



COMP3311 Week 1 Wednesday Lecture

- In today's lecture ...
- CSE Environment
- ER Model (recap)
- Exercise: ER Diagram
- Exercise: ER Models
- Class Hierarchies
- Exercise: Student/Lecturer Class Hierarchy
- Developing ER Models
- Exercise: Medical Information
- Data Models
- Relational Model

❖ In today's lecture ...

Topics:

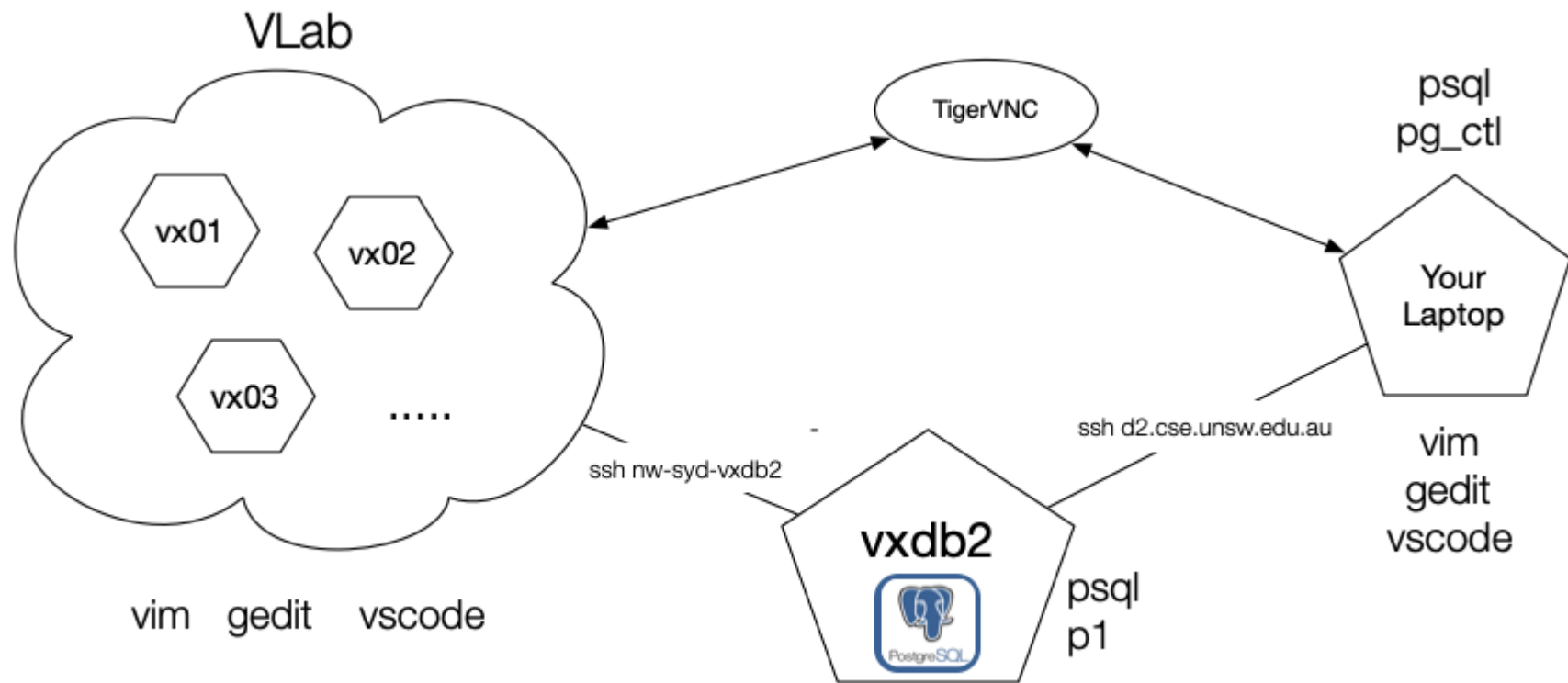
- Entity-Relationship (ER) Model (cont)
- Relational Model
- Mapping ER \rightarrow SQL
- SQL Data Definition Language (DDL)

Reminders:

- tutes start in week 02
- set up your PG server

```
ssh nw-syd-vxdb2
3311 pginit
psql -l
```

❖ CSE Environment



❖ ER Model (recap)

ER models give a visual representation of database structure

Primary components

- Entities = objects of interest in the scenario
- Relationships = associations between entities
- Attributes = properties of entities

ER models don't capture all information from the scenario

- e.g. types and constraints on attribute values

ER models are useful as a step towards an SQL [schema](#)

❖ ER Model (recap) (cont)

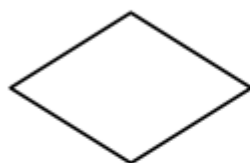
ER design elements:



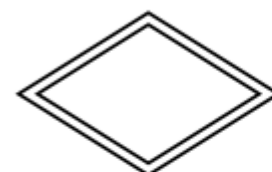
Entity



Weak entity



Relationship



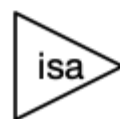
Identifying
Relationship



Attribute



Multi-valued
Attribute



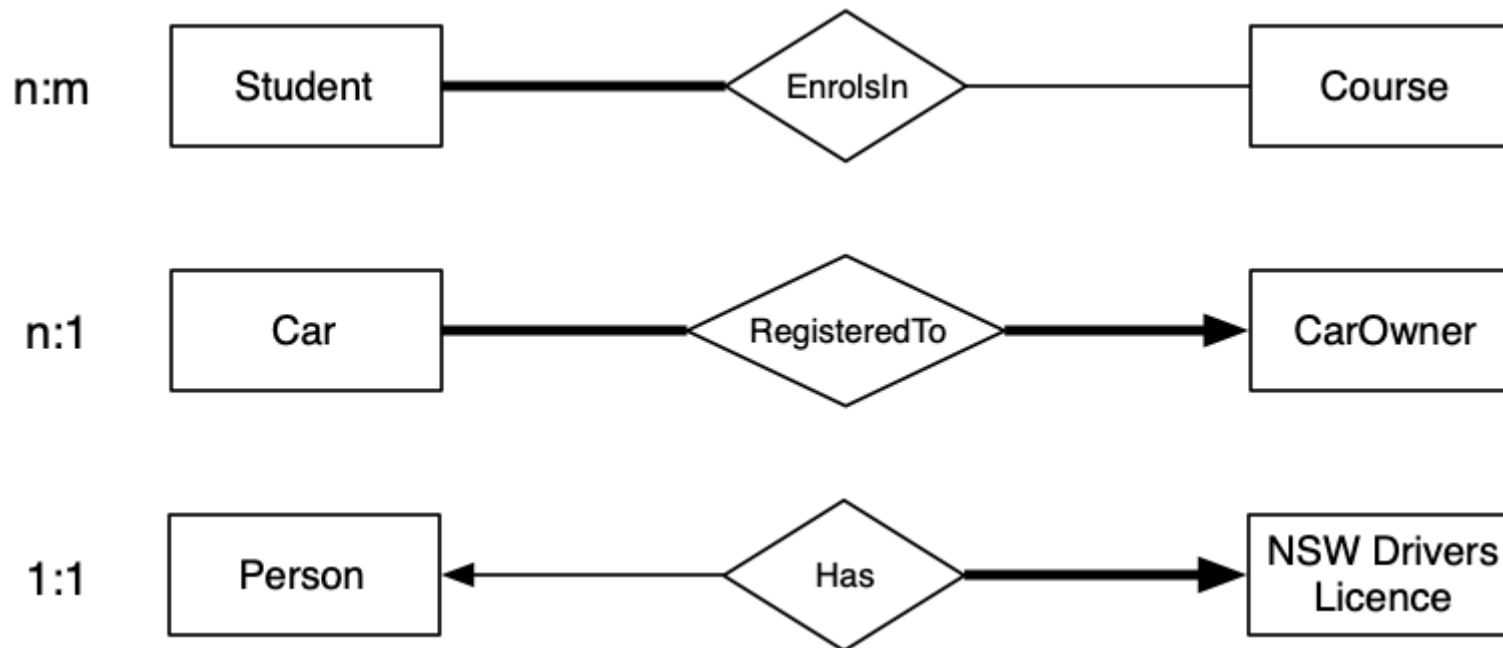
Inheritance



Derived
Attribute

❖ ER Model (recap) (cont)

Relationships:

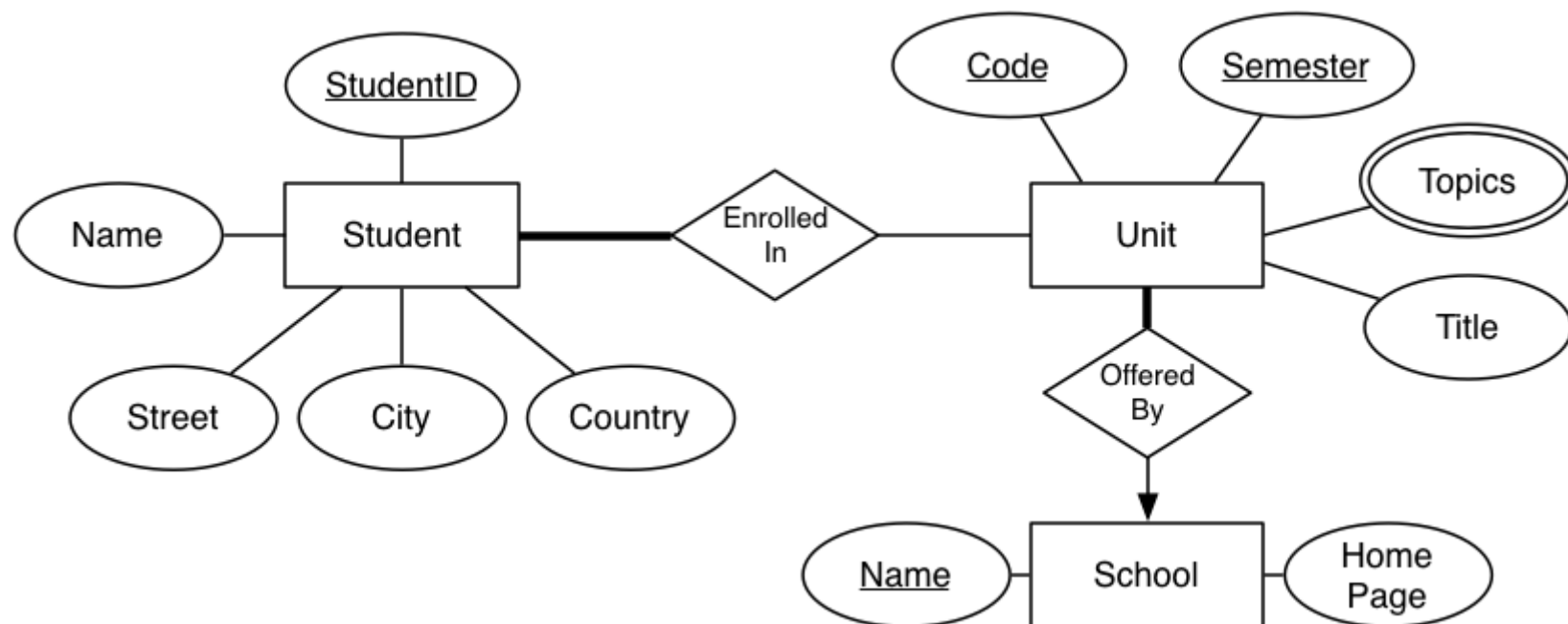


Thick line = total participation; thin line = partial participation

❖ Exercise: ER Diagram

Using the ER diagram below

- give examples of entity values
- describe the semantics of the relationships



❖ Exercise: ER Models

For each of the informal data models

- Course outline
- Instagram
- Gmail

give a suitable ER diagram

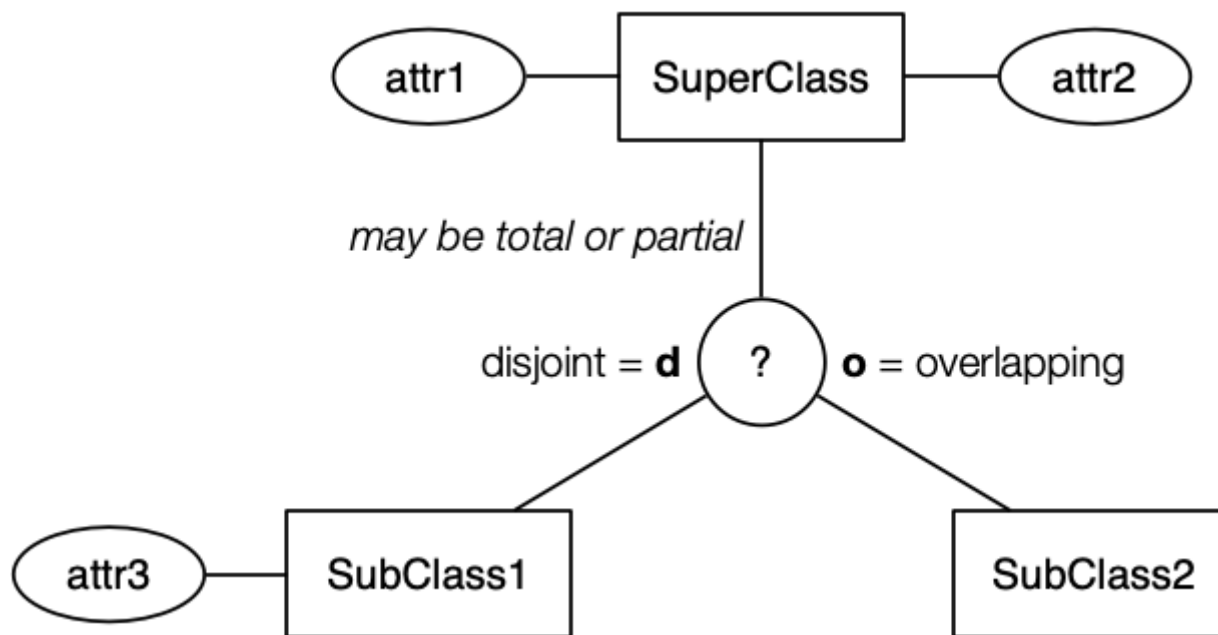
❖ Class Hierarchies

ER also implements super-class / sub-class hierarchies

- both super- and sub-classes consist of entities
- super-class has common properties of all entities in hierarchy
- sub-classes *can* add extra properties to specialise
- entities in super-class *may* have corresponding entities in sub-class
- sub-classes can be
 - **disjoint** ... entities are members of only one sub-class
 - **overlapping** ... entities can be members of several sub-classes
- sub-classes can be involved in separate relationships

❖ Class Hierarchies (cont)

ER class hierarchies use circle to connect super/sub-classes:



❖ Class Hierarchies (cont)

Consider a concrete example of a class hierarchy:

[Diagram:exercises/stu-lec.png]

❖ Exercise: Student/Lecturer Class Hierarchy

Modify the student-lecturer class hierarchy to represent

- some people in the database are students or lecturers
- all people in the database are students or lecturers
- all people in the database are students XOR lecturers
- some people in the database are students XOR lecturers

❖ Developing ER Models

A complete ER model should ...

- include all entities and their attributes
- identify key attributes
- capture accurate semantics for all relationships
- include class hierarchies where appropriate

There are frequently different kinds of people (\Rightarrow sub-classes)

❖ Exercise: Medical Information

Develop an ER model for the following scenario:

- Patients are identified by an SSN, and their names, addresses and ages must be recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty and years of experience must be recorded.
- A pharmacist is identified by an SSN, he/she can only work for one pharmacy. For each pharmacist, their name must be recorded.
- Each pharmacy has a name, address and phone number. A pharmacy must have a manager, who is a pharmacist.
- For each drug, the trade name and formula must be recorded.
- Every patient has a primary physician. Every doctor has at least one patient.
- Each pharmacy sells several drugs, and has a price for each. A drug could be sold at several pharmacies, and the price could vary between pharmacies.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and quantity associated with it.

❖ Data Models

Entity-relationship (ER) model

- world is modelled via entities, relationships, attributes

Relational model

- world is modelled via tuples, relations, constraints

SQL schemas

- a good approximation of the relational model

Also ODL, UML, and a variety of others ... but not in this course.

❖ Relational Model

Attribute = data item with a name and a type/domain

- e.g. **account_balance** has domain non-negative integer

Tuple = list of values (cf. Python tuples, C structs)

- e.g. (1234567, John Smith, BE, SENG, 75.2)

Relation = set of tuples

- e.g. { (1,2,3), (3,2,1), (1,3,5), (2,4,6) }

Constraint = logical statements on valid data

- e.g. zID is unique and $0 \leq \text{WAM} \leq 100$

❖ Relational Model (cont)

Correspondence between ER and Relational models:

- Relational **attributes** correspond to ER **attributes**
 - although ER attributes generally don't have explicit domains
- Relational **tuples** correspond to ER **entities**
- **Relations** correspond to **sets** of ER **entities**
- **Relations** also correspond ER **relationships**

Produced: 13 Sep 2023