

# Medical Informatics

## Lecture 3: The Entity-Relationship Model

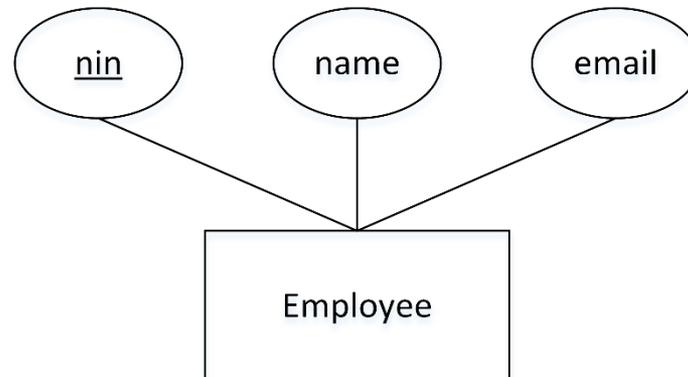
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Nanjing Medical University

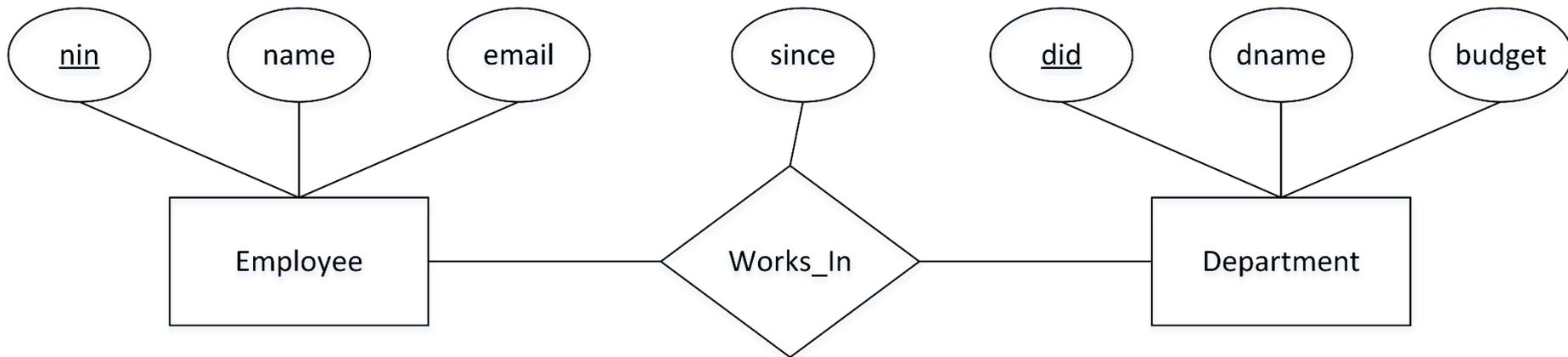
# In the previous lecture

- Entity Relationship model: conceptual database design
- Entities and attributes



# In the previous lecture

- Entity Relationship model: conceptual database design
- Entities and attributes
- Relationships and their attributes

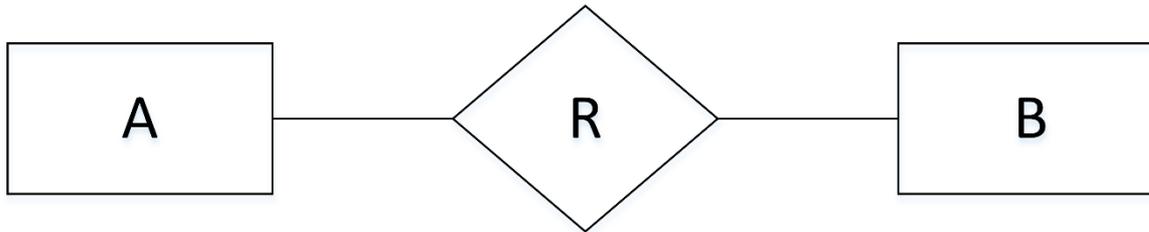


# In this lecture

- Refining the ER model
- Constraints:
  - key constraints
  - participation constraints
- Weak entity sets
- Entity hierarchies

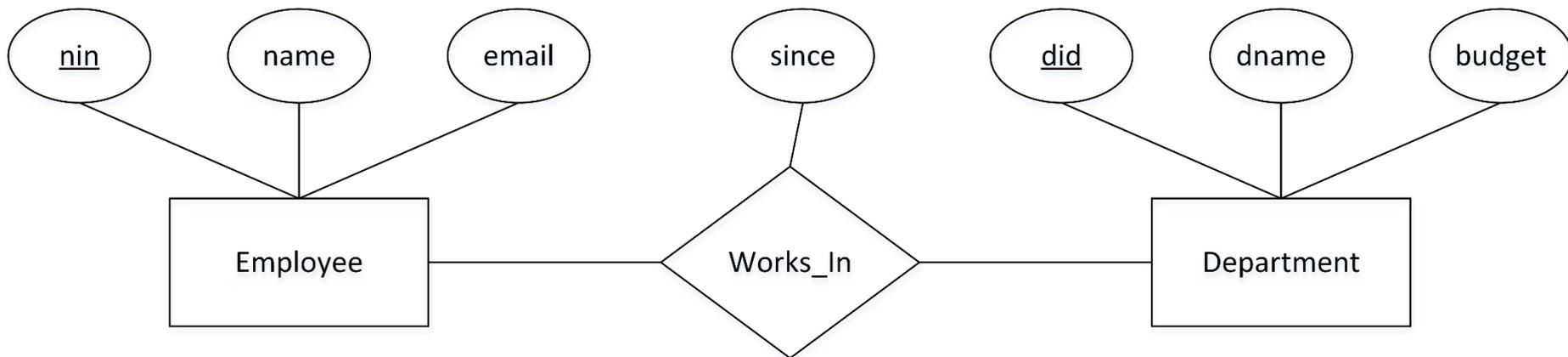
# Key constraints

- A binary relationship set  $R$  between entity sets  $A$  and  $B$  can be:
  - Many-to-many
  - Many-to-one
  - One-to-many
  - One-to-one



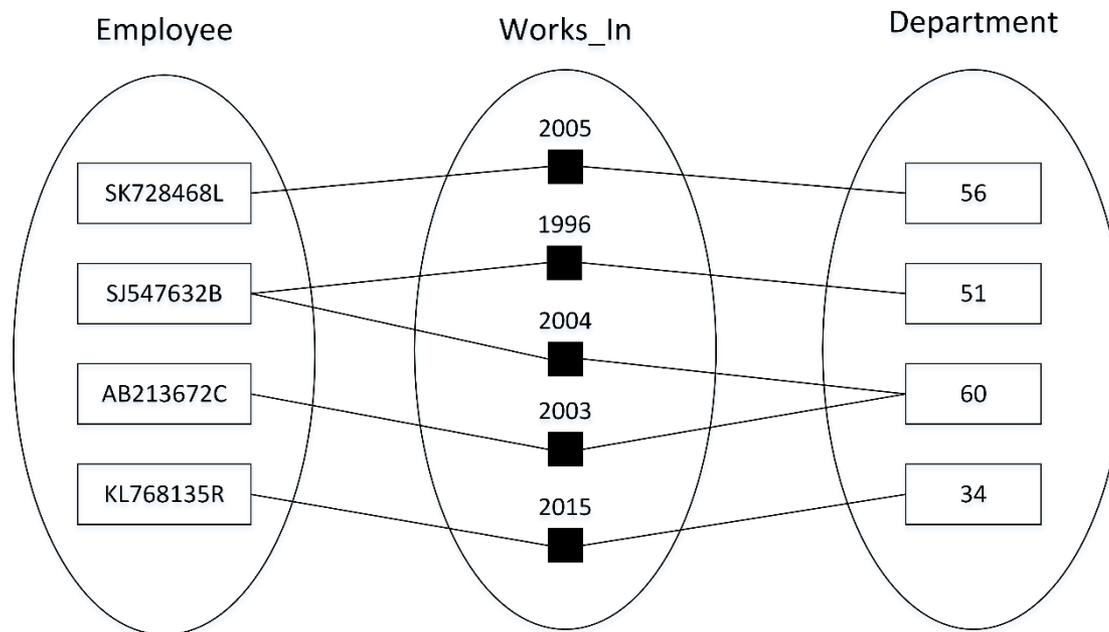
# Key constraints

- A binary relationship set  $R$  between entity sets  $A$  and  $B$  can be:
  - **Many-to-many**: Any number of  $A$  may be related to any number of  $B$ .



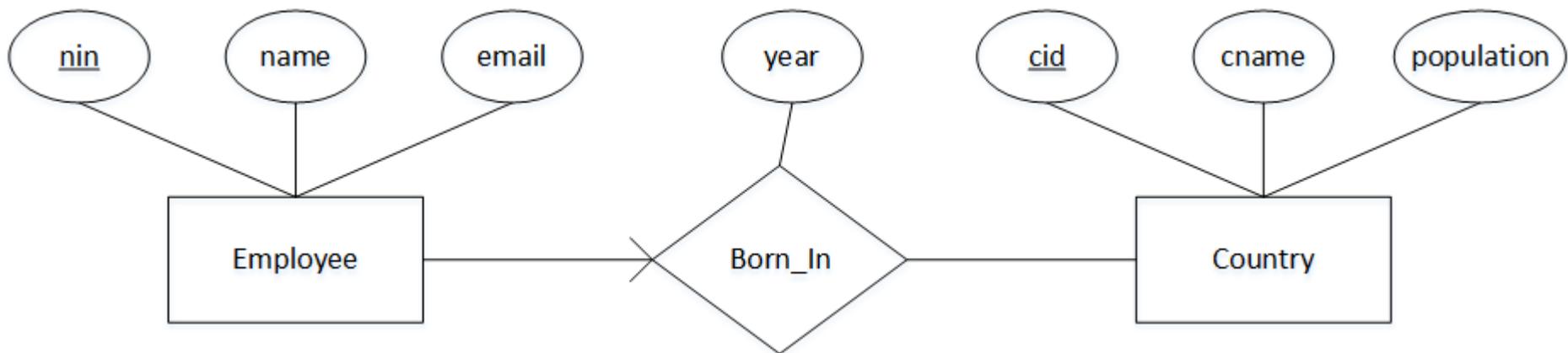
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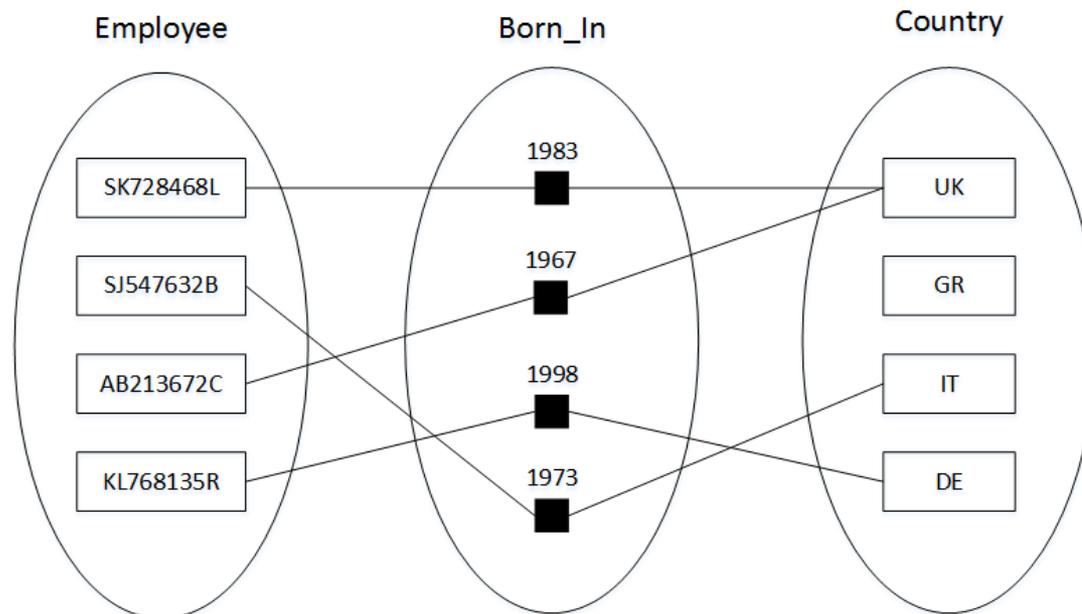
# Key constraints

- A binary relationship set  $R$  between entity sets  $A$  and  $B$  can be:
  - **Many-to-one**: Several  $A$  may relate to a single  $B$ ; but not the other way round.



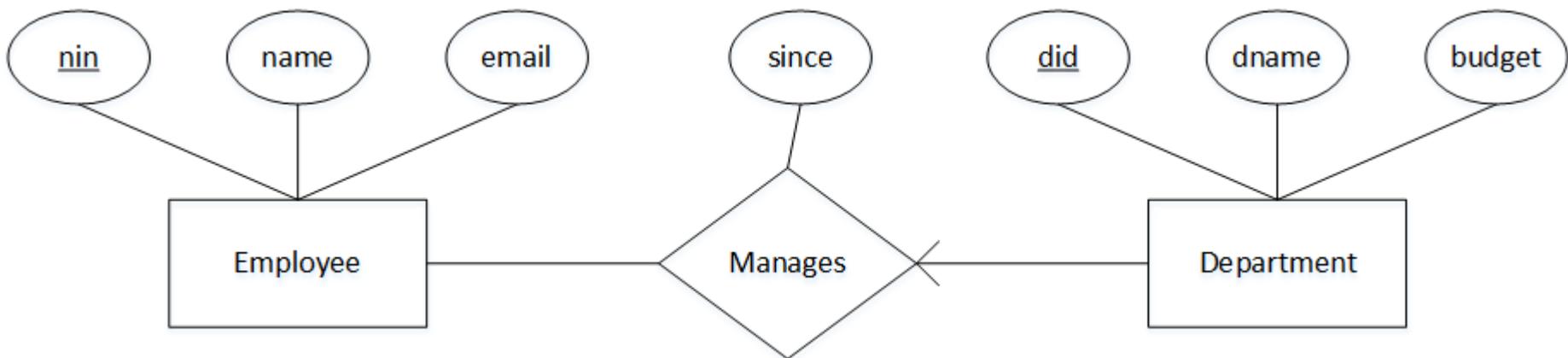
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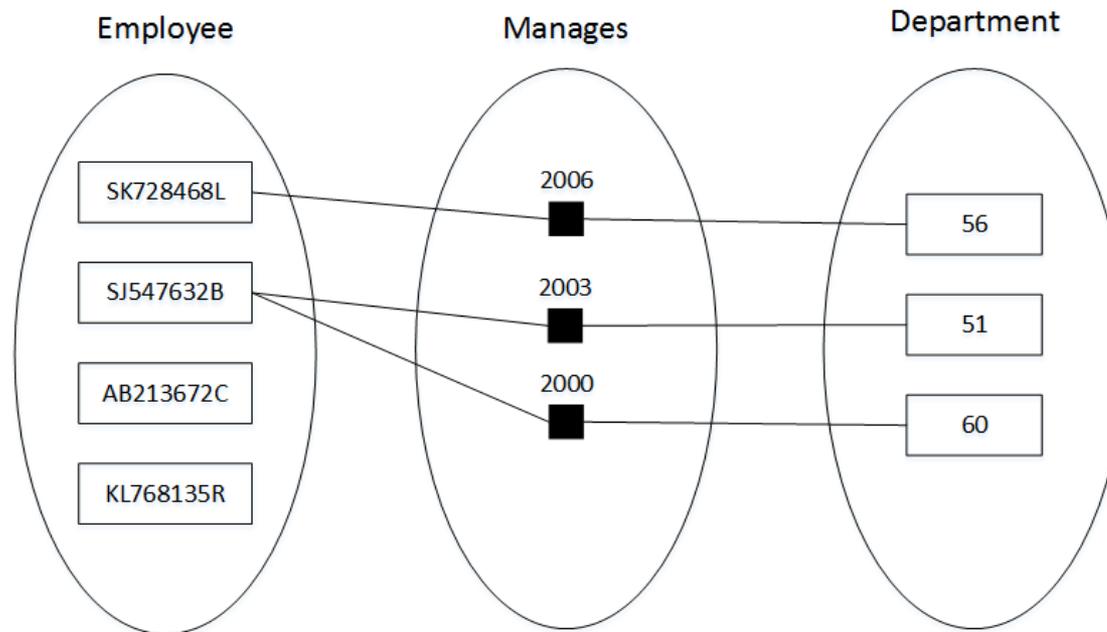
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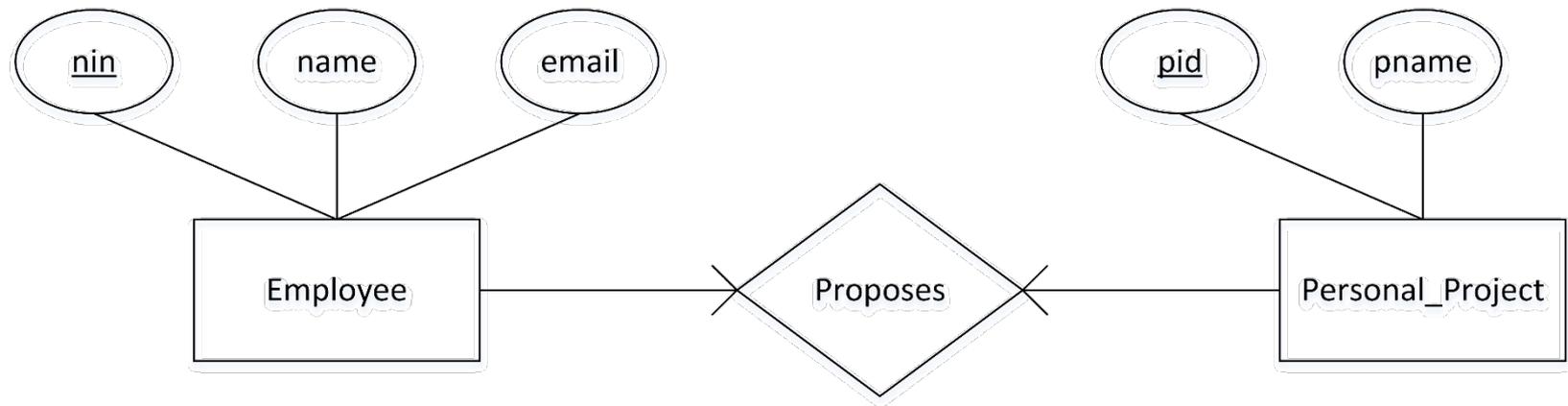
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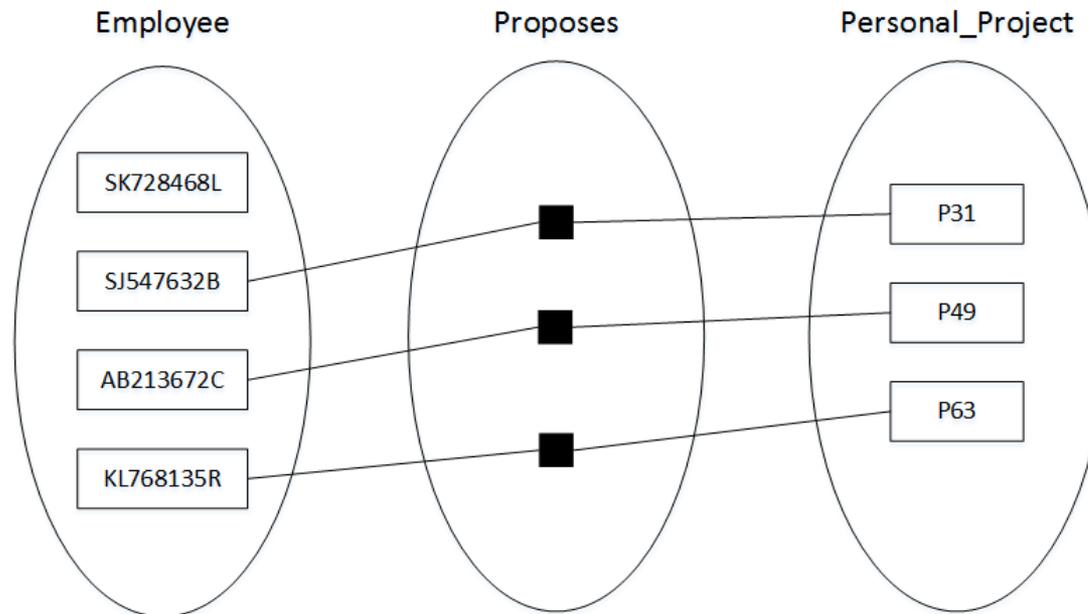
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# Key constraints

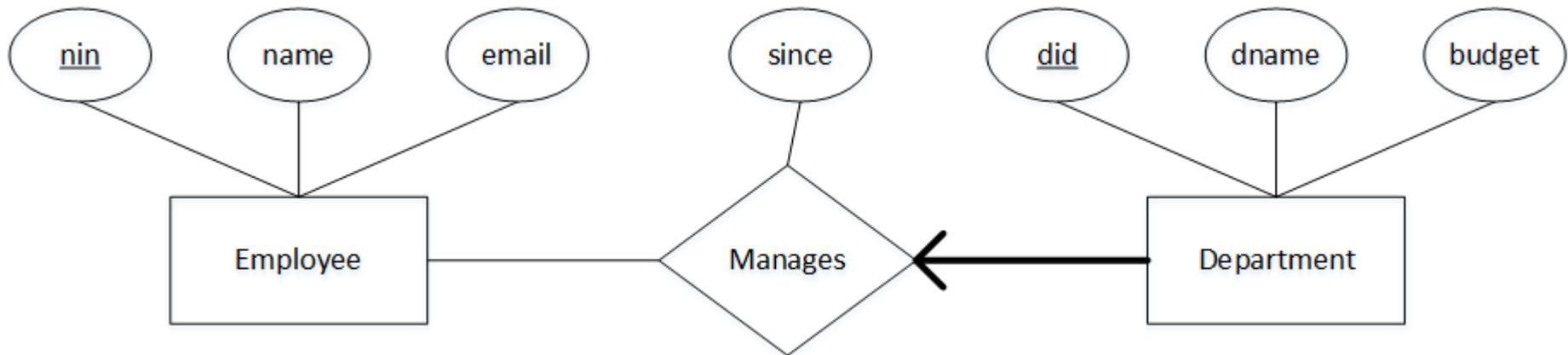
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# Participation constraints

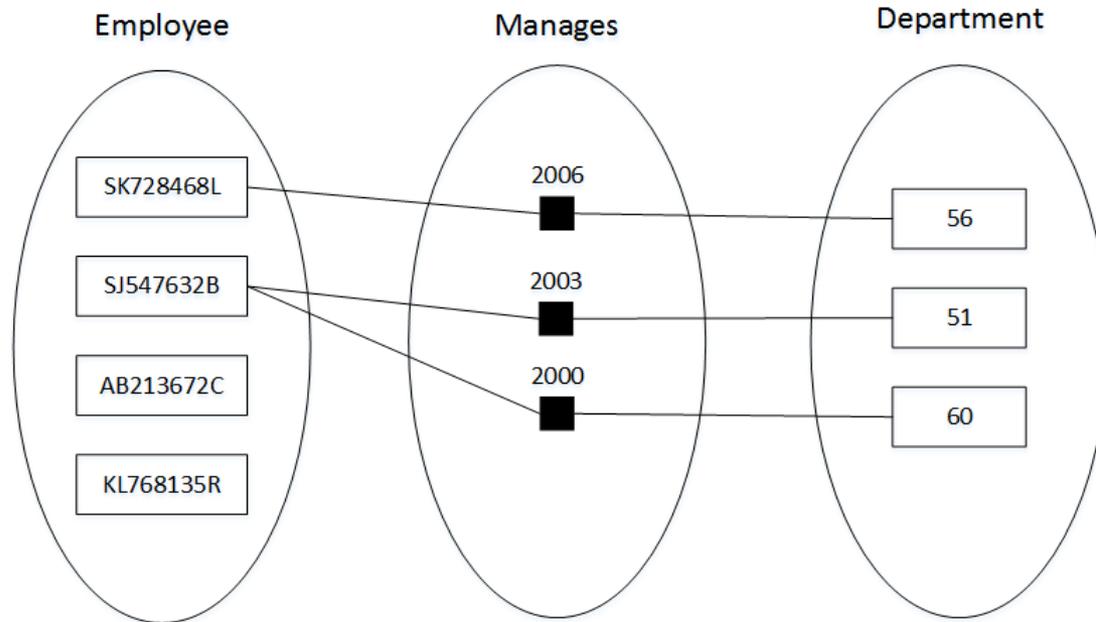
- **Total participation** of entity set E in relationship set R: every entity x in the entity set E is required to participate in at least one relationship in R
- **Partial participation** of entity set E in relationship set R: not every entity x in the entity set E is required to participate in at least one relationship in R

# Participation constraints



- Department has total participation in Manages
- Employee has partial participation in Manages

# Participation constraints



- Department has total participation in Manages
- Employee has partial participation in Manages

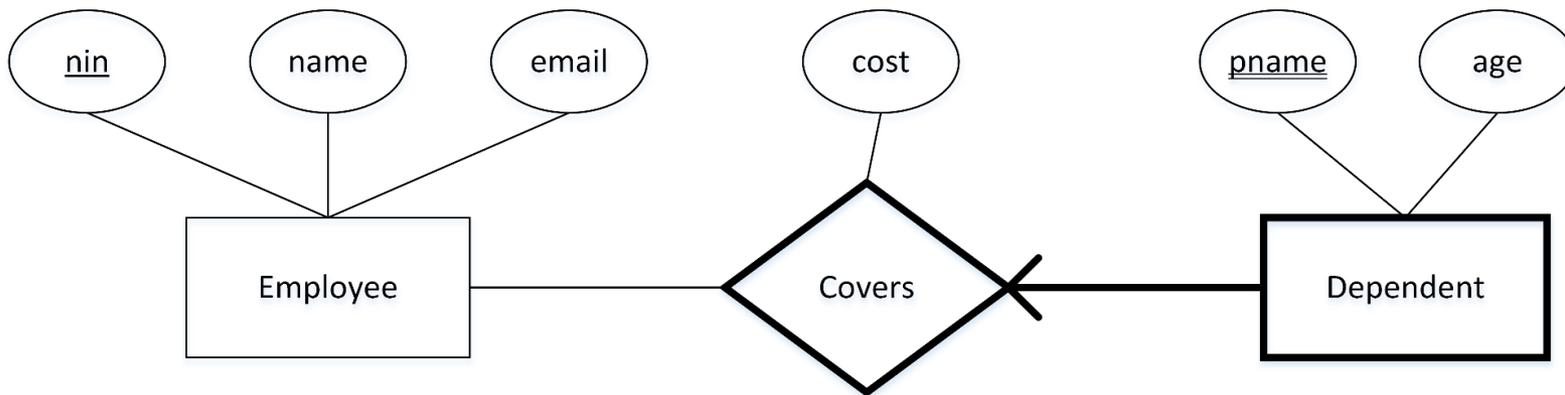
# Let's practise!

- Suppose we want to capture mothers and their children, and we're given the following draft ER diagram, which we're asked to extend.
  - Do we have any key constraints in this scenario? Where? And how do we denote them?
  - Do we have any participation constraints in this scenario? Where? And how do we denote them?



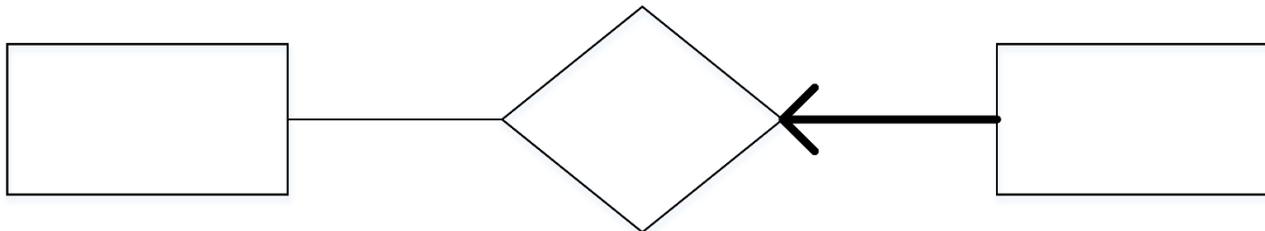
# Weak entities

- The attributes of an entity set may not be sufficient to specify a key. These entity sets are characterised as *weak*.
  - In the following example, Dependent is a weak entity set and pname is a partial key for Dependent.



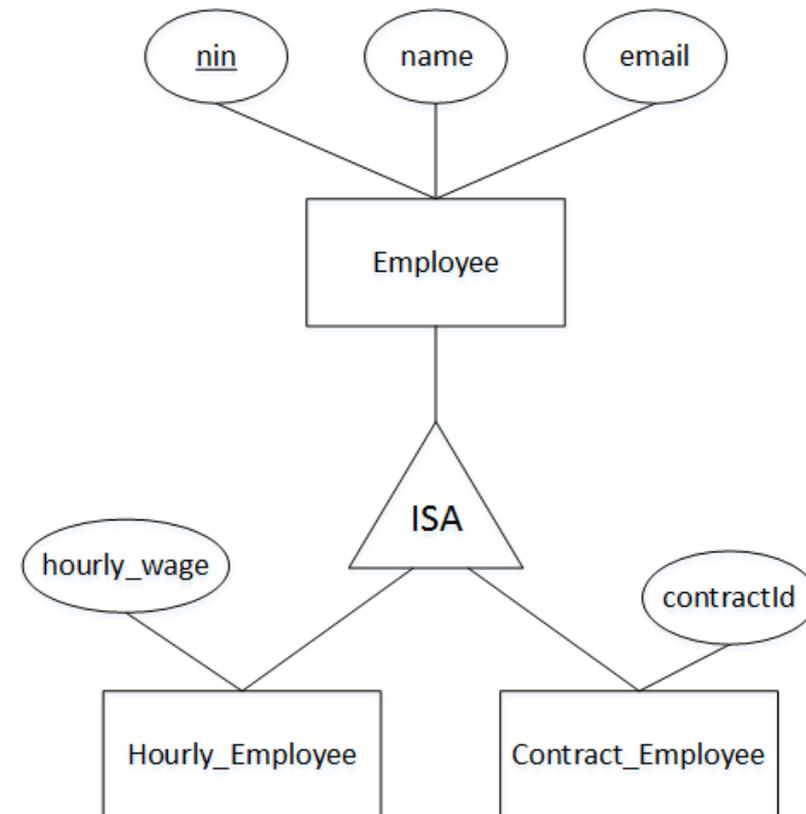
# Weak entities

- To uniquely identify a weak entity, we need to combine some of its attributes with the primary key of a related entity, which is the **identifying owner**.
  - The owner entity set and the weak entity set must participate in an one-to-many relationship set.
  - The weak entity set must have total participation in the identifying relationship.



# Hierarchies

- In some cases we may want to differentiate between **subclasses** of an entity set.
  - Employee is **specialised** into the two subclasses. Hourly\_Employee and Contract\_Employee are **generalised** by Employee.
  - Each entity in Hourly\_Employee is also an Employee, and thus **inherits** all Employee attributes.



# Conceptual design caveat

- As with any type of modelling, in most of the cases, several variations of an ER model could capture the domain of interest.
- No single correct answer. It depends!
- When designing the conceptual design of your database:
  - Are all important aspects of the domain captured?
  - Are the different elements captured correctly?
  - Entity or attribute?
  - Entity or relationship?

# Conclusions

- The ER model is used for the conceptual design of a database.
- Main constructs: entities, relationships, attributes, keys
- Additional elements: key constraints, participation constraints, weak entity sets, entity hierarchies
- Next week we'll have a look at the relational model, which is used for the logical database design.

# Acknowledgements

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