

# COMP3311 Week 2

Welcome everyone!! :)



# Introductions

Manhua Lu 🐧 (not manga xd) [manhualu.dev](http://manhualu.dev)

- 4th year Computer Science and Commerce (Finance)
- Always on the hunt for new music 🎵, food 🥞 and cool photo opportunities 📷
- Executive Vice President of Course Projects in DevSoc ~~<devsoc>~~ [devsoc.app](http://devsoc.app)
- [manhua.lu@student.unsw.edu.au](mailto:manhua.lu@student.unsw.edu.au)



If you're interested and want to join, subcom recruitments are open!!  
Applications close this Sunday :3



*DevSoc Linktree*

# Your turn!



Please tell us your:

- Name
- What you're studying + year of study
- Any societies you've been involved with (you don't have to be a subcom, just attended events)?

# How will our Tutorials Work?



I will assume that you have at least looked through the lecture slides for the week 😬

**Note: Unfortunately tutorials are not a replacement for the lectures!**

# How to HD COMP3311 🤔

- Attend the in-person **lectures** or watch the recording (ik it's hard 💀)
  - In the live lectures, Yuekang will go through the concepts and do examples
- Attend our **tutorials** every week!!
  - Please ask questions! I am here to help : )
- After the tutorial, attempt the **Tute Exercise questions** we didn't go through (solutions will be released the week after).
- Try to attempt the **Practices** that focus on concepts (not compulsory + not graded, but very helpful for assignments)
- This term the exam is 60% of your course mark!

Me after attending one lecture



# Announcements

- Quiz 1 due Friday 23 February @11:59pm AEST (now been extended to Saturday 11:59 )
  - Can make multiple submissions
  - In 'Activities' tab
- Complete Practices 1 (setting up PostgreSQL server) by end of Week 2
  - Because you will need it for your assignment!

# Setting up our PostgreSQL Server at CSE

COMP3311 24T1

## Prac Exercise 01

### PostgreSQL: a client-server RDBMS

Last updated: Saturday 17th February 8:07pm

Most recent changes are shown in red ... older changes are shown in brown.

Database Systems

#### Aims

This exercise aims to get you to:

- install your PostgreSQL database server at CSE
- create, populate and examine a very small database

You ought to get it done by end of Week 2, since you'll need it to start working on Assignment 1.

Live demo...



# Run these Commands **Every Time** to Start Server

1. Login to vxdb2:

```
ssh nw-syd-vxdb2
```

2. Set up your environment:

```
source /localstorage/<your_zID>/env
```

3. Start the PostgreSQL server:

```
p1
```

4. Work with a database:

```
psql <someDatabaseName>
```

5. Stop the PostgreSQL server:

```
p0
```

# Learning Objectives

**01**

→ Data Modelling (Q2)

ER Model (Q6, Q10, Q11, Q14)

**02**

- 
- Entities
  - Attributes
  - Relationships

**03**

→ Relational Model (Q18,Q19)

**04**

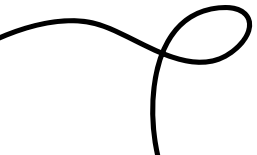
→ ER to Relational Mapping (will be covered in Wk3 too)

**01**

# **Data Modelling**

# 01 → Data Modelling

2. In the context of database application development (aka “database engineering”), what are the aims of **data modelling**?



# 01



## Data Modelling

2. In the context of database application development (aka “database engineering”), what are the aims of **data modelling**?

### Answer

Data modelling:

- Takes in **requirements** given by the client
- Builds a comprehensive description of the **entities** and its **attributes**
- It also shows the **relationship** among these entities.

The model constructed should ensure that all of the requirements can be met.

The data model should give enough detail that a database schema can be derived from it without significant additional information being needed.

# **COMP3311 covers 2 types of Database Models:**

Entity Relational  
(ER) Model

Relational  
Model

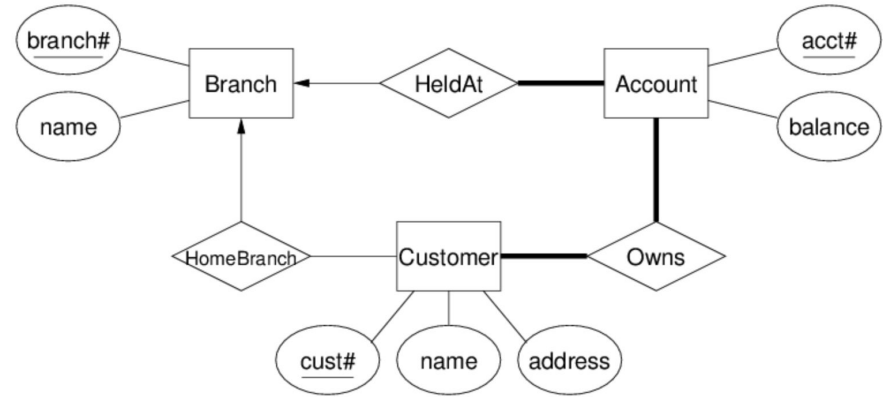
**02**

# **Entity Relational (ER) Model**

# 02

## Entity Relational Model

- A data model that consists of **entities** which have **attributes** and are **related** to each other.
- **Entities:** Objects (rectangle)
- **Attributes:** Properties (oval)
- **Relations:** Describe how entities interact with each other (diamond and arrows/lines)

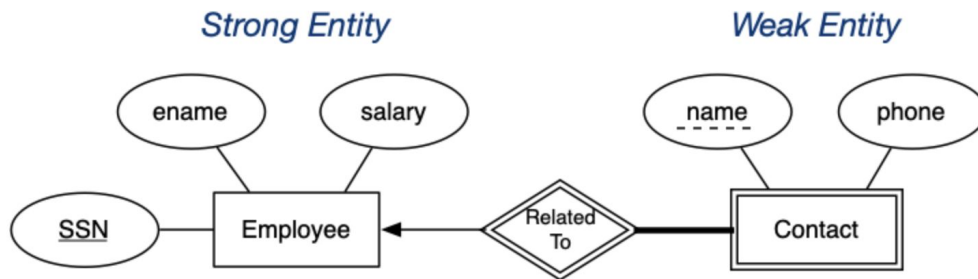




# 02

## Entity Relational Model: Entities

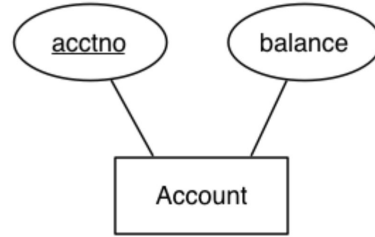
- Can have attributes
- A **weak entity** exists only because of association with strong entities
  - They have no key of their own, instead have a discriminator (**dotted-underlined**)
  - Its primary key is made up of its **strong entity's primary key + its own discriminator**



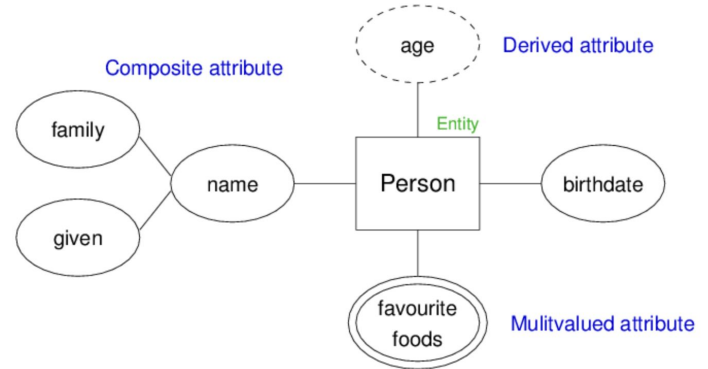
# 02

## Entity Relational Model: Attributes

- The attribute that is used to identify the entity is called the **primary key** and is **underlined**
- An attribute can be **composite**, **derived** or **multi-valued**



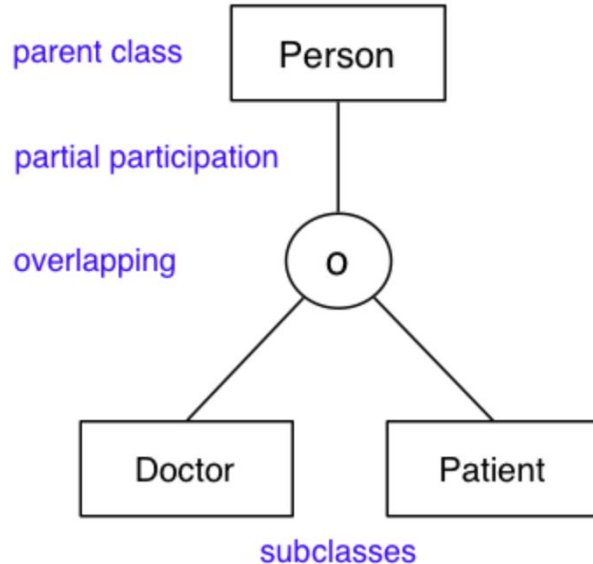
Example of attribute notations:



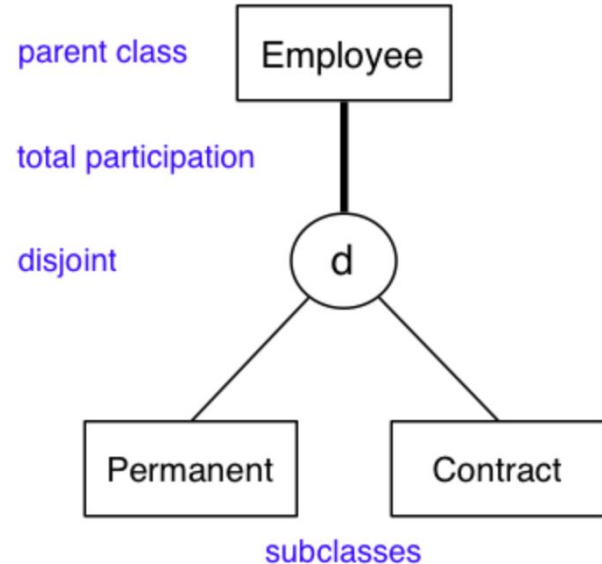
## 02

# Entity Relational Model: Subclasses + Inheritance

*A person may be a doctor and/or  
may be a patient or may be neither*



*Every employee is either a permanent  
employee or works under a contract*



## 02

# → Entity Relational Model: Relationships

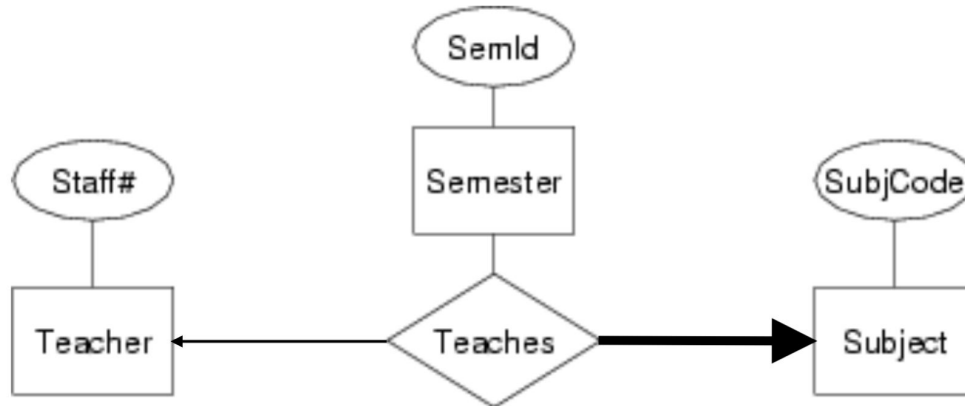
- Semantics:
  - One to one
  - One to many
  - Many to many
- Participation
  - Total (**thicc** line)
  - Partial

# 02

## Entity Relational Model: Relationships

### One to one

"A teacher can teach 0 or ONE subject, a subject must be taught by **ONE** person."

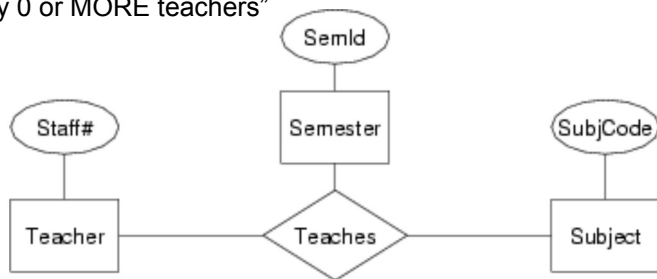


# 02

## Entity Relational Model: Relationships

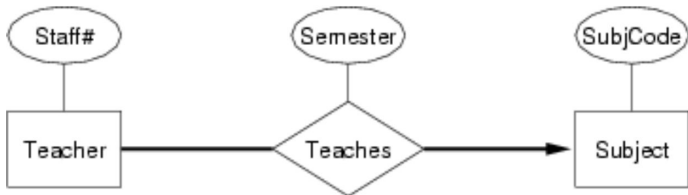
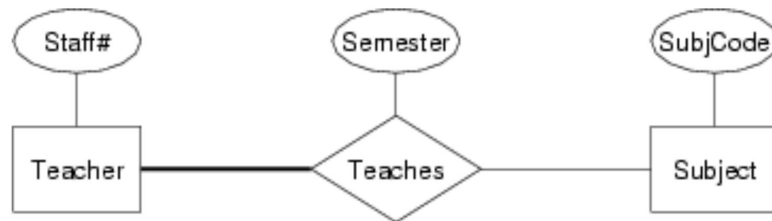
### Many to many

“A teacher can teach 0 or MORE subjects, a subject can be taught by 0 or MORE teachers”



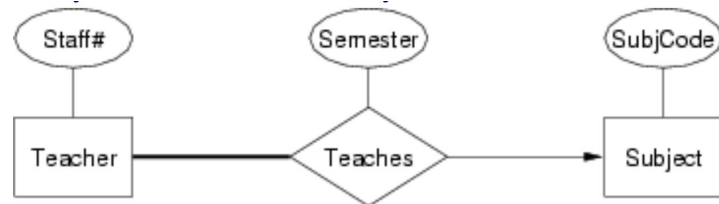
### Many to many

“A teacher must teach **ONE** or MORE subjects, a subject can be taught by 0 or MORE teachers”



### One to many

“Teacher must teach only **ONE** subject, a subject must be taught by **ONE** or MORE teachers”



### One to many

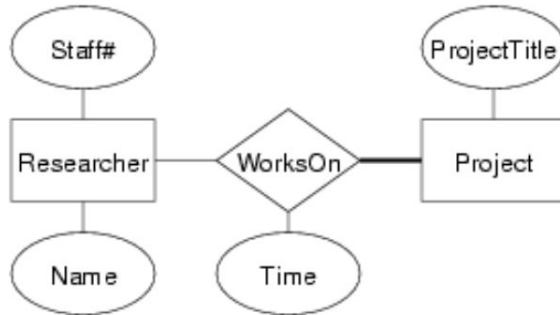
“Teacher must teach only **ONE** subject, a subject can be taught by 0 or MORE teachers”

# 02

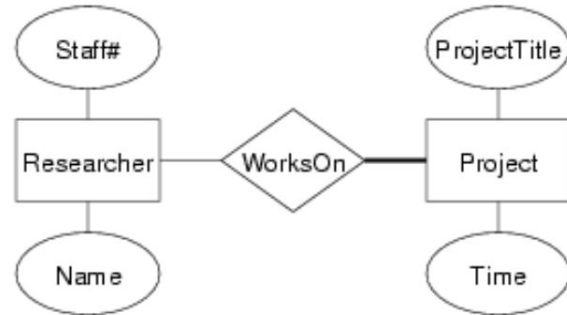
## Entity Relational Model: Relationships Question

6. Researchers work on different research projects, and the connection between them can be modelled by a WorksOn relationship. Consider the following two different ER diagrams to represent this situation.

(a)



(b)



Describe the different semantics suggested by each of these diagrams.

## 02

## Entity Relational Model: Relationships Question

### Answer

Between the 2 diagrams, the *Time* attribute is in different places.

- a) We can get how much time each researcher spent on a particular project.
- b) We can only get the total amount of time everyone has spent on a project. We don't know how much time each researcher spent on a project.

Both diagrams are saying: A researcher can work on 0 or more projects, a project must be worked on by **ONE** or MORE researchers.



## 02

# Entity Relational Model Question

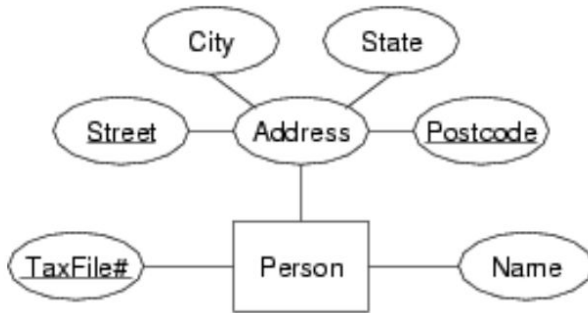
10. Assume there is a `Person` entity type. Each person has a home address. More than one person can live at the same home address.
- a. Create two, different ER diagrams to depict `Persons` and their addresses, one with `Address` as an attribute, the other with `Address` as an entity.
  - b. Why would we choose one rather than the other?
  - c. Assume that we have a `ElectricCompany` entity type. Only one of these companies supplies power to each home address. Add that information to each ER diagram.

**02**

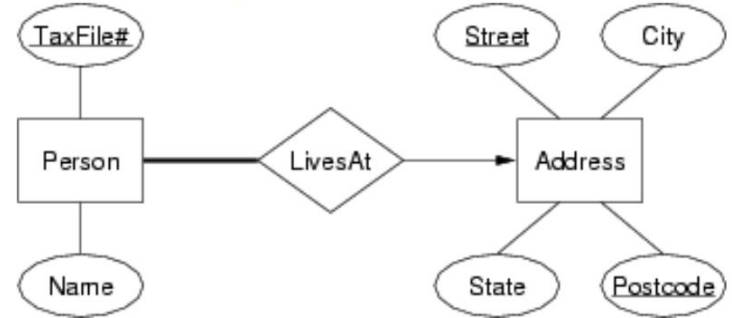
## Entity Relational Model Question

### Answer for a)

Address as attribute



Address as entity



**02**

## **Entity Relational Model Question**

### **Answer for b)**

The second diagram is generally better because an Address could have multiple Persons.

It is also more flexible for if we wanted to add things like c) asks for

## 02

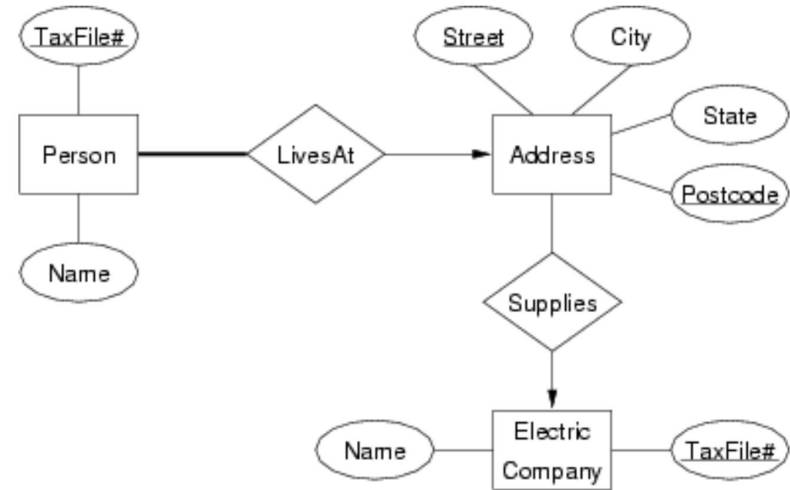
# Entity Relational Model Question

### Answer for c)

When Address is an attribute, it is not possible to relate electric companies directly to an address.

- Instead they can only be related to Person and through them indirectly related to addresses

When Address is an entity, it is possible.



**02**



## **Entity Relational Model Question**

11. [Based on GUW 2.1.3] Give an ER design for a database recording information about teams, players, and their fans, including:

- a. For each team, its name, its players, its captain (one of its players) and the colours of its uniform.
- b. For each player, their name and team.
- c. For each fan, their name, favourite teams, favourite players, and favourite colour.

(Skip if no time in tute but heavily recommend you do this in your own time!)

# 02

## Entity Relational Model Question

14. Give an ER design to model the following scenario ...

- for each person, we need to record their tax file number (TFN), their real name, and their address
- everyone who earns money in Australia has a distinct tax file number
- authors write books, and may publish books using a "pen-name" (a name which appears as the author of the book and is different to their real name)
- editors ensure that books are written in a manner that is suitable for publication
- every editor works for just one publisher
- editors and authors have quite different skills; someone who is an editor cannot be an author, and vice versa
- a book may have several authors, just one author, or no authors (published anonymously)
- every book has one editor assigned to it, who liaises with the author(s) in getting the book ready for publication
- each book has a title, and an edition number (e.g. 1st, 2nd, 3rd)
- each published book is assigned a unique 13-digit number (its ISBN); different editions of the same book will have different ISBNs
- publishers are companies that publish (market/distribute) books
- each publisher is required to have a unique Australian business number (ABN)
- a publisher also has a name and address that need to be recorded
- a particular edition of a book is published by exactly one publisher

(Skip if no time in tute but heavily recommend you do this in your own time!)

State all assumptions used in developing your data model.

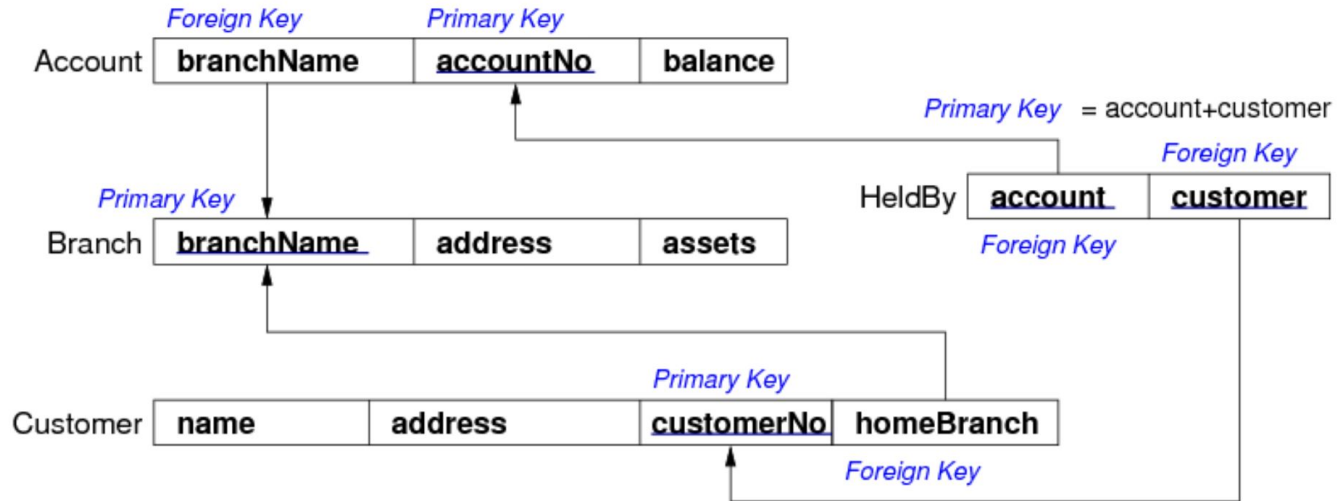
**03**

# **Relational Model**

# 03

## Relational Model

- Model data as a set of **relations** with attributes.
- The general process is to create a relational model from ER diagram.

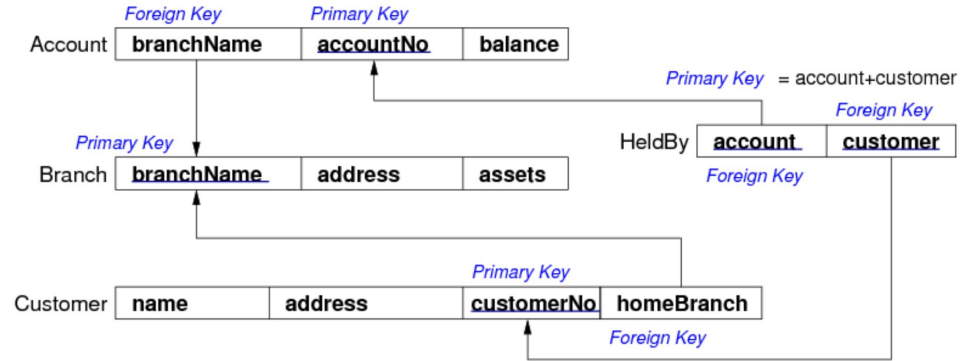




# 03

## Relational Model

- **Attributes:** columns
- **Domain:** the set of values which an attribute can take e.g. integer, string, date
- **Tuples/Records:** rows
- **Relation:** table
- **Primary key (underlined):** attribute that uniquely identifies each tuple
- **Foreign key:** a referencing mechanism that allows us to link 2 tables together



# 03

## Relational Model Question

18. Consider the following simple relational schema:

R(a1, a2, a3, a4)  
S(b1, b2, b3)

which of the following tuples are not legal in this schema? Explain why the illegal tuples are invalid.

R(1, a, b, c) R(2, a, b, c) R(1, x, y, z)

R(3, x, NULL, y) R(NULL, x, y, z)

S(1, 2, x) S(1, NULL, y) S(2, 1, z)

# 03

## → Relational Model Question

19. Consider the following relations which form a tiny part of the schema for the MyUNSW database:

```
Person(zID, zPass, familyName, givenName, dateOfBirth, countryOfBirth, ...)
Student(zID, degreeCode, WAM, ...)
Staff(zID, office, phone, position, ...)
Course(cID, code, term, title, UOC, convenor)
Room(rID, code, name, building, capacity)
Enrolment(course, student, mark, grade)
```

Identify all of the primary keys and foreign keys, and suggest suitable domains for each attribute. You can introduce new relations if you think would likely be used to represent objects not in the current tables. Discuss which attributes could have NULL values, and the circumstances under which this might occur.

**04**

## **ER to Relational Mapping**

# 04



## ER to Relational Mapping

- Entities become tables
- **Many to many** relations become tables
- **One to one** relations collapse into either entity
- **One to many**, put the foreign key of the 'one' side in the 'many' entity

(We will do questions on this in Wk3, so no stress if you don't get it just yet!!)

