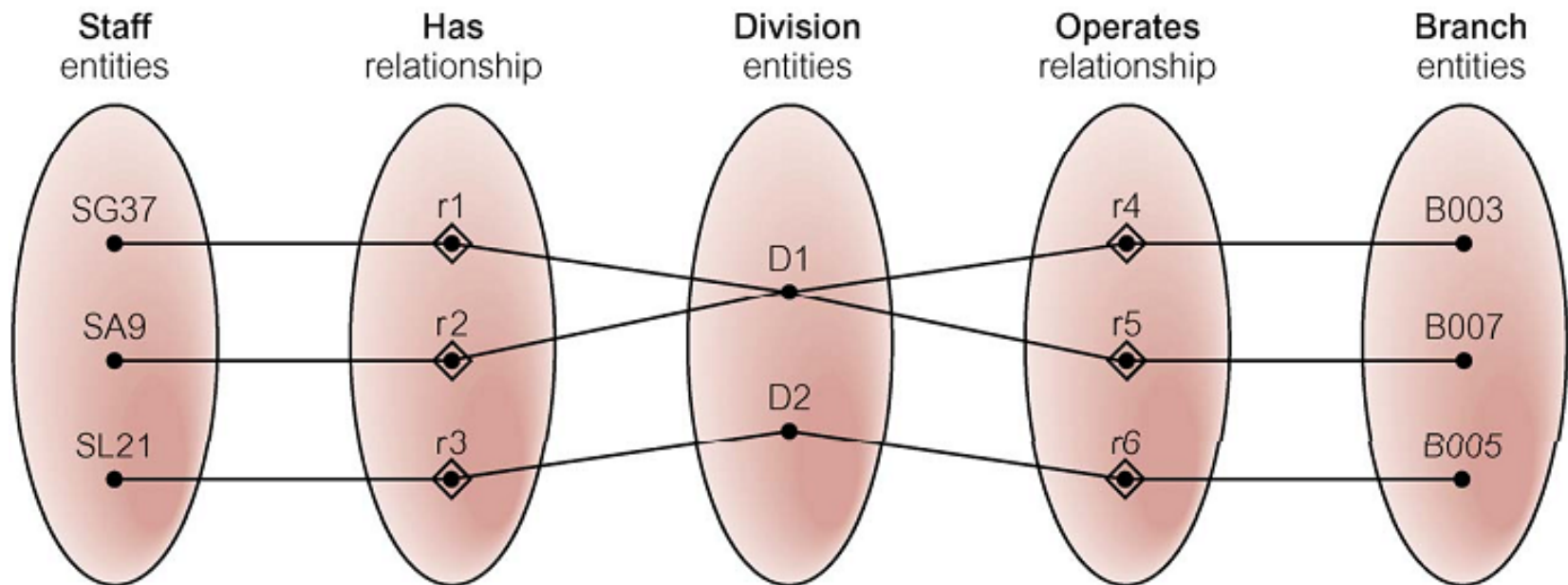


## 2. Example 3

### ❖ Not express :

- Irreflexive : no one can be his/her own manager.
  - Asymmetric : A is the manager of B, B is not the manager of A.
  - Transitive : higher-level managers.
- Combination : no cycles in Employee.

## 2. Example 4 (Fan trap)



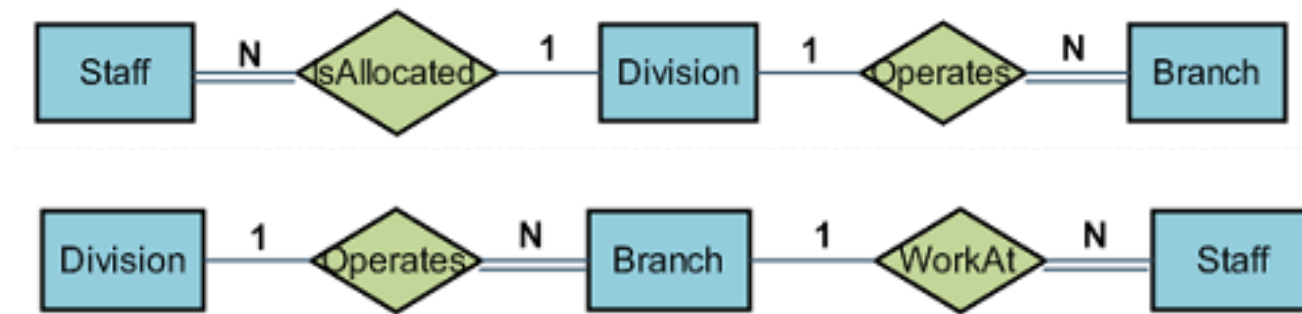
**At which branch office does staff number SG37 work?**

## 2. Example 4 (Fan trap)

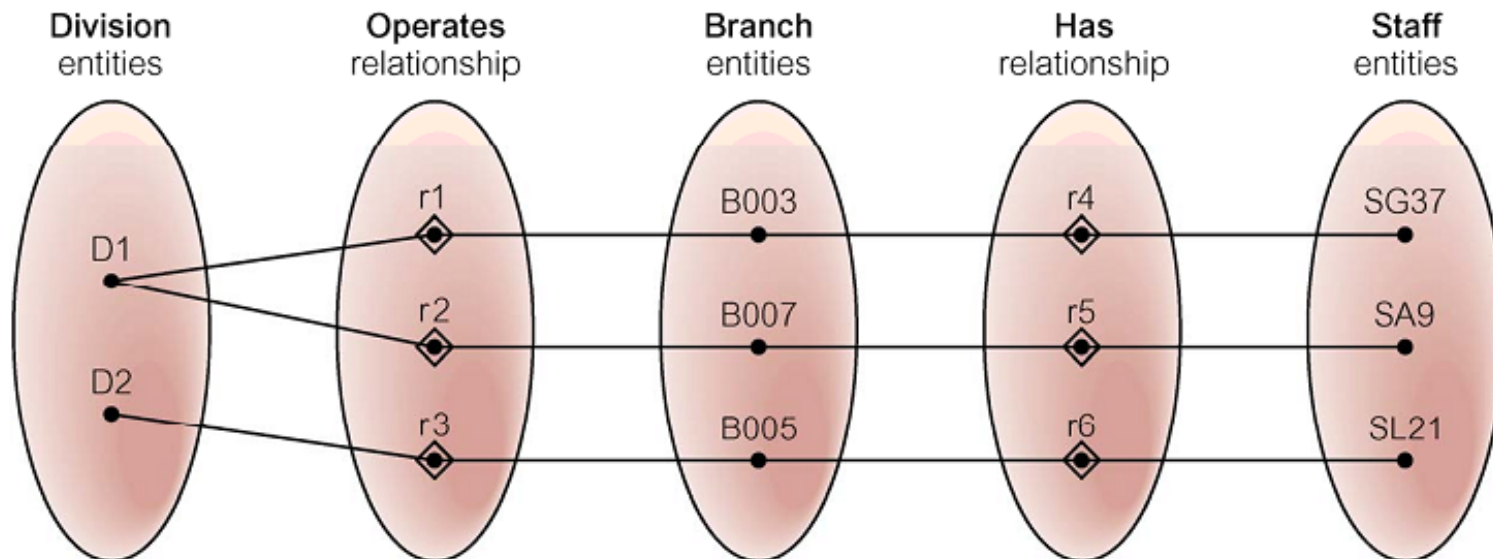
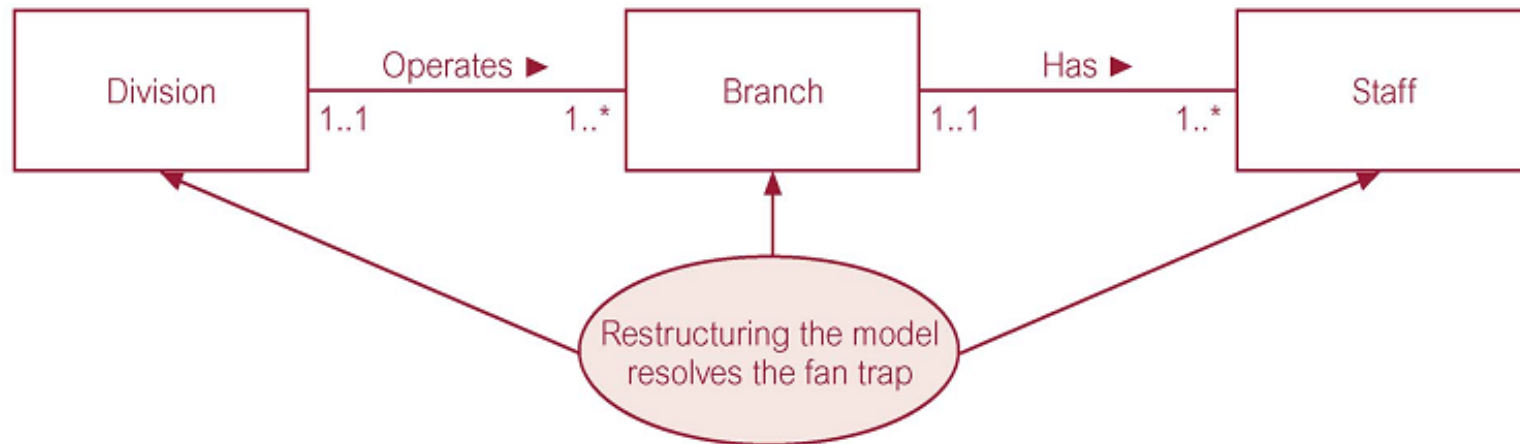
### ❖ Fan trap :

- Pathway between certain entity occurrences is ambiguous.
- Two or more 1:N relationships fan out from the same entity.

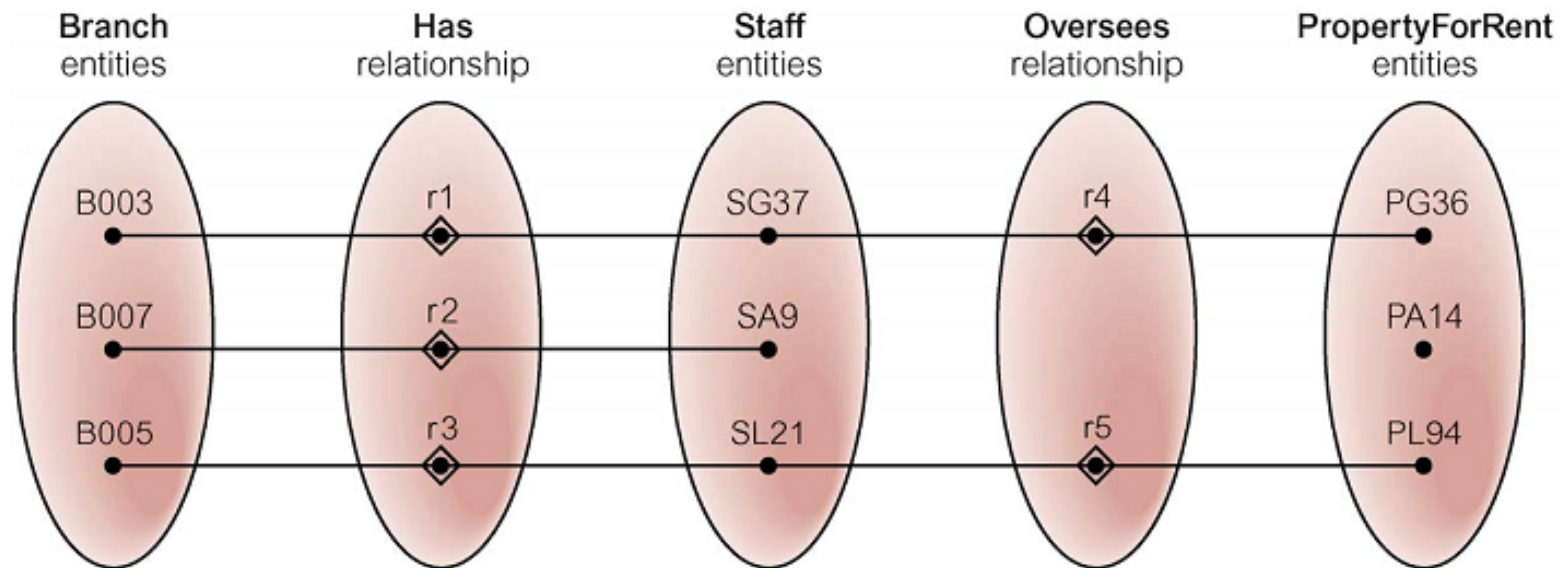
### ❖ Solution : restructuring



## 2. Example 4 (Fan trap)



## 2. Example 5 (Chasm Trap)



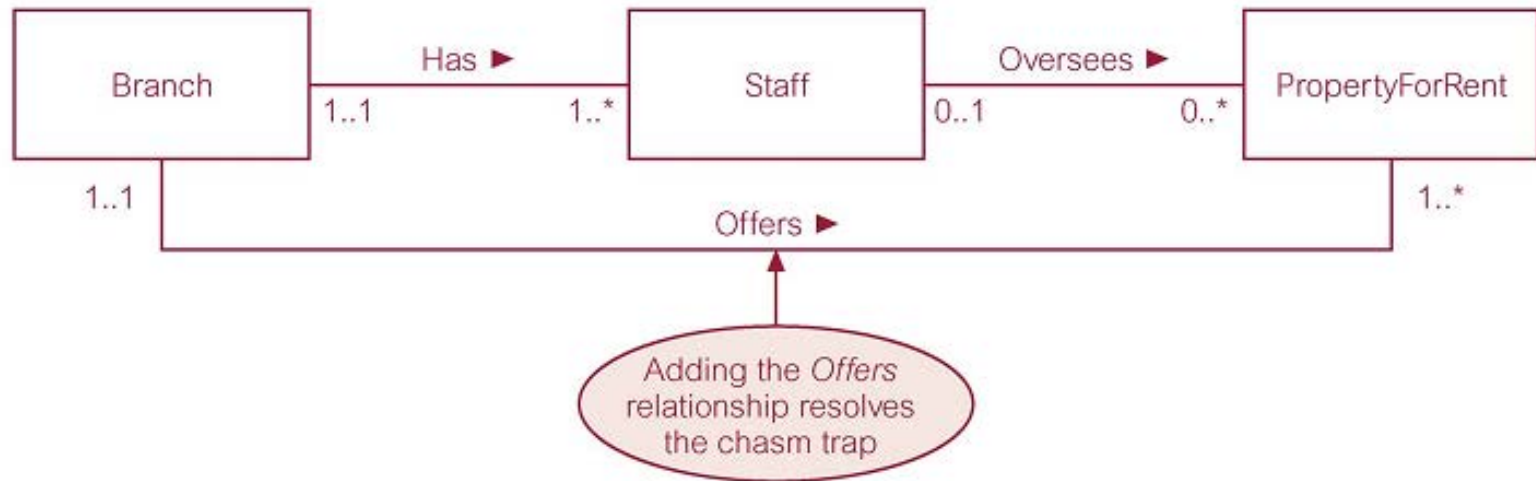
**At which branch office is property PA14 available?**

## 2. Example 5 (Chasm Trap)

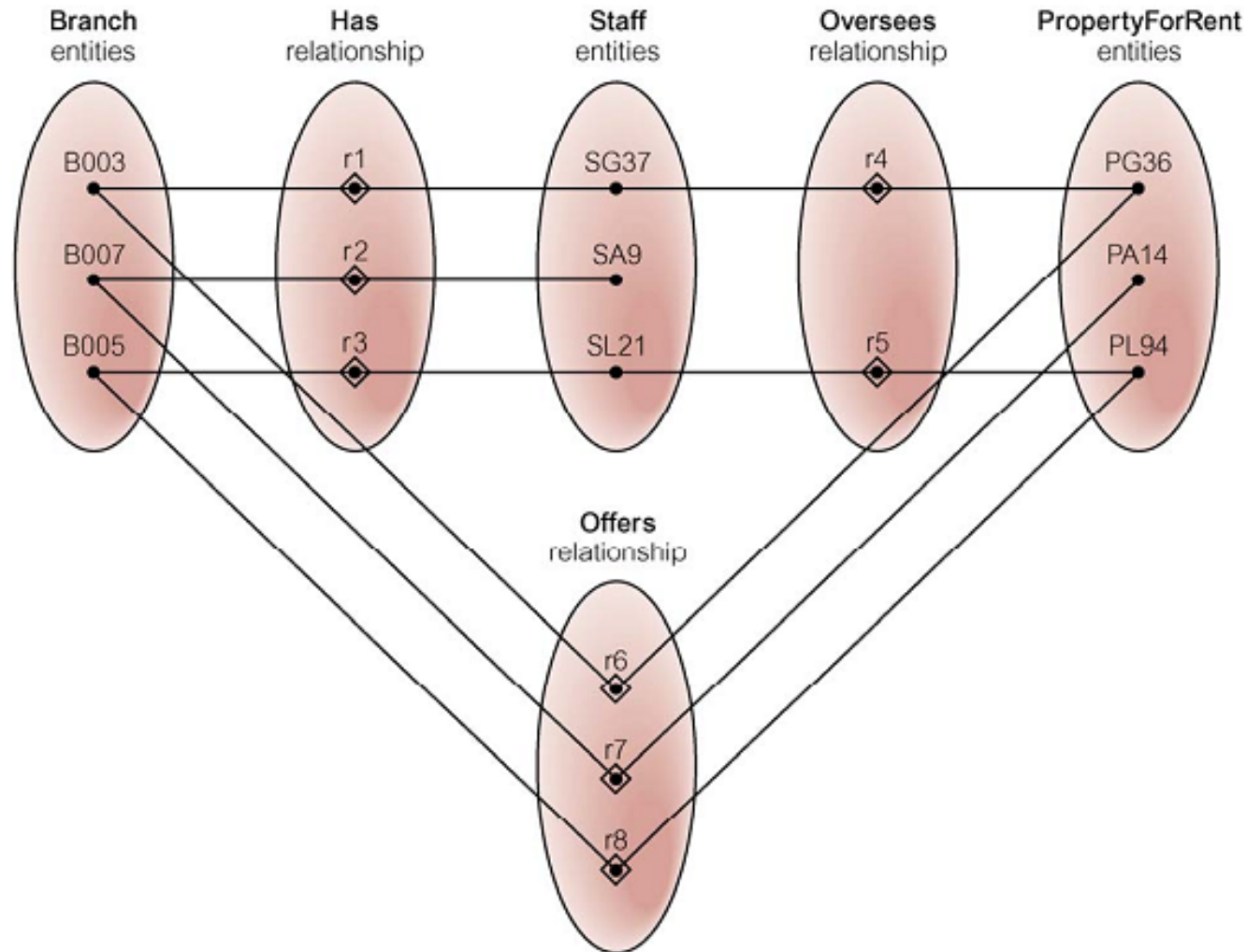
### ❖ Chasm trap :

- Pathway does not exist between certain entity occurrences.

### ❖ Solution :

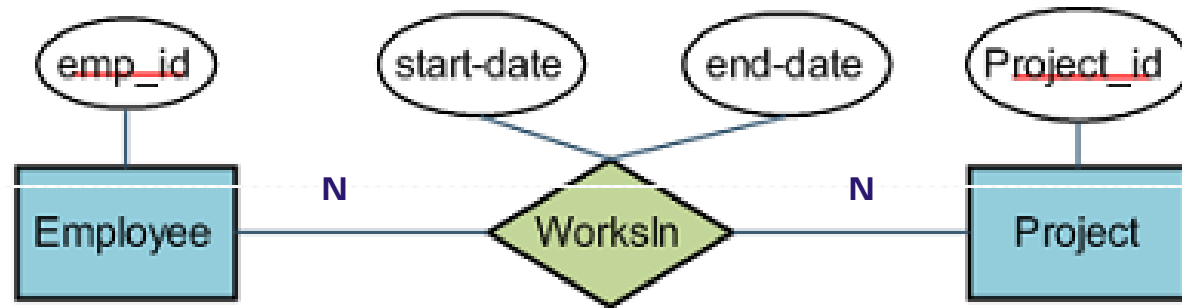


## 2. Example 5 (Chasm Trap)



## 2. Example 6

### ❖ A Company :



❖ **Rule:** an employee can't work in 2 projects at the same time.

❖ EMP-PROJ(emp-id, start-day, end-day, project\_id)

- FD: emp\_id, start-day, end-day -> project\_id



# Contents



**1. Introduction**

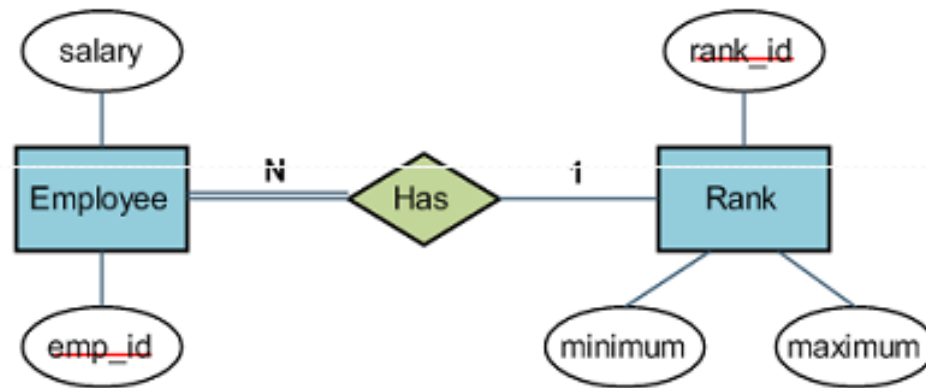
**2. Relation Constraints**

**3. Attribute Constraints**

**4. Conclusion**

### 3. Attribute Constraints

#### ❖ A Company



#### ❖ Rule : $\min \leq \text{salary} \leq \max$

#### ❖ Solution :

- NOT EXISTS (SELECT \* FROM Employee E, Rank R  
WHERE E.Rank-id = R.Rank-id  
AND (Salary < Minimum OR Salary > Maximum))

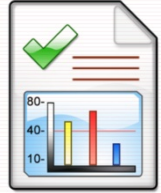
### 3. Attribute Constraints

- ❖ **Limit : inability to sharing information**
- ❖ **Heterogeneous information integration :**
  - 2 Restaurants : attribute “meal-cost”
    - Include taxes vs no taxes
    - US \$ vs VietNam Dong
  - 2 Colleges : attribute “grade”
    - “A,B,C,D,F” vs “1-10”

## 4. Conclusion

- ❖ **Semantics can't be completely captured in any conceptual model.**
- ❖ **Database design : E-R model + requirement specification document (adding checks and assertions)**
- ❖ **Balance expressiveness and complexity.**

# References



- ❖ Antonio Badia, *Entity-Relationship modeling Revisited*, SIGMOD Record, Vol.33, No.1 March 2004.



- ❖ Camps Pare, R. *From Ternary Relationships to Relational Tables: A case Against Common beliefs*, SIGMOD record, v.31, n.2 June 2002.





Thank You !  
Q&A