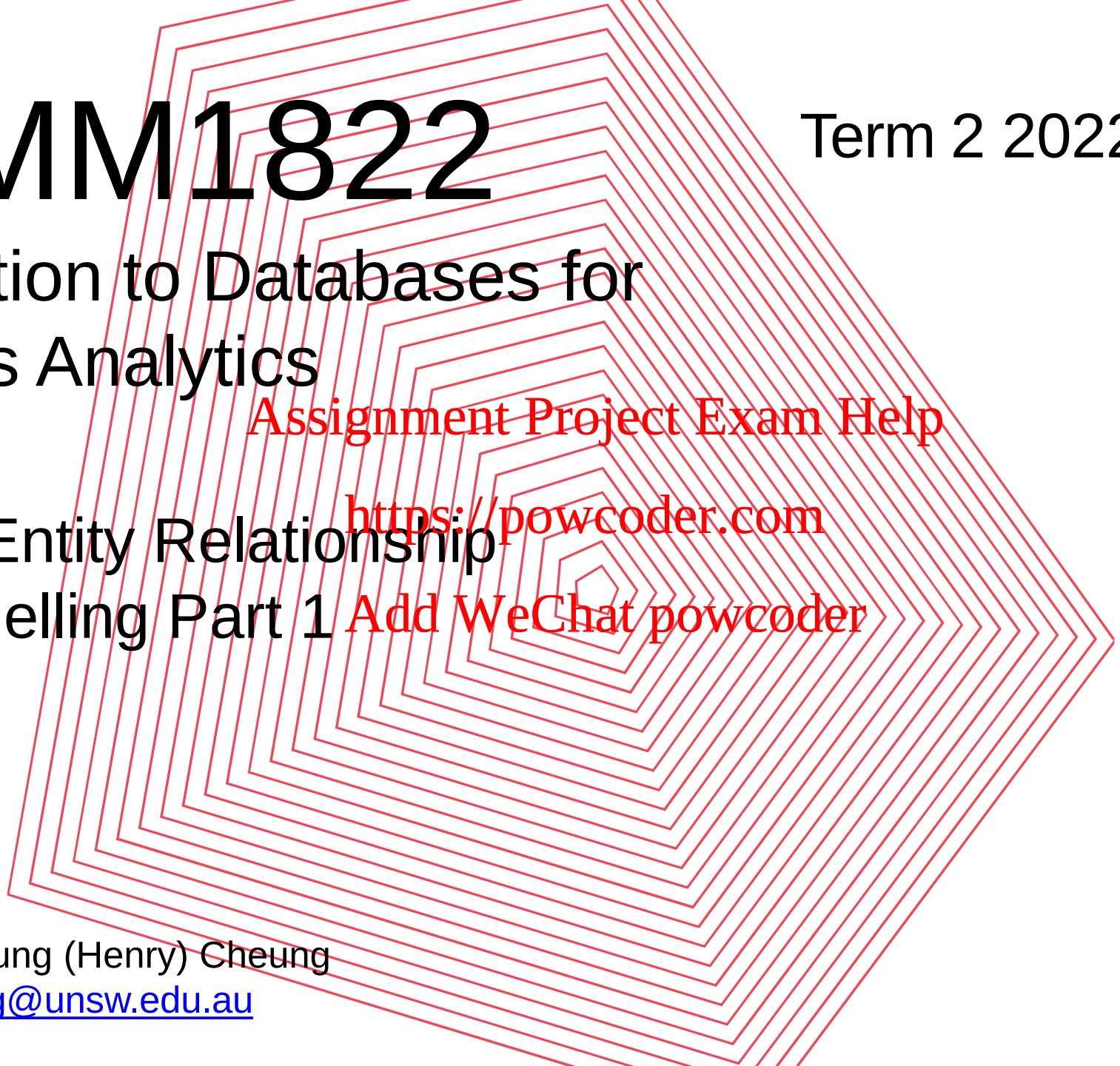
# COMM1822

Term 2 2022

## Introduction to Databases for Business Analytics

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

## Week 1 Entity Relationship (ER) Modelling Part 1



Lecturer: Kam-Fung (Henry) Cheung
E-mail: kf.cheung@unsw.edu.au

UNSW SYDNEY

# WARNING

This material has been reproduced and communicated to you by or on behalf of the University of New South Wales in accordance with section 113P(1) of the Copyright Act 1968 (Act). The material in this communication may be subject to copyright under the Act. Any further reproduction or communication of this material by you may be the subject of copyright protection under the Act.

Do not remove this notice



Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Copyright

- There are some file-sharing websites that specialise in buying and selling academic work to and from university students.

Assignment Project Exam Help

- If you upload your original work to these websites, and if another student downloads and presents it as their own either wholly or partially, **you might be found guilty of collusion — even years after graduation**.

https://powcoder.com

Add WeChat powcoder

- These file-sharing websites may also accept purchase of course materials, **such as copies of lecture slides and tutorial handouts. By law, the copyright on course materials, developed by UNSW staff in the course of their employment, belongs to UNSW. It constitutes copyright infringement, if not academic misconduct, to trade these materials.**

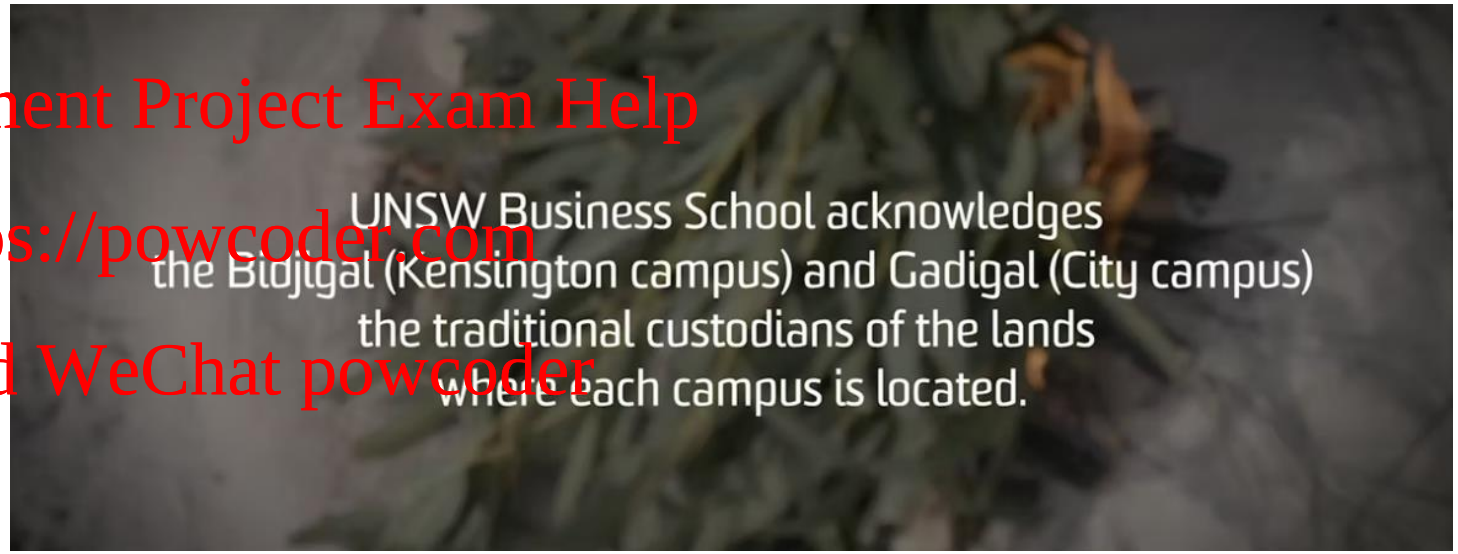
# Acknowledgement of Country

UNSW Business School acknowledges the Bidjigal (Kensington campus) and Gadigal (City campus) the traditional custodians of the lands where each campus is located.

We acknowledge all Aboriginal and Torres Strait Islander Elders, past and present and their communities who have shared and practiced their teachings over thousands of years including business practices.

We recognise Aboriginal and Torres Strait Islander people's ongoing leadership and contributions, including to business, education and industry.

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

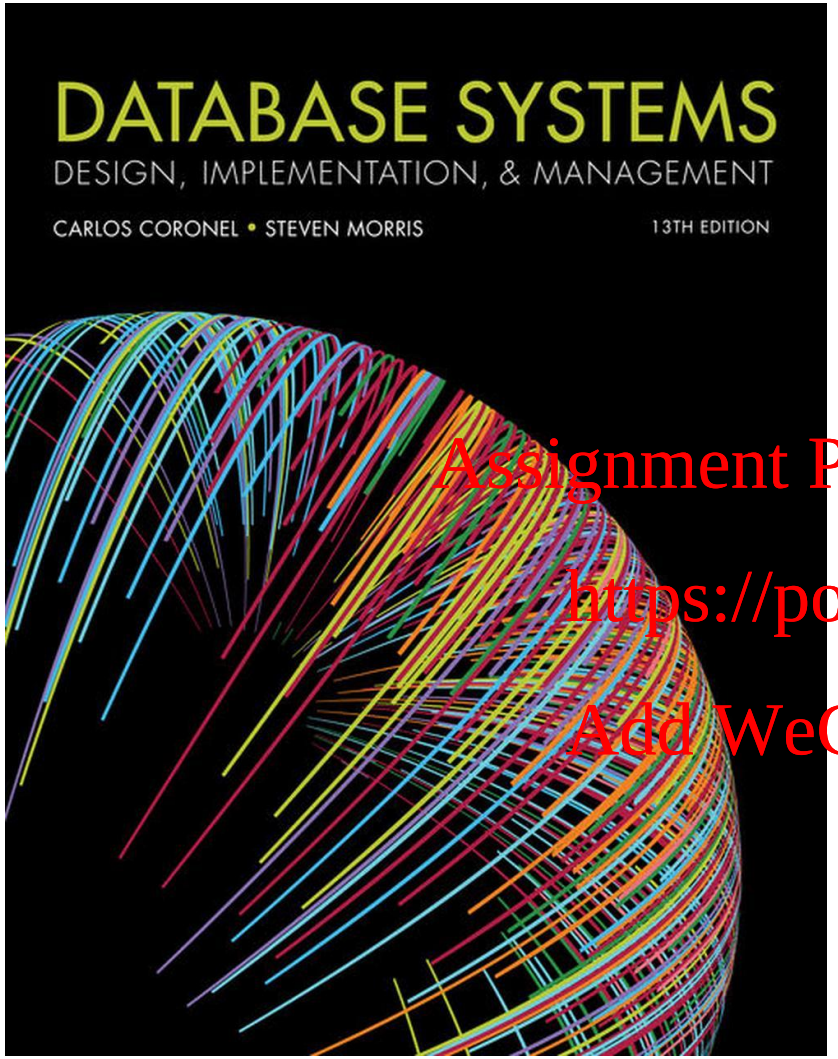



UNSW Business School. (2022, May 7). *Acknowledgement of Country* [online video]. Retrieved from https://vimeo.com/369229957/d995d8087f

# Agenda

- **Data Modelling**
  - ❑ Data model as a (relatively) simple abstraction of the complex real-world (for the purpose of creating a DB).
  - ❑ A good DBMS will perform poorly with a poorly designed database.
  - ❑ One modelling technique to design a database: **Entity Relationship Modelling**
- **Entity Relationship Modelling**
  - ❑ Entity Types and Entity Instances
  - ❑ Attributes and Values
  - ❑ Keys
  - ❑ Relationships
  - ❑ Connectivity
  - ❑ Cardinality

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder




# Chapter 2
# Data Models
# 2-1 to 2-6

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Chapter 4
# Entity Relationship (ER) Modelling
# 4-1 to 4-2

# Data Modeling and Data Models

- **Model** - Abstraction of a real-world object or event
- **Data modeling**: Iterative and progressive process of creating a specific data model for a determined problem domain

Assignment Project Exam Help
https://powcoder.com

To model and translate the business requirements into a data model they can be used to store data which to business can use

Add WeChat powcoder

- **Data models**: Simple representations of complex real-world data structures
  - Useful for supporting a specific problem domain

What would be the data model like for UNSW?

# Importance of Data Models

- Are a communication tool
- Give an overall view of the database
- Organize data for various users
- Are an abstraction for the creation of good database

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Data Model Basic Building Blocks

- **Entity**: Unique and distinct object used to collect and store data
  - ❑ **Attribute**: Characteristic of an entity
- **Relationship**: Describes an association among entities
  - ❑**One-to-many (1:M)**
  - ❑**Many-to-many (M:N or M:M)**
  - ❑**One-to-one (1:1)**
- **Constraint**: Set of rules to ensure data integrity

e.g., people, thing, event, …

Consider the following entities: professors, students, courses, departments, research centres, etc.

Violation examples:

- Enter an SID to STUDENT table, it finds two students (Entity integrity)
- STUDENT table says that student X's department code is Y. But in the DEPARTMENT Table, there is no code Y. (Referential integrity)

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Business Rules – Design a Data Model

- Brief, precise, and unambiguous description of a policy, procedure, or principle
- Enable defining the basic building blocks
- Describe main and distinguishing characteristics of the data

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Translating Business Rules into Data Model Components

- Nouns translate into entities

Each student can take at most 3 courses each semester.

Each research student must have two supervisors at UNSW.

Assignment Project Exam Help

- Verbs translate into relationships among entities

https://powcoder.com

- Relationships are bidirectional

Add WeChat powcoder

Each student can take at most 3 courses each semester.

Each course may have up to 300 students at UNSW.

- Questions to identify the relationship type: 1:1, 1:M or M:N
  - ❑How many instances of B are related to one instance of A?
  - ❑How many instances of A are related to one instance of B?

# Naming Conventions

- Entity names - Required to
  - ❑ Be descriptive of the objects in the business environment
  - ❑ Use terminology that is familiar to the users

STUDENT, EMPLOYEE, DEPARTMENT, …

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

- Attribute name - Required to be descriptive of the data represented by the attribute

STUDENT: SID, DOB, GENDER, FIRST_NAME, LAST_NAME, …

- Proper naming
  - Facilitates communication between parties
  - Promotes self-documentation



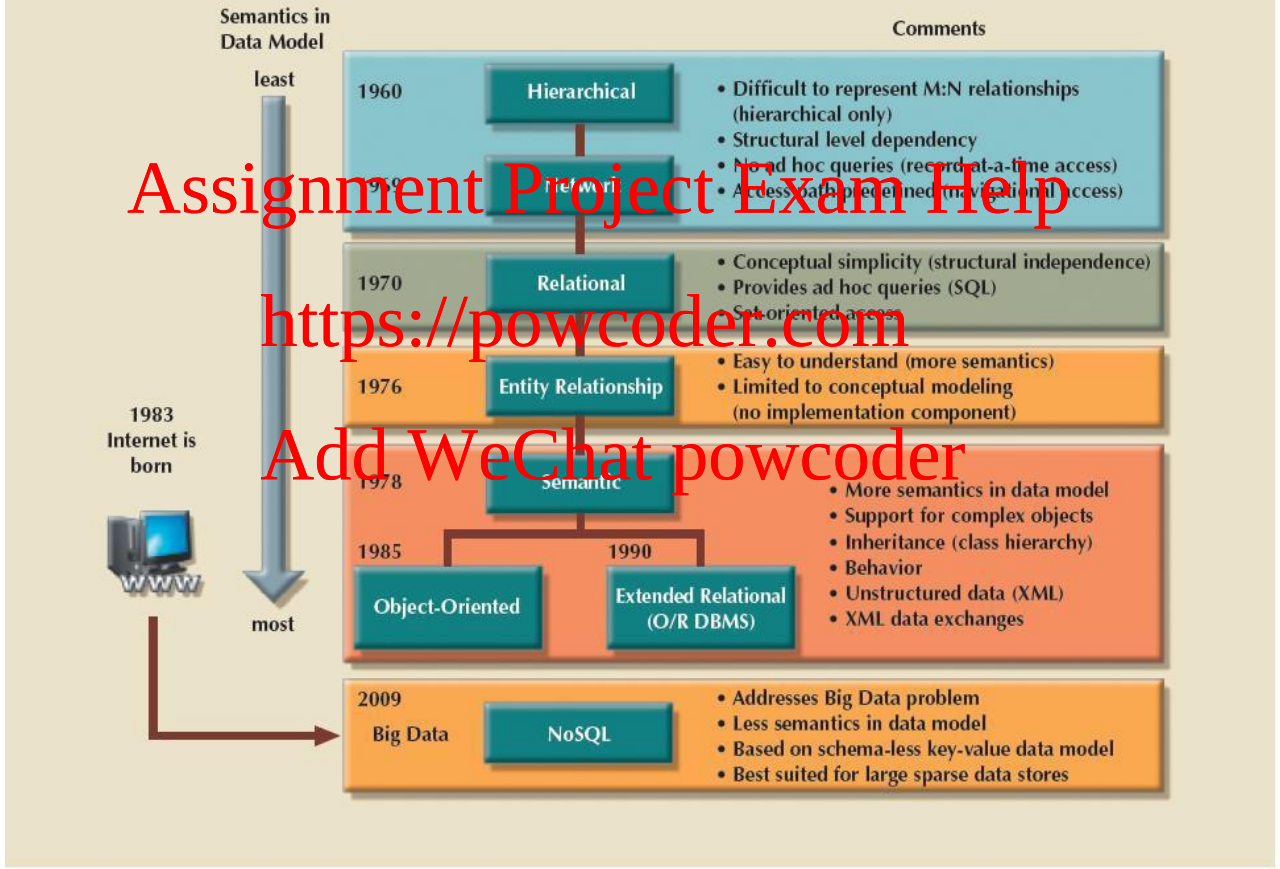
UNSW SYDNEY

# Evolution of Data Models

We will focus and discuss more on relational, entity relationship, and NoSQL in the last few weeks.

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

FIGURE 2.6 THE EVOLUTION OF DATA MODELS

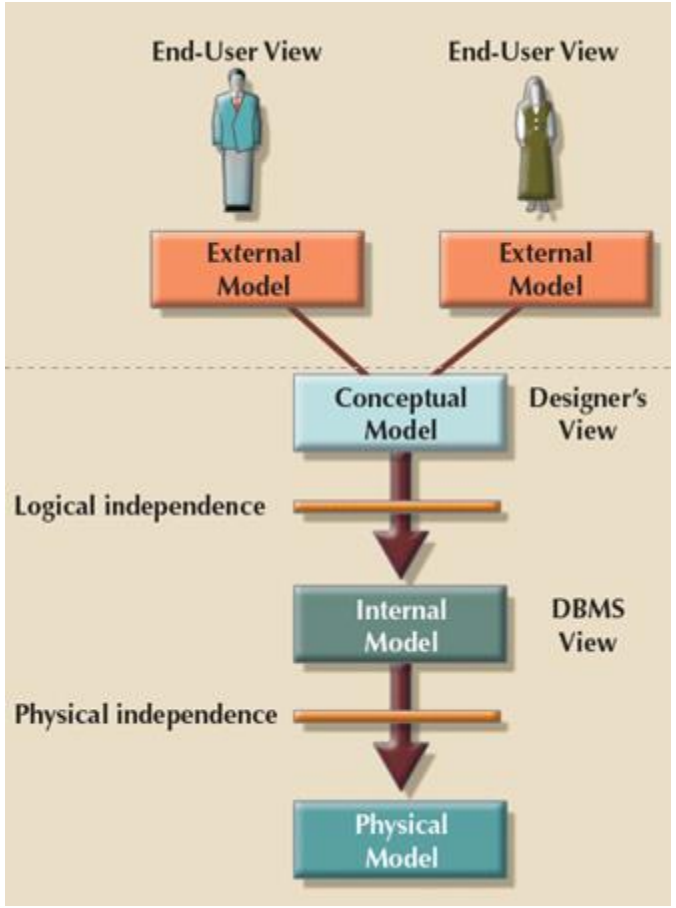



Source: Coronel, Morris, Rob 2017

# Levels of Data Abstraction

| Model | Degree of Abstraction | Focus | Independent of |
|---|---|---|---|
| External | High | End user views | Hardware and software |
| Conceptual | | Global view of data (database model independent) | Hardware and software |
| Internal | | Specific database model | Hardware |
| Physical | Low | Storage and access methods | Neither hardware nor software |

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder




Source: Coronel, Morris, Rob 2017

Data abstraction is the reduction of a particular body of data to a simplified representation of the whole.

Abstraction, in general, is the process of taking away or removing characteristics from something in order to reduce it to a set of essential characteristic.

# Conceptual Data Modelling Techniques

Two common techniques:

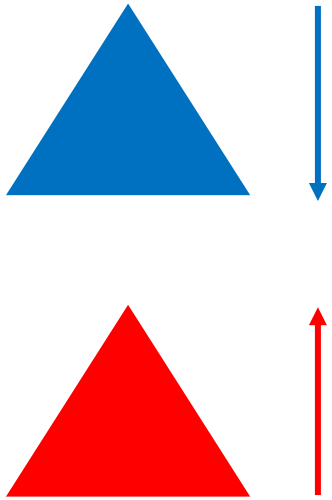
Assignment Project Exam Help

- **Entity-Relationship (ER) modelling**: Top-down approach. Begins by looking for the data groups in the system.

https://powcoder.com

Add WeChat powcoder

- **Normalization**: Bottom-up approach. Begins by looking at the smallest individual items of data recorded by the system.

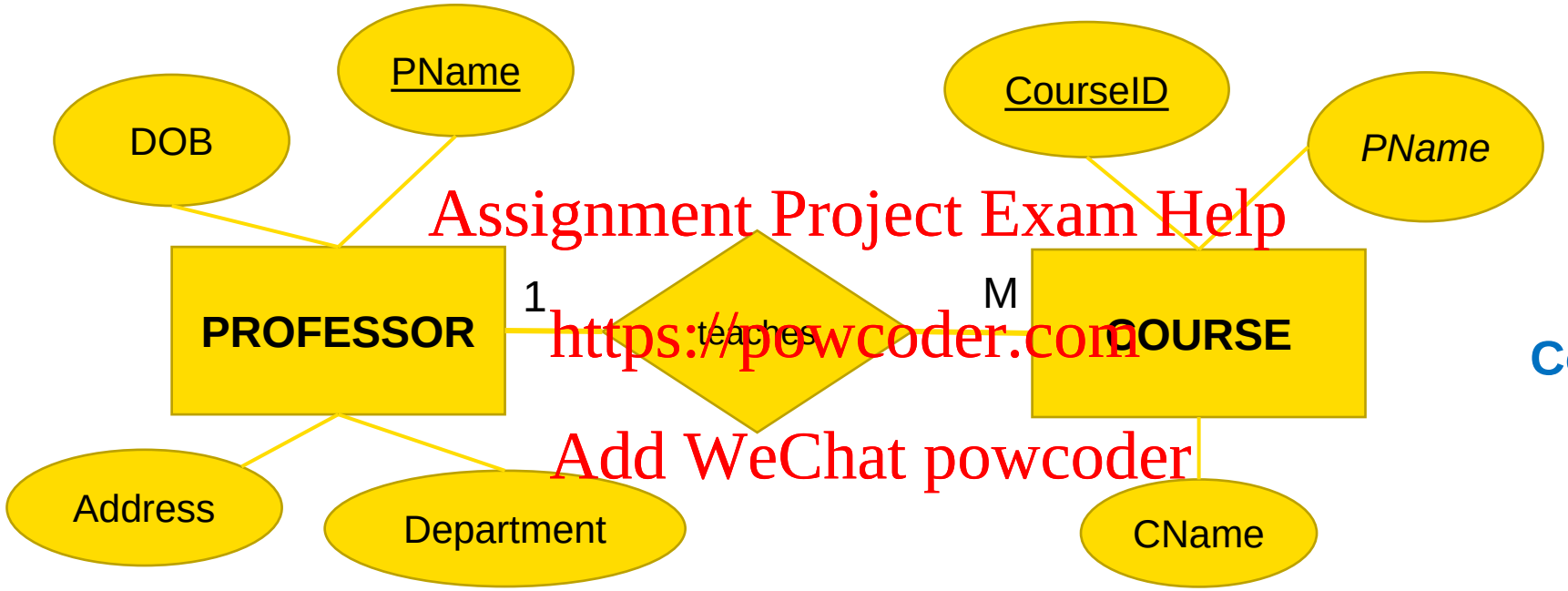


# Internal Model and Conceptual Model

- The internal model is the model that we used when database is **implemented**.
- The internal model maps the **conceptual model to the DBMS.**
- The internal model depends on the **specific database software.**
- Hence, a change in DBMS software requires internal model be changed.
- **Logical independence**: you can change the internal model without affecting conceptual model!

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Conceptual Model




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

**Conceptual Model**

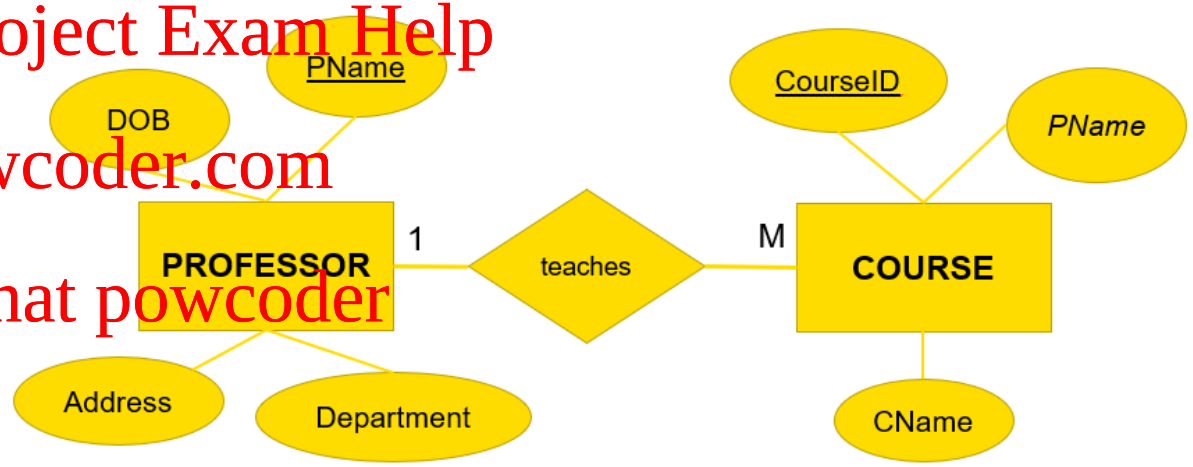
PROFESSOR (**PName**, DOB, Address, Department)
COURSE (**CourseID**, CName, ***PName***)

**Internal Model**

# Conceptual Modelling: ER Model

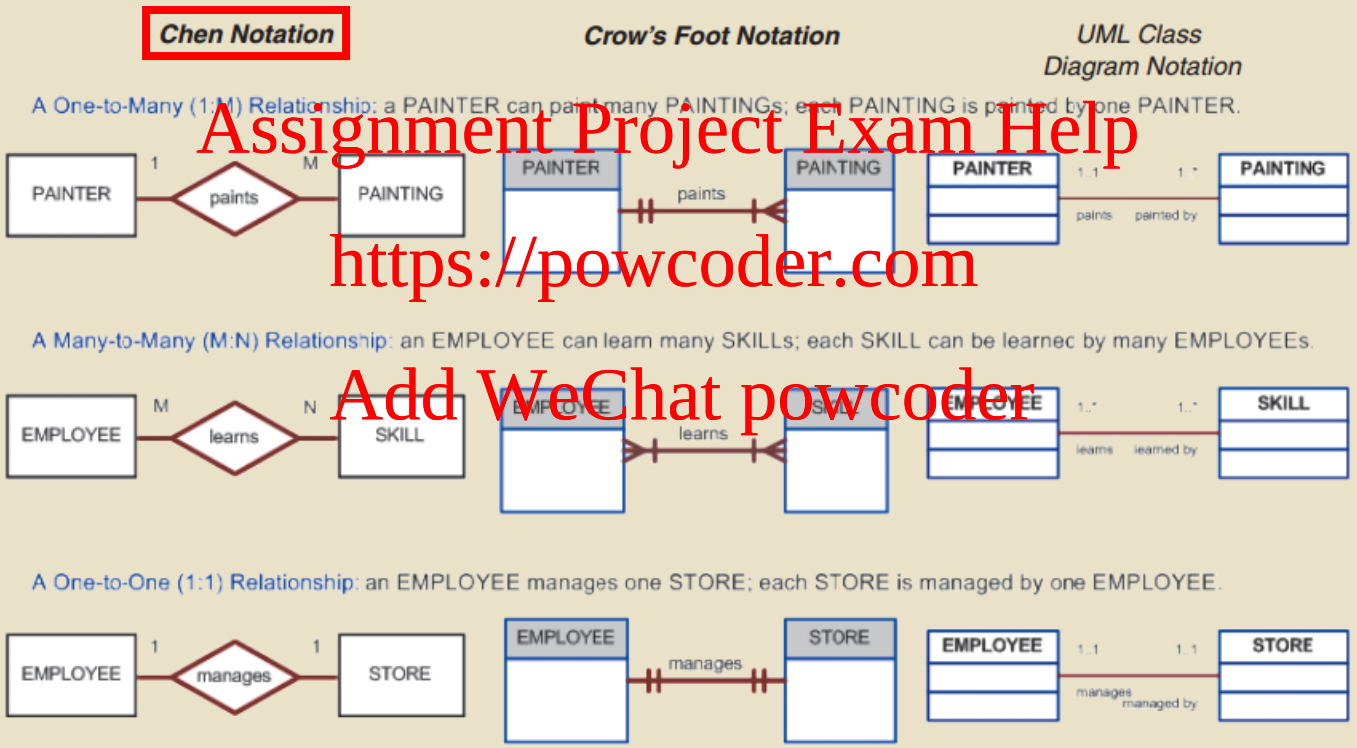
- An **Entity-Relationship (ER) model** is a detailed, logical representation of the data for an organisation or for a business area.
- The ER model is expressed in terms of **entities** in the business environment, the **relationships** or associations among those entities, and the **attributes** of both the entities and their relationships.
- An ER model is normally expressed as an **ER diagram**, which is a graphical representation of an ER model. In this course we will follow **Chen's notation**.

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder



# ER Model Notations

FIGURE 2.3 THE ER MODEL NOTATIONS




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Agenda

- **Data Modelling**
  - ❑ Data model as a (relatively) simple abstraction of the complex real-world (for the purpose of creating a DB).
  - ❑ A good DBMS will perform poorly with a poorly designed database.
  - ❑ One modelling technique to design a database: **Entity Relationship Modelling**
- **Entity Relationship Modelling**
  - ❑ Entity Types and Entity Instances
  - ❑ Attributes and Values
  - ❑ Keys
  - ❑ Relationships
  - ❑ Connectivity
  - ❑ Cardinality

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Entity Relationship Modelling (ERM)

- Basis of an entity relationship diagram (ERD)

Assignment Project Exam Help

- ERD depicts the:
  - Conceptual database as viewed by end user
  - Database's main components
    - Entities (Tables)
    - Attributes (Columns of tables)
    - Relationships (Associations between tables)

https://powcoder.com

Add WeChat powcoder

- Entity - Refers to the entity set and not to a single entity occurrence

# Entity (Type) and (Entity) Instance

- **en·ti·ty** /ˈentitē/ (Noun)
  - A thing with distinct and independent existence.
  - Existence; being: "entity and nonentity".
- Synonyms: being - existence - essence - thing

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

- **in·stance** /ˈinstəns/ (Noun)
  - An example or single occurrence of something: "an instance of corruption".
  - A particular case: "in this instance".
- Synonyms: example - case - sample - event - occurrence - exemplar

- One type of things is a Person. Joe is an instance of Person.
- One type of things is a Drink. Espresso an instance of Drink.

# Entity (Type) and (Entity) Instance

- **Entities**: “An **entity** is an object about which the system requires to hold data.”
- An **entity type** (entity class) is a collection of entities that share common properties or characteristics (similar to be grouped into one Entity Type).
- It is represented as a rectangle **box in the ER model** diagram with the name of the entity inside.
- An **entity instance** is a **single occurrence of an entity type.**

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

**STUDENT**

| **Entity Type** | **Entity Instances** | | |
|---|---|---|---|
| STUDENT | z1234567 | Martin, S. | BEng |
| | z1357926 | Fong, L. | BSc |



UNSW SYDNEY

# ER Model with Only Appropriate Entities

A treasurer looks after researchers' research accounts. Each account pays more than one expenses. The treasure prints expense reports regularly, e.g., every month.

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

# Attribute

**Characteristics of entities**

- **Required attribute**: Must have a value, cannot be left empty
- **Optional attribute**: Does not require a value, can be left empty
- **Domain**: Set of possible values for a given attribute
- **Identifiers**: One or more attributes that uniquely identify each entity instance
  called Keys in the relational model

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

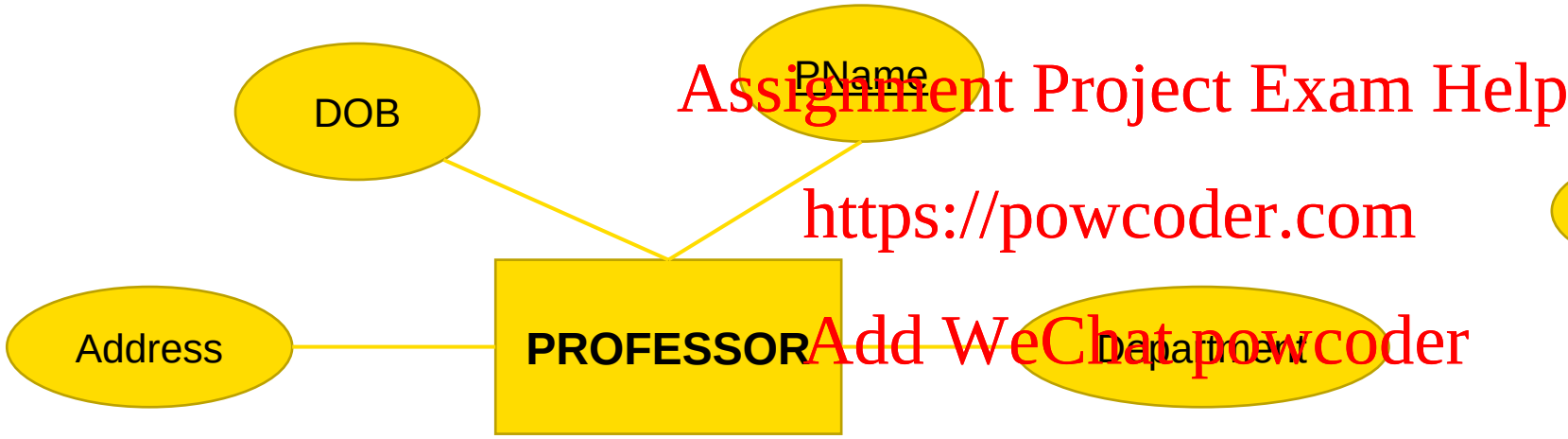
# Attributes

- **Simple attribute**: Attribute that cannot be subdivided
  - ❑ Example: zID
- **Composite attribute**: Attribute that can be subdivided to yield additional attributes
  - ❑ Example: Address (= street, city, state, area code)
- **Single-valued attribute**: Attribute that has only a single value
- **Multivalued attribute**: Attribute that have many values
- **Derived attribute:** Attribute that derived using an algorithm

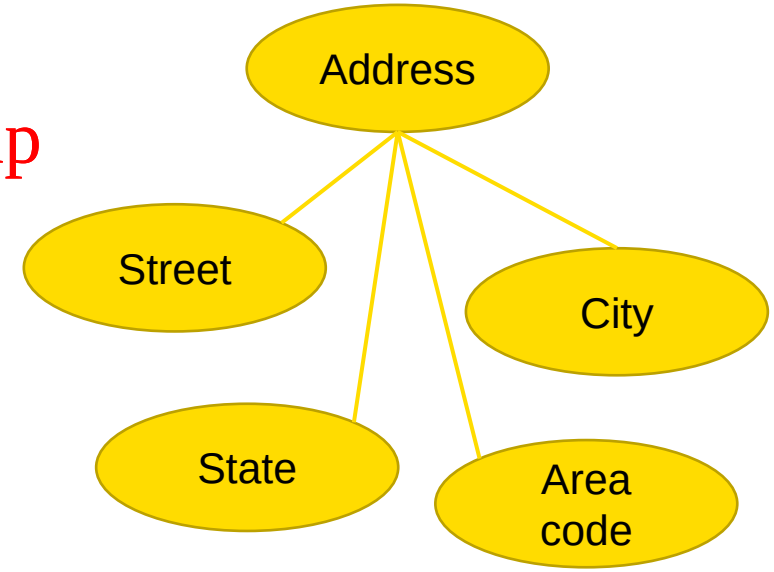
Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

- **A Key attribute** is unique so to identify the entity.

# Example of Attributes




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

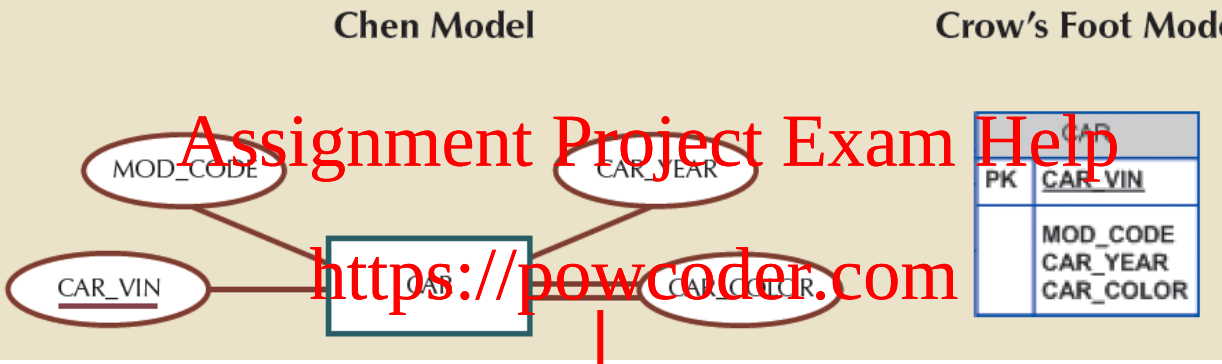



Entity: PROFESSOR
Attribute: PName, Department, Address, DOB

Composite attribute: Address

# A Multivalued Attribute in an Entity

FIGURE 4.3 A MULTIVALUED ATTRIBUTE IN AN ENTITY




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

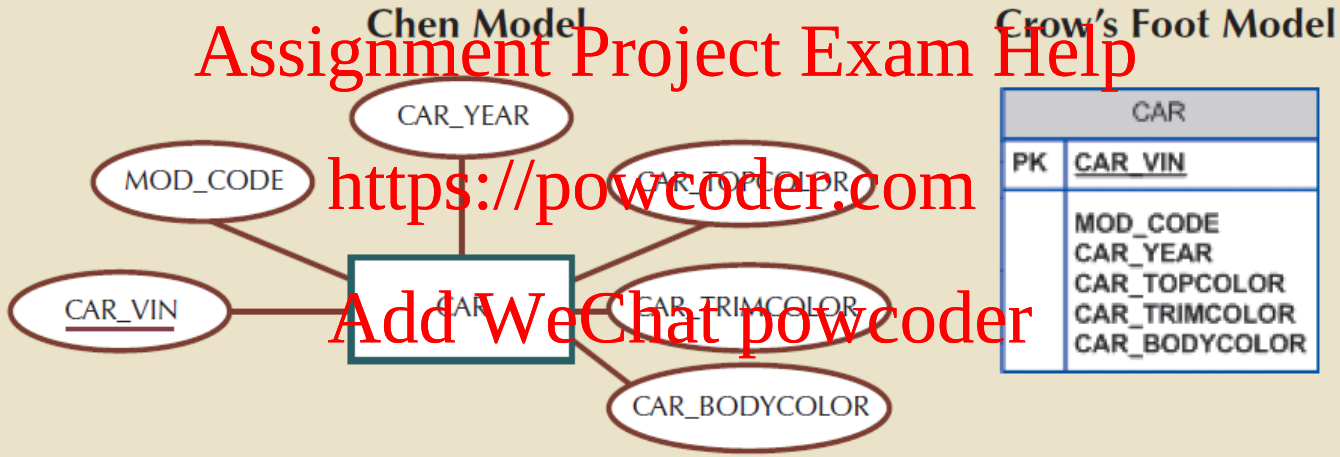
multiple values




UNSW SYDNEY

# Splitting the Multivalued Attributes into New Attributes

FIGURE 4.4 SPLITTING THE MULTIVALUED ATTRIBUTE INTO NEW ATTRIBUTES




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Is this a good idea?

Depends on your design!

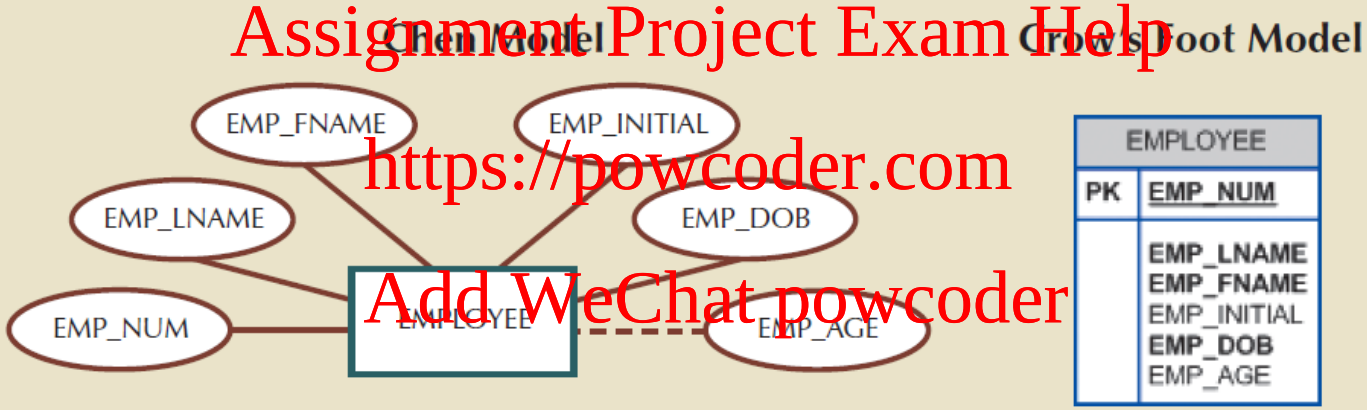


UNSW SYDNEY

# Depiction of a Derived Attribute

Derived attribute is when the value is calculated from other attributes.
e.g., EMP_AGE can be calculated from EMP_DOB.

FIGURE 4.6 DEPICTION OF A DERIVED ATTRIBUTE




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Do we need EMP_AGE?

Technically, we do not store the employee's age because we can calculate from date of birth of the employee. Otherwise, you have to update the age every day.

# Advantages and Disadvantages of Storing Derived Attributes

Assignment Project Exam Help

| | Derived Attribute: Stored | Derived Attribute: Not Stored |
|---|---|---|
| **Advantage** | • Saves CPU processing cycles<br>• Saves data access time<br>• Data value is readily available<br>• Can be used to keep track of historical data | • Saves storage space<br>• Computation always yields current value |
| **Disadvantage** | • Requires constant maintenance to ensure derived value is current, especially if any values used in the calculation change | • Uses CPU processing cycles<br>• Increases data access time<br>• Adds coding complexity to queries |

https://powcoder.com

Add WeChat powcoder

# Keys

- Consist of one or more attributes that determine other attributes
- Used to
  - ❑ Ensure that each row in a table is uniquely identifiable
  - ❑ Establish relationships among tables and to ensure the integrity of the data

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

- **Primary key (PK)**: Attribute or combination of attributes that uniquely identifies any given row

For example, STUDENTS table, the PK is zID; EMPLOYEES table, PK is employee ID.
A PK may contain more than one attribute.

# Find the Primary Keys

| Table: STUDENT | Example |
|---|---|
| zID | z1234567 |
| Email | z1234567@student.unsw.edu.au |
| LastName | Bold |
| FirstName | Alice |
| DOB | 28/02/2010 |

| Table: CLASS_ENR | Example |
|---|---|
| zID | z1234567 |
| CourseID | COMM1822 |
| TermID | 2022T2 |
| Lab | W16A |
| Lecture | M18A |

| Table: COURSE | Example |
|---|---|
| CourseID | COMM1822 |
| CourseName | Intro to DB for BusAn |

| Table: DEGREE | Example |
|---|---|
| zID | z1234567 |
| ProgramID | 3347 |

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

For simplicity, not all attributes are included in the tables. Also, I used COMM1822 as the course ID.

# Answer for the Primary Keys

| Table: STUDENT | Example | Keys |
|---|---|---|
| zID | z1234567 | PK |
| Email | z1234567@student.unsw.edu.au | |
| LastName | Bold | |
| FirstName | Alice | |
| DOB | 28/02/2010 | |

| Table: CLASS_ENR | Example | Keys |
|---|---|---|
| zID | z1234567 | PK |
| CourseID | COMM1822 | PK |
| TermID | 2022T2 | PK |
| Lab | W16A | |
| Lecture | M18A | |

| Table: COURSE | Example | Keys |
|---|---|---|
| CourseID | COMM1822 | PK |
| CourseName | Intro to DB for BusAn | |

| Table: DEGREE | Example | Keys |
|---|---|---|
| zID | z1234567 | PK |
| ProgramID | 3347 | PK |

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Types of Keys

- **Composite key**: Key that is composed of more than one attribute

  e.g., the CLASS_ENR table has (zID, CourseID, TermID) is a composite key

- **Key attribute**: Attribute that is a part of a key

Assignment Project Exam Help

https://powcoder.com

- **Superkey:** Key that can uniquely identify any row in the table

  e.g., zID, {zID, Last_Name}, {zID, First_Name}, {zID, First_Name, Last_Name}, … in STUDENT table

Add WeChat powcoder

- **Candidate key**: Minimal superkey

  e.g., zID in STUDENT table; mobile number can identify you if you forget your rewards card.

- **Entity integrity**: Condition in which each row in the table has its own unique identity
  - ❑ All of the values in the primary key must be unique
  - ❑ No key attribute in the primary key can contain a null



UNSW SYDNEY

# Types of Keys

- **Null**: Absence of any data value that could represent
  - ❑ An unknown attribute value
  - ❑ A known, but missing, attribute value
  - ❑ An inapplicable condition
- **Referential integrity**: Every reference to an entity instance by another entity instance is valid
- **Foreign key (FK)**: Primary key of one table that has been placed into another table to create a common attribute
- **Secondary key:** Key used strictly for data retrieval purposes

  e.g., people do not remember their membership no. (PK), the secondary key can be their name, which may not be unique.

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Example of Foreign Key

| Table: CLASS_ENR | Example | Keys |
|---|---|---|
| zID | z1234567 | PK, FK |
| CourseID | COMM1822 | PK |
| TermID | 2022T2 | PK |
| Lab | W16A | |
| Lecture | M18A | |

| Table: COURSE | Example | Keys |
|---|---|---|
| CourseID | COMM1822 | PK |
| CourseName | Intro to DB for BusAn | |

| Table: DEGREE | Example | Keys |
|---|---|---|
| zID | z1234567 | PK, FK |
| ProgramID | 3347 | PK |

| Table: STUDENT | Example | Keys |
|---|---|---|
| zID | z1234567 | PK |
| Email | z1234567@student.unsw.edu.au | |
| LastName | Bold | |
| FirstName | Alice | |
| DOB | 28/02/2010 | |

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Relationships

A relationship is a link between two entities which is significant for the system.

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

- The **degree of a relationship is the number of entity types** that participate in that relationship.
- The most common relationships are **unary, binary, ternary, and quaternary**.
- The relationships between entities can be
  - ❑ One-to-One 1:1
  - ❑ One-to-Many 1:M
  - ❑ Many-to-Many M:N



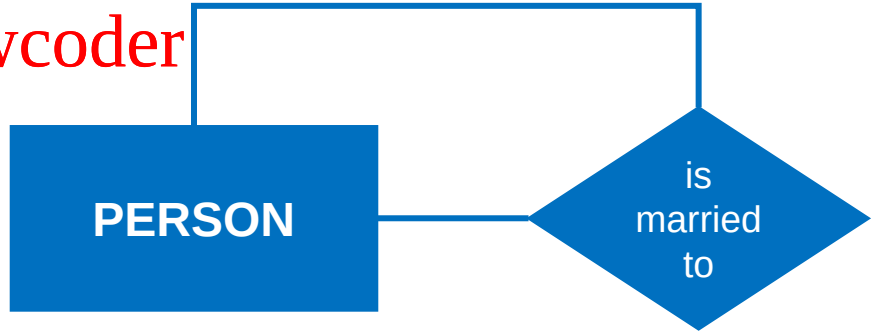
UNSW SYDNEY

# Entity Relationships

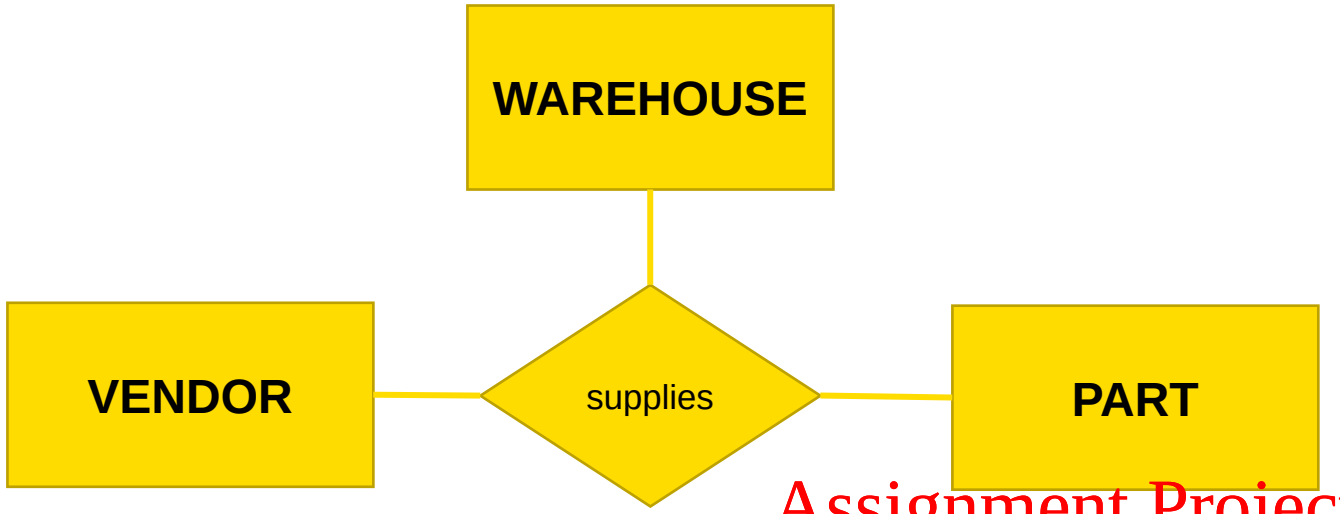

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Entity 1 Relationship Entity 2

Binary Relationship (2 entities)



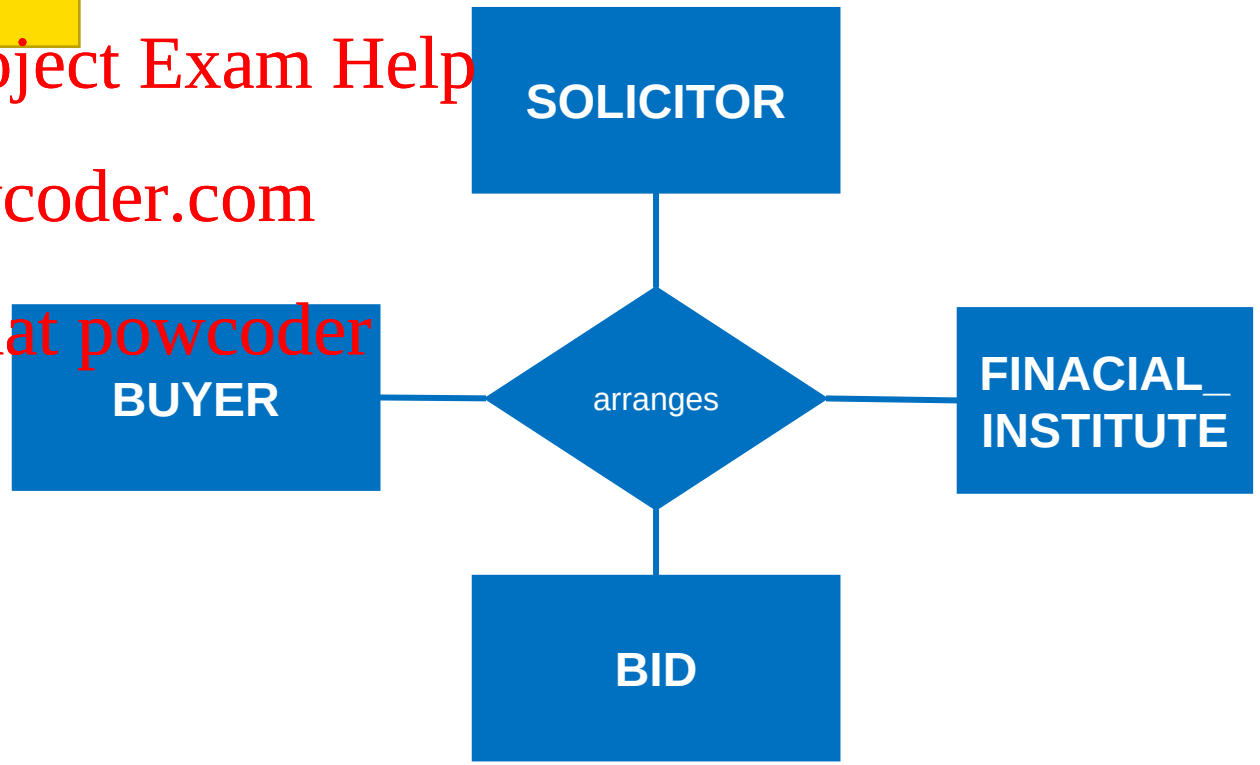

Unary Relationship (1 entity)




Ternary Relationship (3 entities)

Quaternary Relationship (4 entities)

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder



# Connectivity

- **Connectivity** is used to describe the **relationship classification**.
- The ER diagram indicates connectivity by using a numeric notation.

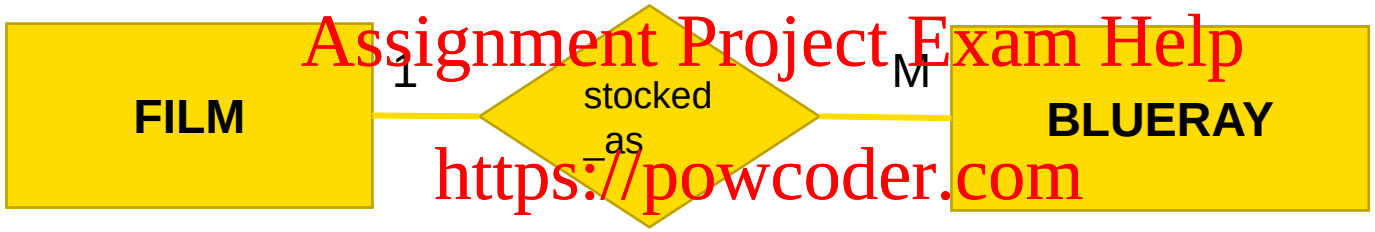
Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Basic Relationship (One-to-One 1:1)


Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

| State | | Capital City |
|---|---|---|
| NSW | ---------- | Sydney |
| Victoria | ---------- | Melbourne |

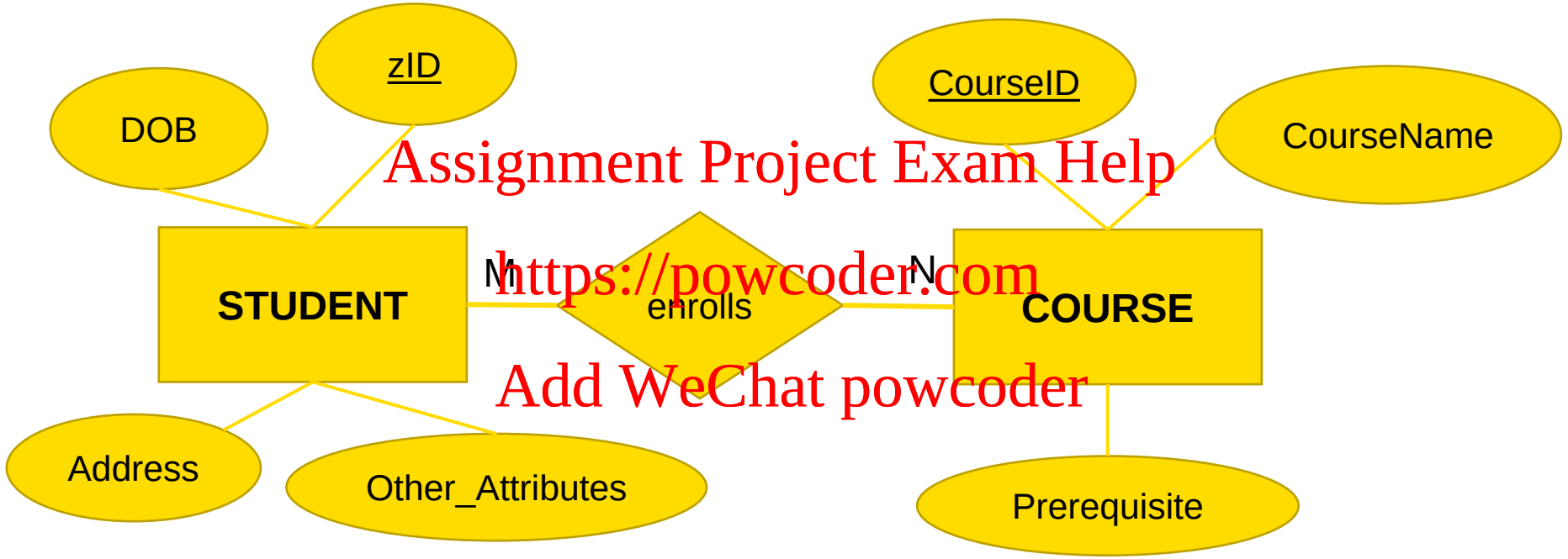
# Basic Relationship (One-to-Many 1:M)




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

- A movie (e.g., Avengers) can be stocked as several blurays (e.g., 30 copies)
- All blurays contain a film.
- There is “one-to-many” relationship between film and bluray.

# Basic Relationship (Many-to-Many M:N)




Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

- A student enrolls many courses.
- Each course is enrolled by many students.

# Cardinality

- **Cardinality** expresses the **specific number of entity occurrences associated with one occurrence of related entity.**

Assignment Project Exam Help

- A **cardinality constraint** specifies the number of instances of entity A that can be associated with each instance of entity B. Cardinality constraints are derived from business rules.

https://powcoder.com

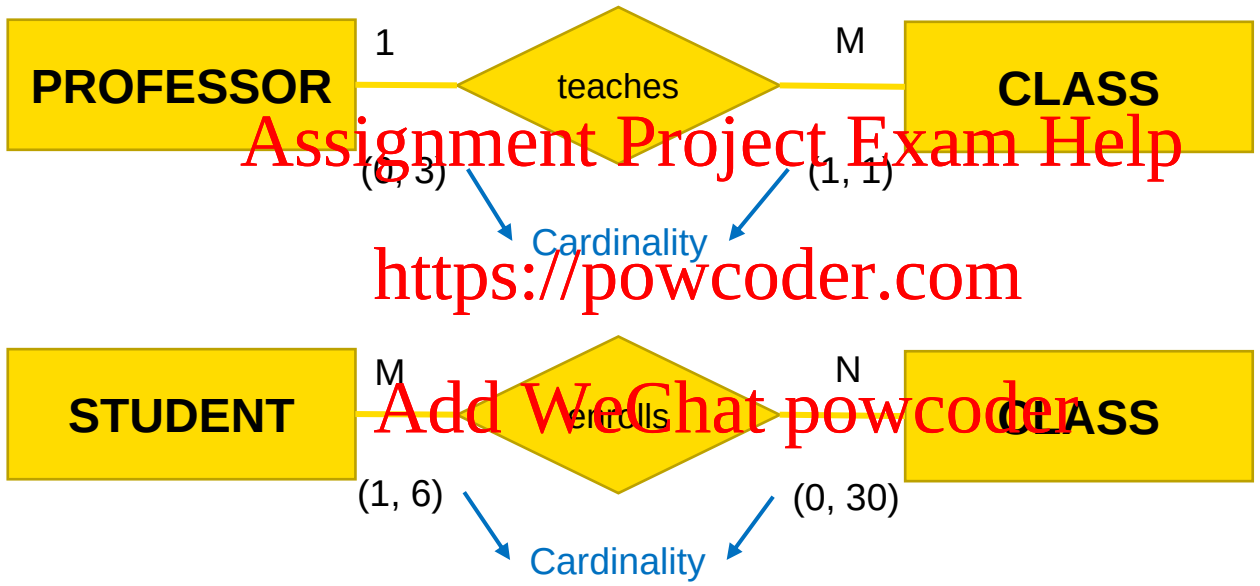
- **Business rules**: They are derived from organisation's data environment.

Add WeChat powcoder

- **Minimum cardinality** is the minimum number of instances of one entity that may be associated with each instance of another entity.

- **Maximum cardinality** is the maximum number of instances of one entity that may be associated with each instance of another entity.

# Examples of Cardinality




One-to-Many Relationship

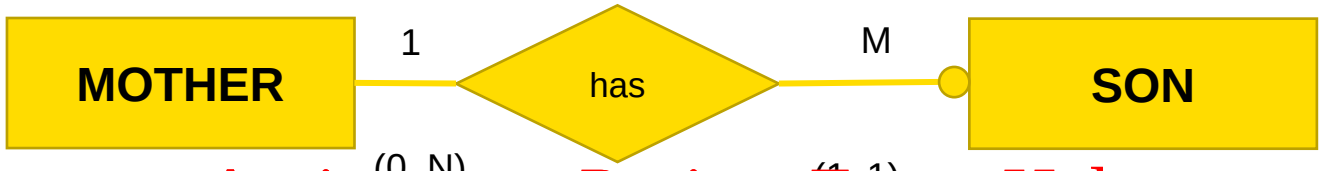
Many-to-Many Relationship

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

How to read this?

- A professor teaches (0, 3) classes. A class is taught by (1, 1) professors.
- A student enrolls in (1, 6) classes. A class has enrolled in it (0, 30) students.

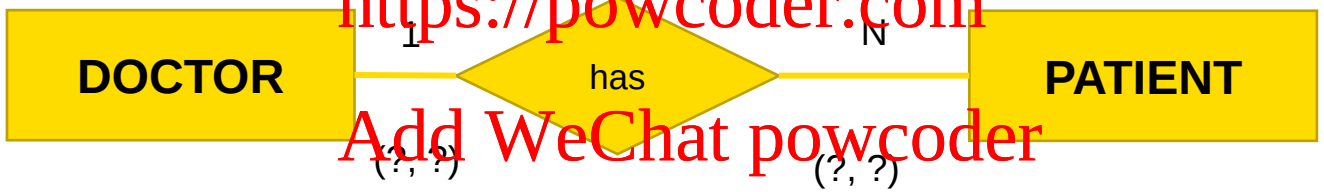
# Relationship Participation




Assignment Project Exam Help

Optional relationships for MOTHER, mandatory relationship for SON

https://powcoder.com




Add WeChat powcoder

Mandatory relationship between DOCTOR & PATIENT

- A participating entity in a relationship can be either **optional** or **mandatory**.
- Determined by the **specific meaning of the terms used**.
  - ❑ Depends on context.
  - ❑ Need to state assumptions.

# Ternary Relationships

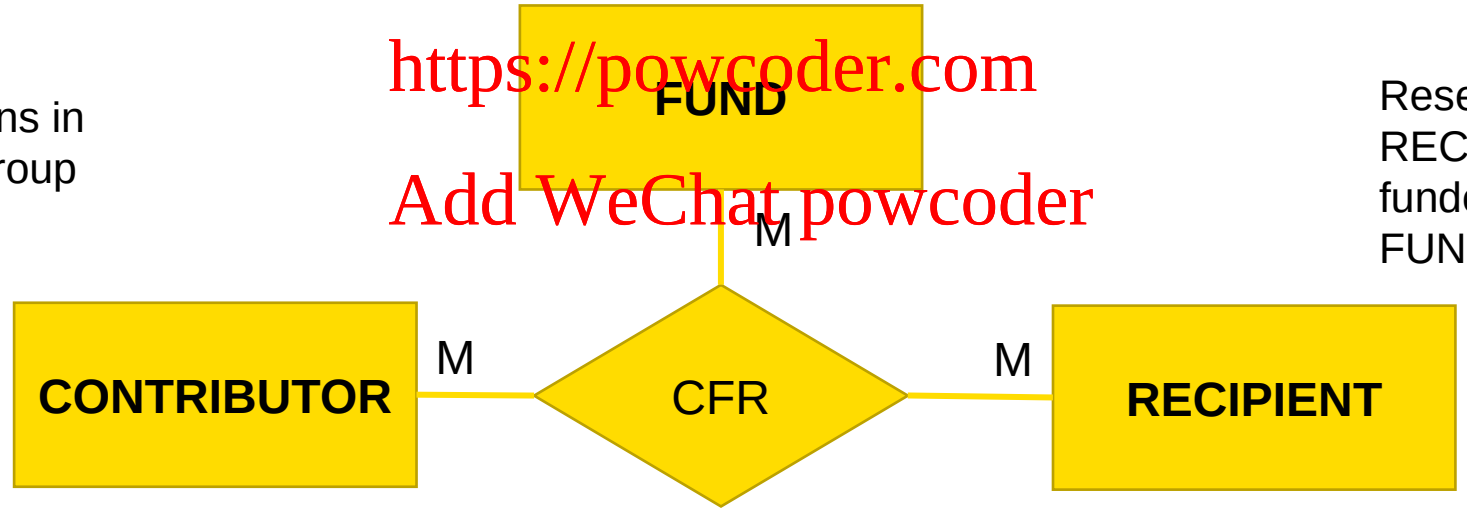
Research fund may be placed into several categories.

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

People or institutions in CONTRIBUTOR group donate money to a special research FUND.




Researchers found in RECIPIENT are funded through the FUND contents.

# Relationship, Connectivity, Cardinality

- **Relationship:** Association between entities that always operate in both directions
  tables
- **Participants**: Entities that participate in a relationship
  - The most common relationships are unary, binary, ternary, and quaternary.
- **Connectivity**: Describes the relationship classification
  1:1, 1:M and M:N
- **Cardinality**: Expresses the minimum and maximum number of entity occurrences associated with one occurrence of related entity
  e.g., how many classes at most one professor can teach.

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Recap: ER Modelling Part 1

- **Data Modelling**
  - ❑ Data model as a (relatively) simple abstraction of the complex real-world (for the purpose of creating a DB).
  - ❑ A good DBMS will perform poorly with a poorly designed database.
  - ❑ One modelling technique to design a database: **Entity Relationship Modelling**
- **Entity Relationship Modelling**
  - ❑ Entity Types and Entity Instances
  - ❑ Attributes and Values
  - ❑ Keys
  - ❑ Relationships
  - ❑ Connectivity
  - ❑ Cardinality

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

# Questions


Source: tryinteract.com