

Medical Informatics

Lecture 3: The Entity-Relationship Model

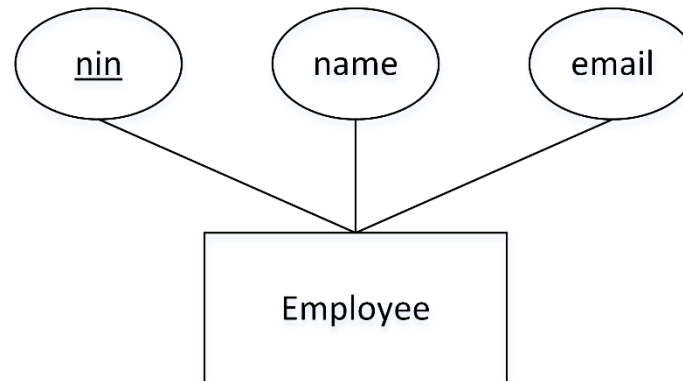
Dr Areti Manataki



Nanjing Medical University

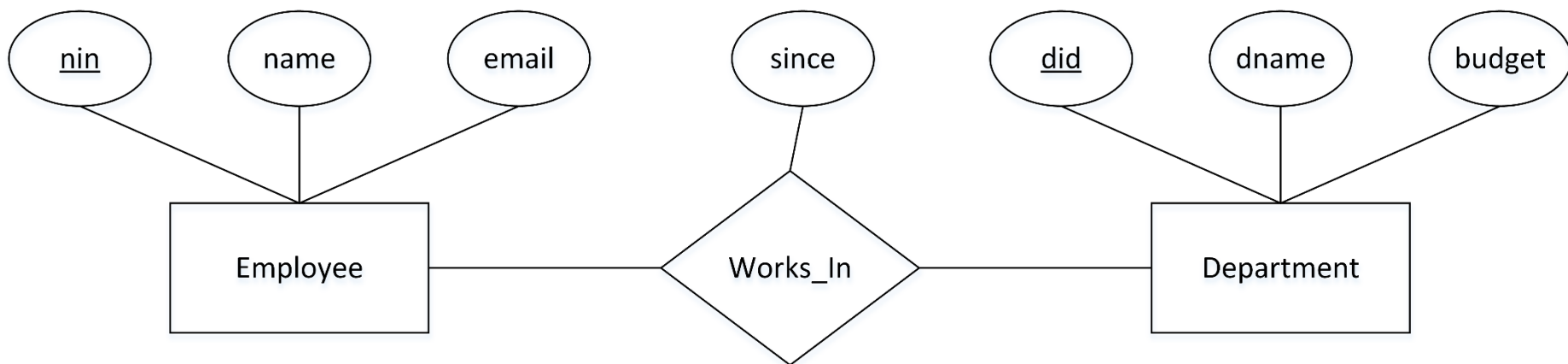
In the previous lecture

- 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

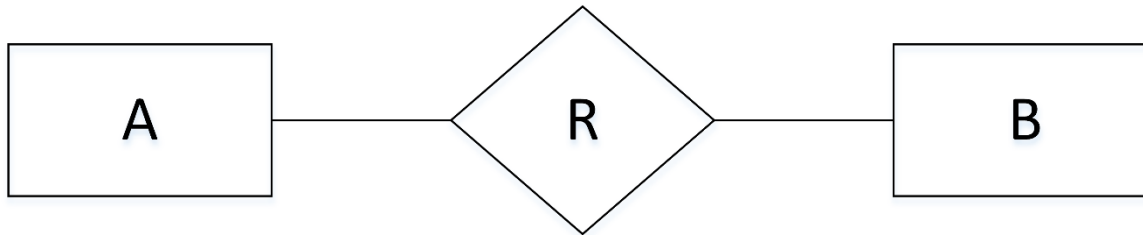


In this lecture

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

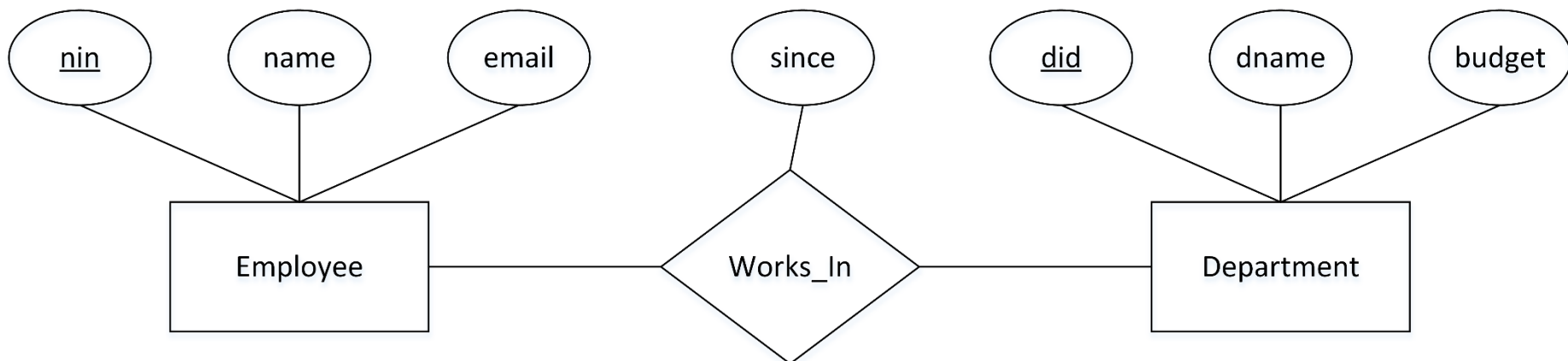
Key constraints

- 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



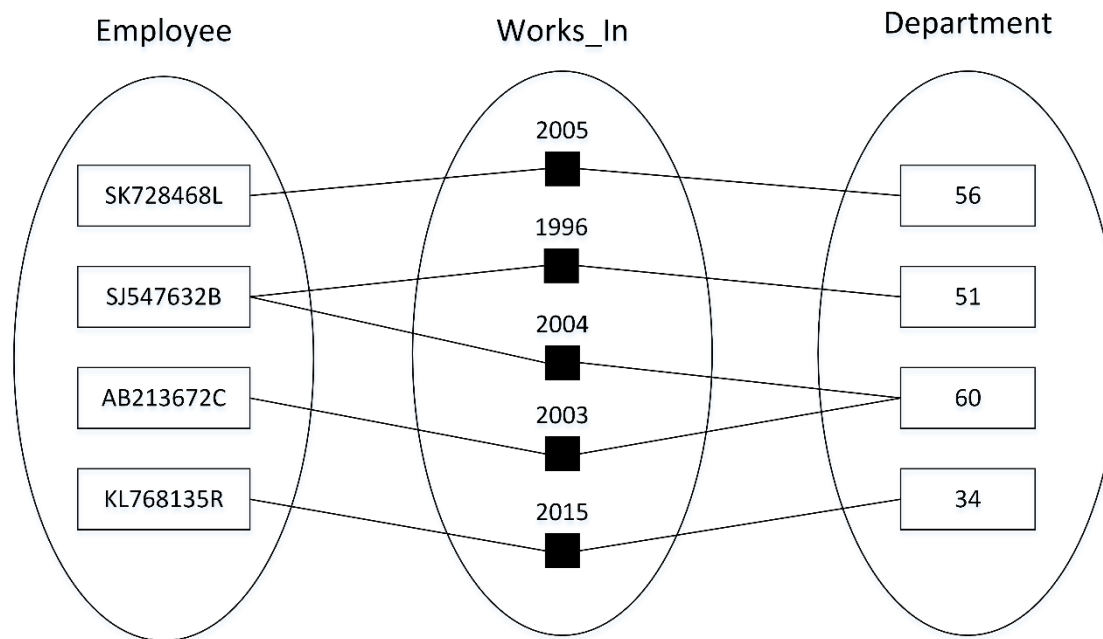
Key constraints

- 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 .



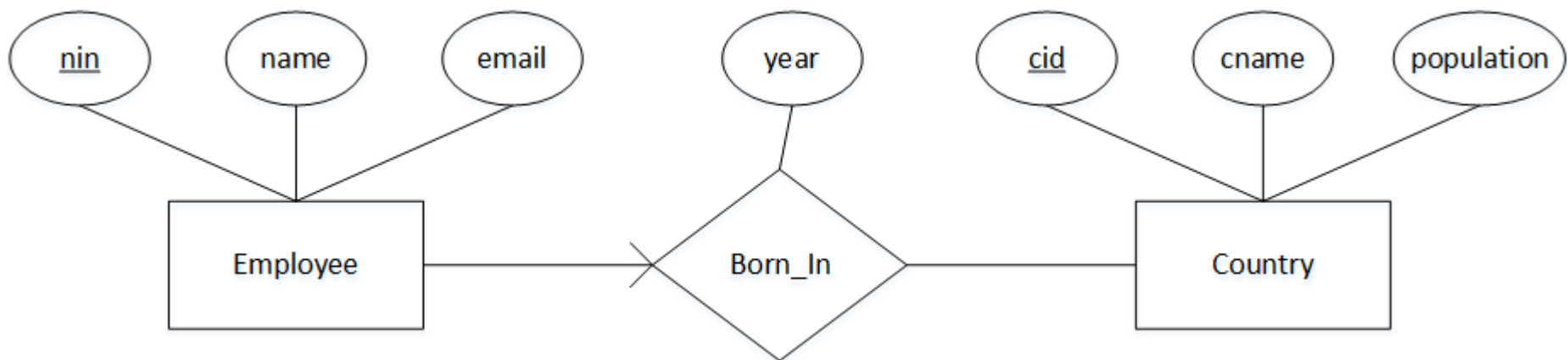
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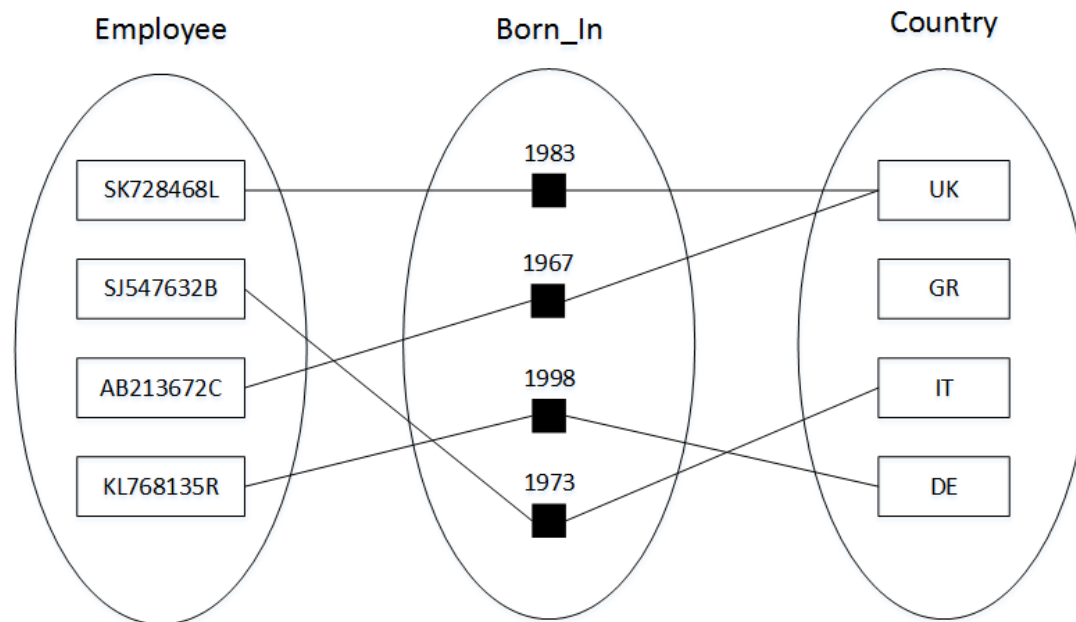
Key constraints

- 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.



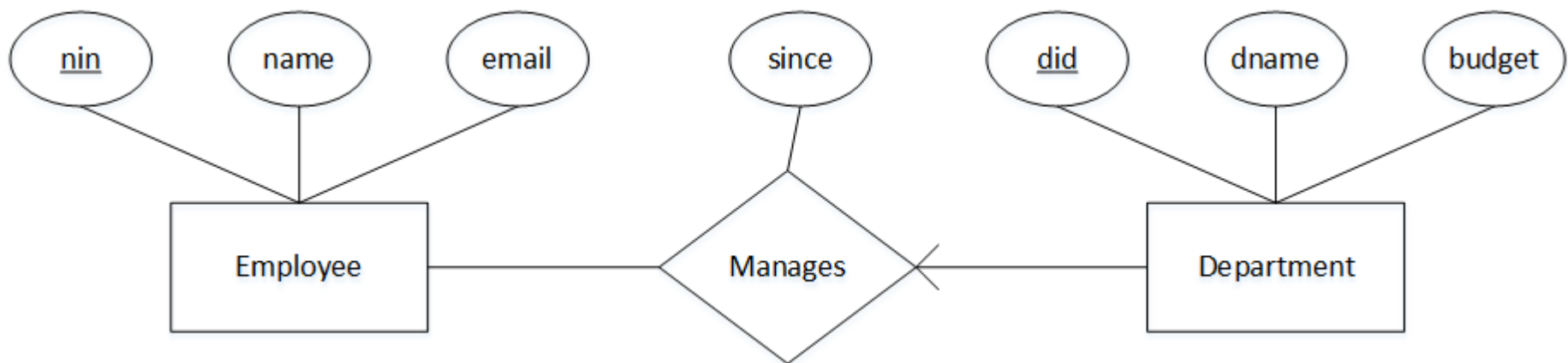
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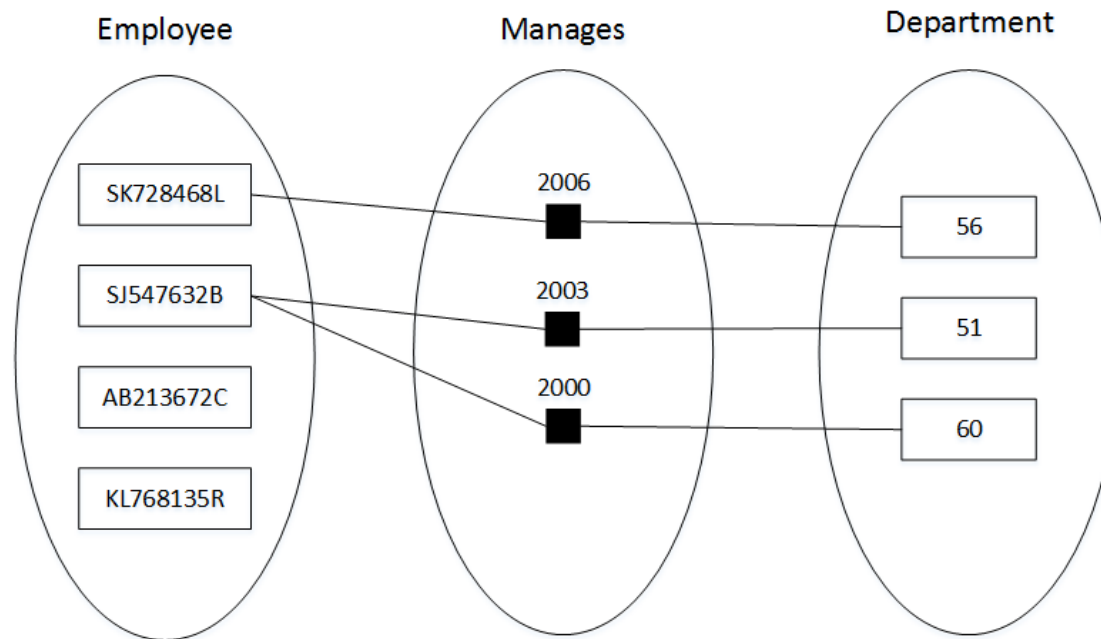
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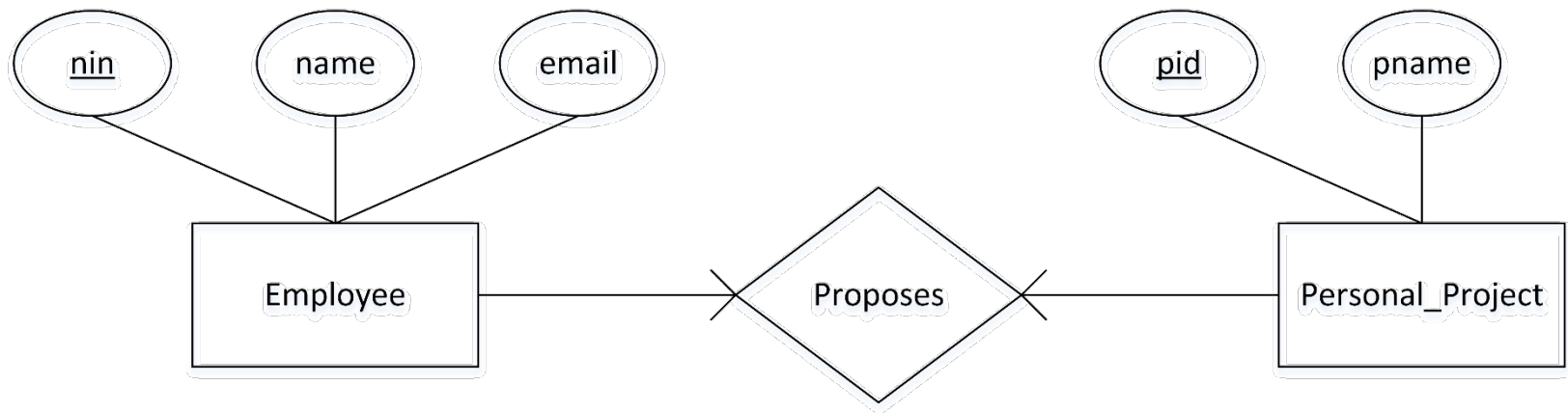
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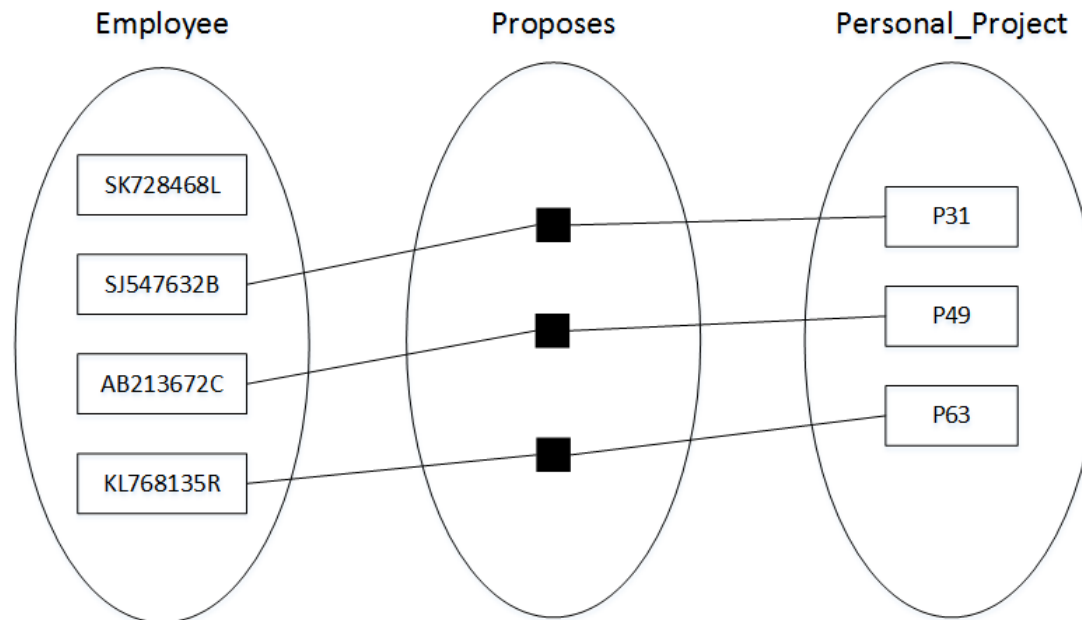
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Key constraints

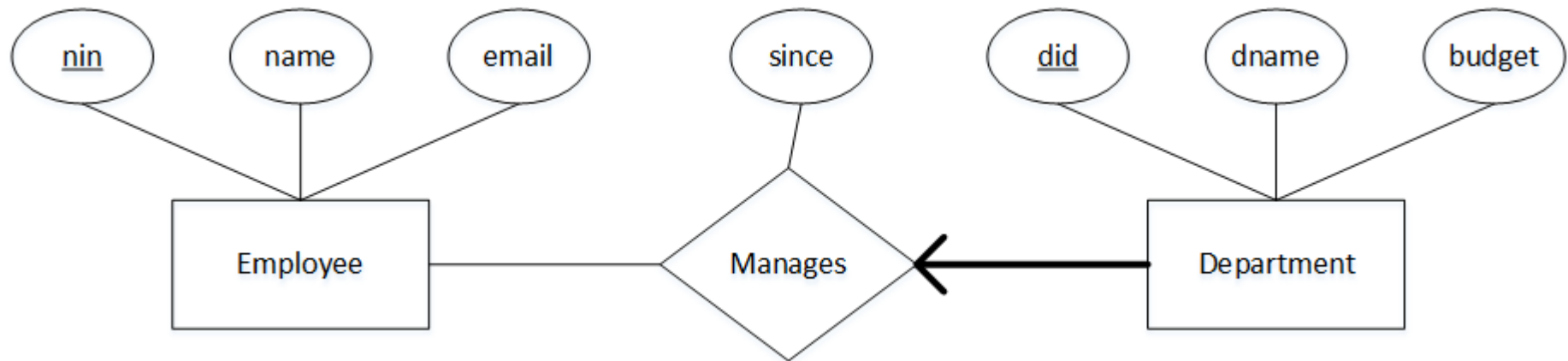
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Participation constraints

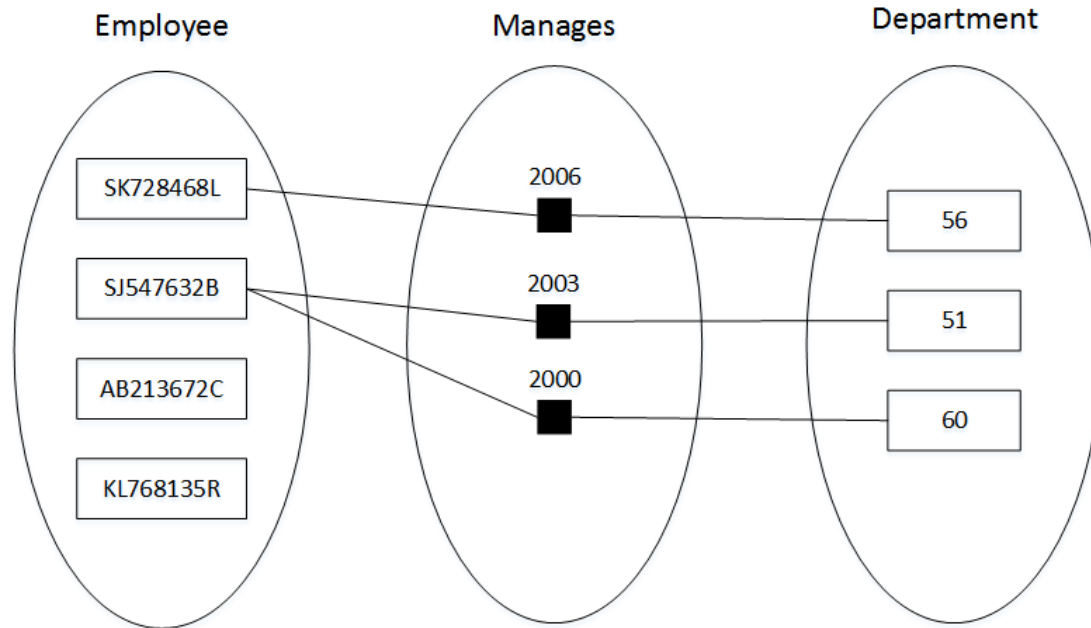
- **Total participation** of entity set E in relationship set R: every entity x in the entity set E is required to participate in at least one relationship in R
- **Partial participation** of entity set E in relationship set R: not every entity x in the entity set E is required to participate in at least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

Participation constraints



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

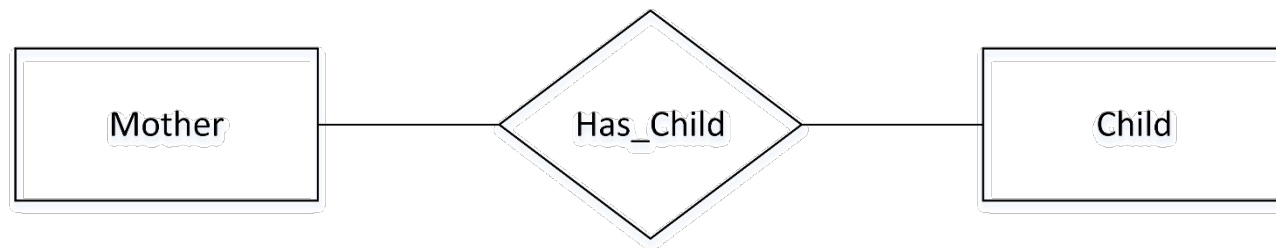
Participation constraints



- Department has total participation in Manages
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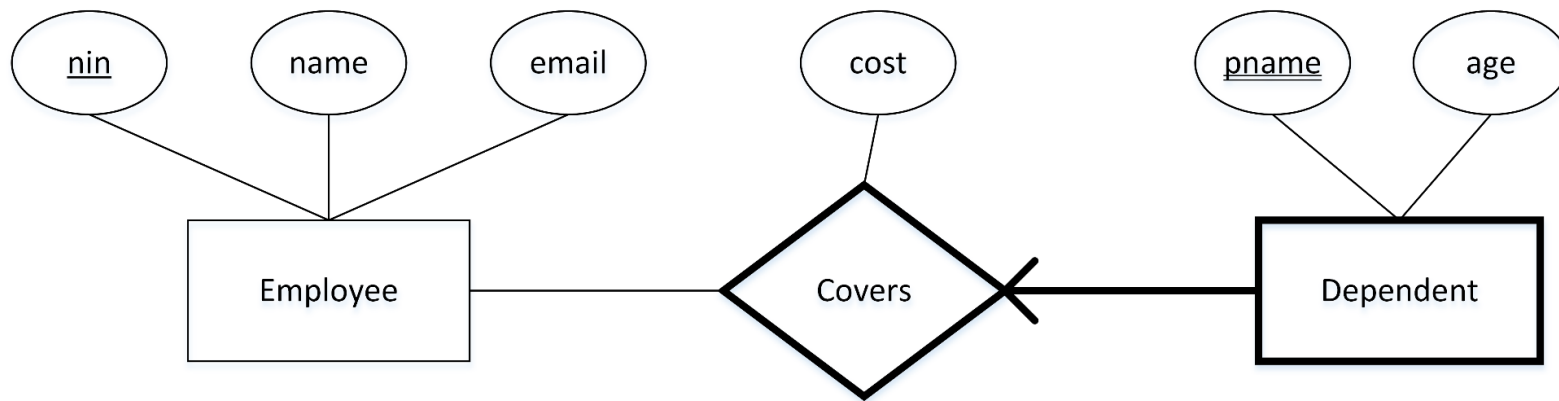
Let's practise!

- 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?



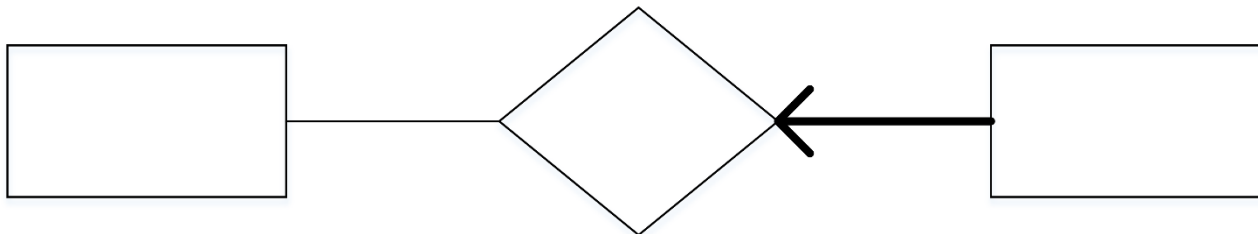
Weak entities

- 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.



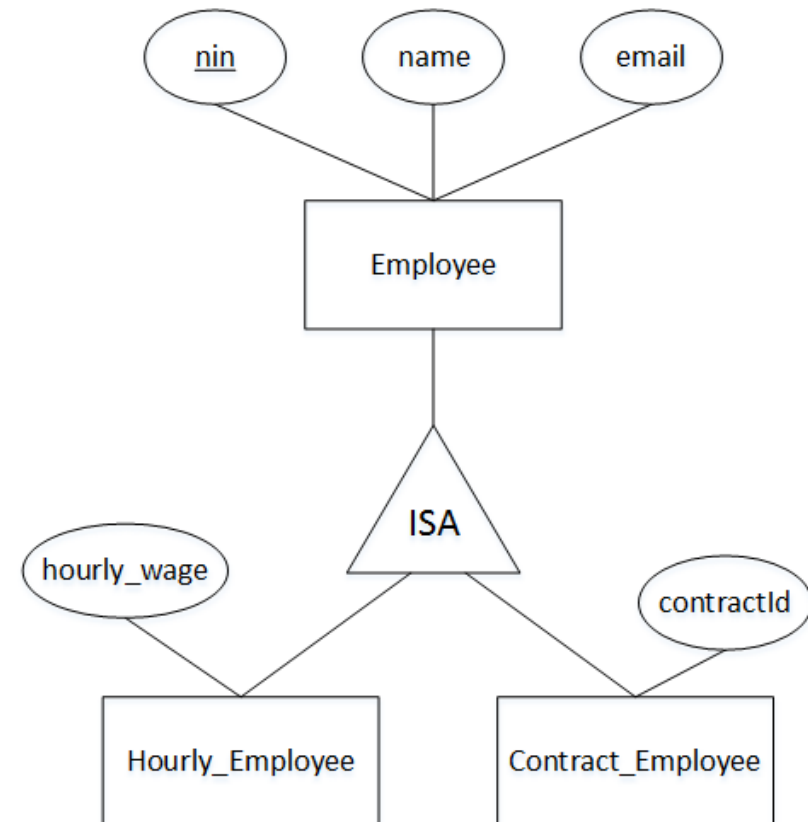
Weak entities

- 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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