

L15: ER Diagrams

CS1106/CS6503: Intro to Relational Databases

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Summary

The database design process and the role of ER modelling in same. Basic constituents of ER diagrams: entities, relationships and attributes.

- While designing database it's handy to have notation to “sketch” schemas
- Two common diagrammatic notations:
 - UML diagrams (Universal Modelling Language)
 - ER diagrams (Entity Relationship) → cs1106 choice
- Captures the information requirements of our database: what data it contains and how these interrelate

Database development process

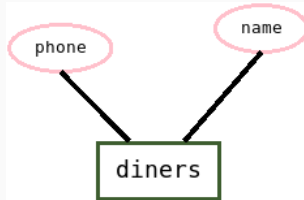
1. Requirements analysis: figure out what is required of our database
2. Design:
 - Develop an ER diagram to sketch a design that meets these requirements
 - “Translate” ER diagram into detailed DB schema
3. Implementation: Generate SQL code for design

ER Basics

- An *entity* is a “thing” e.g. a person
- An *entity set* is a collection of similar entities e.g. a collection of persons
- An *attribute* is some property of the entities in an entity set e.g. the date of birth of each person

Entities in ER diagrams

- Will represent entity sets using rectangles, attributes as ovals

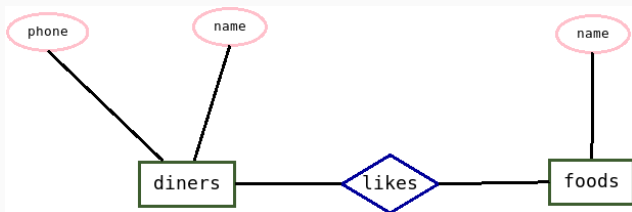


- Entity set eaters has attributes name and address; each entity with this set has a value for each attribute

- Relationship captures a connection between two or more entity sets
- Example:
 - Entity sets: students, modules
 - Relationships:
 - is_taking: Alice is taking cs1106
 - loves: Bob loves cs1117

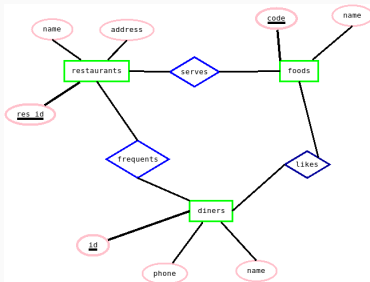
Relationships in ER diagrams

- We use diamonds to depict relationships



- Connect diamond to entity sets involved in relationship

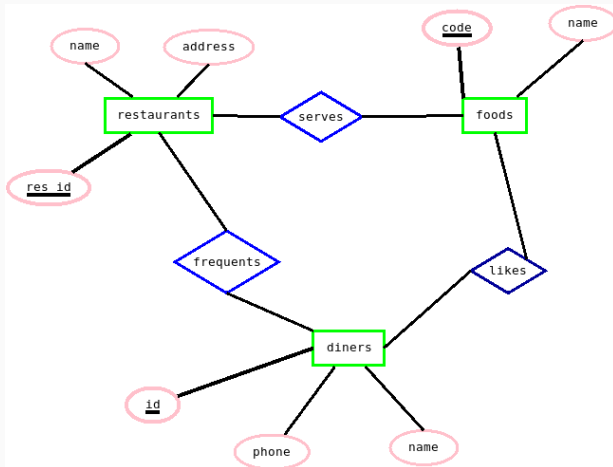
A more complex example



Key:

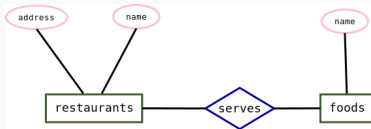
- Restaurants serve some foods
- Eaters like some foods
- Eaters frequent some restaurants

A more complex example cont'd



Relationship sets

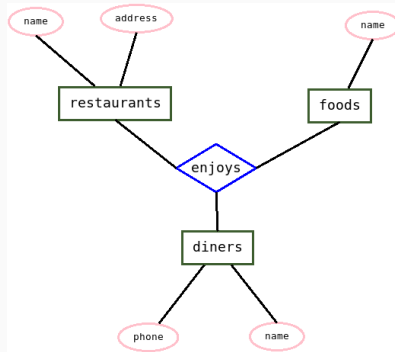
- The “value” of an entity set is the set of entities that currently belong to it e.g. the set of eaters in our database
- The “value” of a relationship is a *relationship set*, the set of tuples with one component for each related entity set
- Example (serves relationship)



Restaurant	Food
Luigi's	Spaghetti
Luigi's	Lasagne
Luigi's	Pizza
Gunther's	Bratwurst
Gunther's	Sauerkraut
Pierre's	Beans on Toast
Pierre's	Pizza

Binary and multiway relationships

- Relationships such as likes, frequents, serves are all *binary* i.e. involve two entity sets
- We sometimes need relationships involving three or more entity sets



Relationship sets cont'd

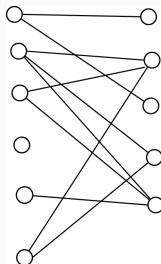
Restaurant	Eater	Food
Luigi's	Alice	Spaghetti
Pierre's	Alice	Beans on Toast
Luigi's	Bob	Spaghetti
Gunther's	Bob	Bratwurst
Pierre's	Clare	Pizza

Types of Relationships

Many-many relationships

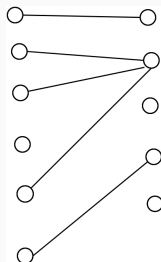
- Consider likes relationships between students and modules
- In many-many relationship each entity in either entity set can be connected with many entities from the other entity set
- Example (takes relationship):

- Each student may take *many* modules
- Each module may be taken by *many* students



Many-one relationships

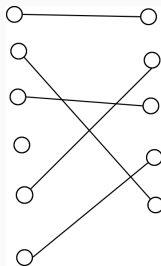
- In a many-one relationship each entity from the first set is connected to at most one entity in the second set
- Note that each entity in the second entity set can be connected to many entities in the first
- Example:
 - Imagine a teaches relationship between academics and modules ^a
 - Each module can have (at most) one lecturer.
 - Each academic may teach a number (*many*) of modules.



^aAssumes single-lecturer modules.

One-one relationships

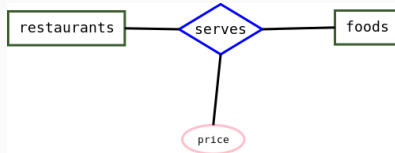
- In a one-one relationship each entity in either set is connected to at most one entity in the other entity set
- Example:
 - Imagine `is_head` relationship between academics and schools.
 - Each school has (at most) one head.
 - Each academic can be head of at most one school.



Preview of Company ER Example

Relationships with attributes

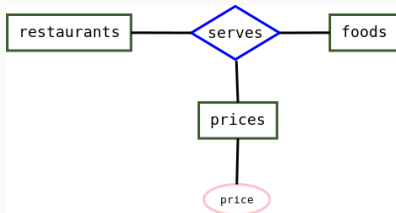
- It can be useful to associate attributes with relationships instead of entity sets



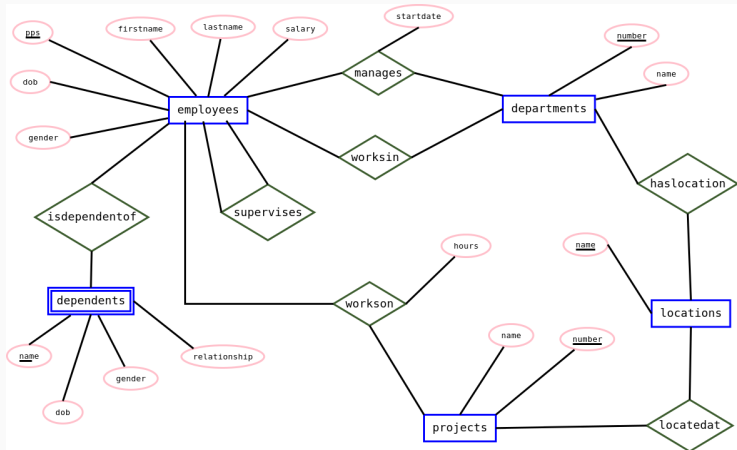
- Intuitively such an attribute is a property of the tuples in the relationship

Relationships with attributes cont'd

- Can usually re-work relationship-attributes by spinning off a separate entity set



An Example



Acknowledgements

This lecture is based on material from the text by Ullman and Widom and their website.