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INFORMATION  
TECHNOLOGY

# FIT2094 Databases

Assignment Project Exam Help

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## Week 2 - Conceptual Modelling

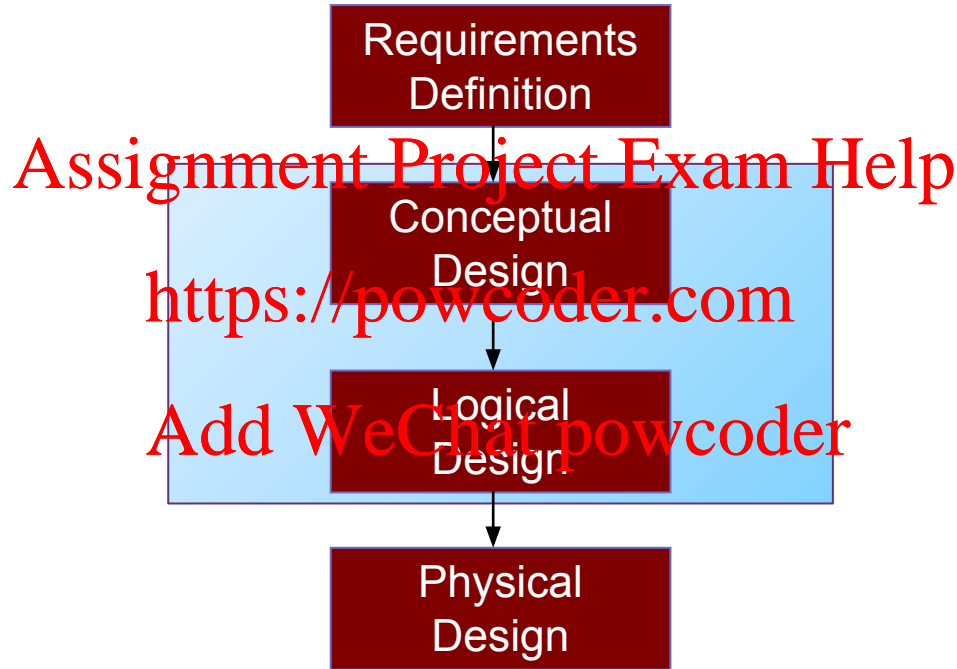
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*Please obtain a copy of the Drone case study for this workshop from the week 2 block on Moodle under "Workshop Resources" header*

Workshop S1 2022



# The Database Design Life Cycle



# Requirements Definition

- Identify and analyse user views.
- A 'user view' may be a report to be produced or a particular type of transaction that should be supported.
- Corresponds to the external level of the ANSI/SPARC architecture.
- Output is a statement of specifications which describes the user views' particular requirements and constraints.

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# Different views of the underlying data

**Web Enrolment System**

Enrolment / Re-Enrolment

Fees / Scholarships

Student Services

Course Progression

Enrolment Access Dates

WES Guides

**Monash Links**

my.monash

Allocate+ (Class Allocation)

Class Timetable (prev. MUTTS)

Moodle

Unit code	Action	Unit name	Campus	Semester	Type	Credits
ACF1200	Change Remove	Accounting for managers PENDING - ENROLLED	CAUL	Semester 1 (2018)	ON-CAMPUS	6
BFF1001	Change Remove	Foundations of finance PENDING - ENROLLED	CAUL	Semester 1 (2018)	ON-CAMPUS	6
BTF1010	Change Remove	Business law PENDING - ENROLLED	CAUL	Semester 2 (2018)	ON-CAMPUS	6
MKF1120	Change Remove	Marketing theory and practice PENDING - ENROLLED	CAUL	Semester 1 (2018)	ON-CAMPUS	6
ECF1100	Change Remove	Microeconomics PENDING - ENROLLED	CAUL	Semester 2 (2018)	ON-CAMPUS	6
ETF1100	Change Remove	Business statistics PENDING - ENROLLED	CAUL	Semester 2 (2018)	ON-CAMPUS	6
MGF1010	Change Remove	Introduction to management PENDING - ENROLLED	CAUL	Semester 2 (2018)	ON-CAMPUS	6
MKF2111	Change Remove	Buyer behaviour PENDING - ENROLLED	CAUL	Semester 2 (2018)	ON-CAMPUS	6
Total credits:						48

If you do not get a Transaction Number after you submit, your enrolment is not complete.

handbook.monash.edu/2022/units/FIT2094?year=2022

Overview

Offerings

Rules

Contacts

Learning outcomes

Teaching approach

Assessment summary

Scheduled teaching activities

Workload requirements

Learning resources

**Learning outcomes** Expand all

On successful completion of this unit, you should be able to:

1. Apply the theories of the relational database model;
2. Develop a sound relational database design;
3. Implement a relational database based on a sound database design;
4. Manage data that meets user requirements, including queries and transactions;

Contrast the differences between non-relational database models and the relational database model.

**Teaching approach** Expand all

Peer-assisted learning

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Student

Allocate<sup>+</sup>

Staff & Student

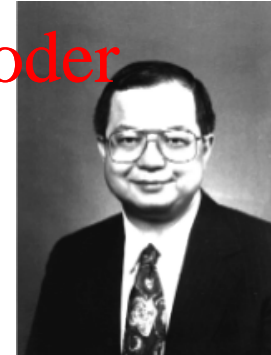
Admin



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# ER Modeling

- ER (Entity-Relationship) model developed by Peter Chen in 1976 to aid database design.
- Used for conceptual model (ERD).
- ER diagrams give a visual indication of the design.
- Basic components:
  - Entity
  - Attribute
  - Relationship



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# Conceptual Design

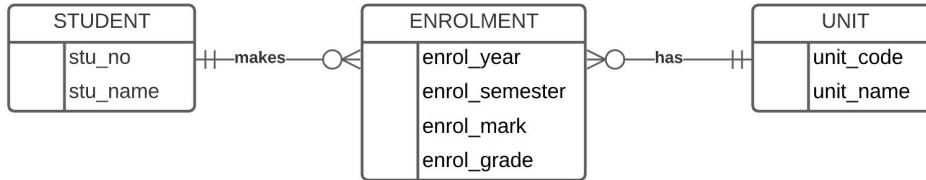
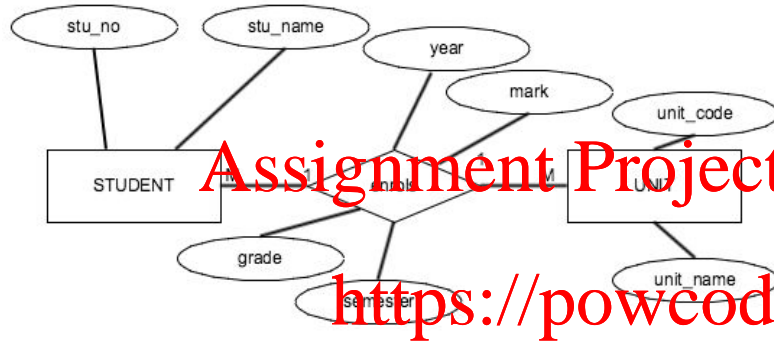
- Develop the enterprise data model.
- Corresponds to the conceptual level of the ANSI/SPARC architecture.
- *Independent of all physical implementation considerations (the type of database to be used)*
- Various design methodologies may be employed such as UML, ER (Entity-Relationship) Modelling and Semantic Modelling.
- ER consists of ENTITIES and RELATIONSHIPS between entities
  - An ENTITY will have attributes (things we wish to record), one or more of which will identify an entity instance (called the KEY)

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# ERD - Notation



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Information

Engineering/James  
Martin/Crows foot

***\* This is what we will  
be using***

# Conceptual Level (ER Model)

## ENTITY

Collection of "Customer(s)"

## RELATIONSHIP

Connects entities - on a conceptual model this is the **ONLY** manner in which entities are connected

## KEY ATTRIBUTE(S)

Instance identifier

## NON KEY ATTRIBUTE

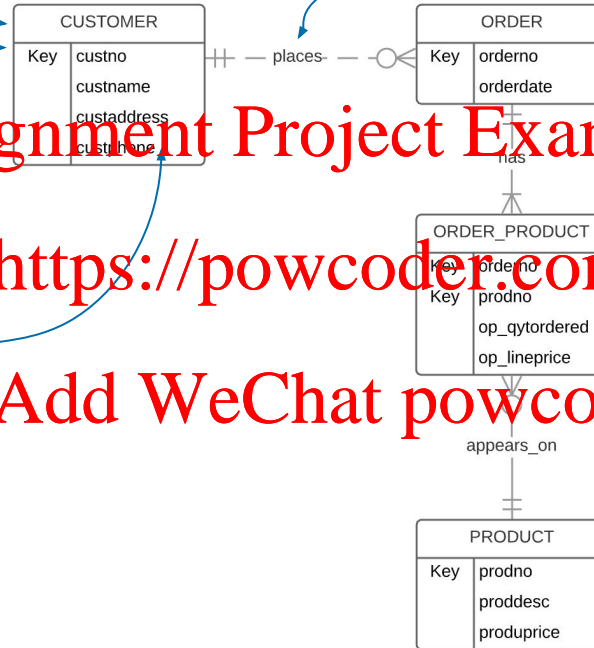
Other non-key attributes

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Assignment 1A





**Q1. In your group, discuss your pre workshop identification of the Monash Software Entities. How many entities did your group identify?**

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- A. 2 <https://powcoder.com>
- B. 4 Add WeChat powcoder
- C. 5
- D. 6

# Conceptual Level (Monash Software Entities)

TRAINING	
Key	training_code

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TEAM	
Key	team_no

EMPLOYEE	
Key	emp_no

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FAMILY_MEMBER	
Key	

# Logical Design

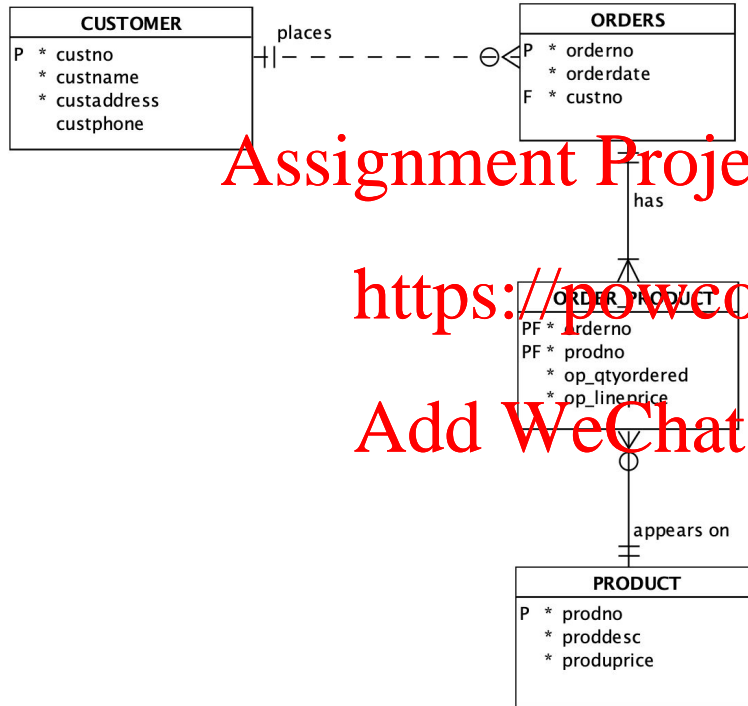
- Develop a data model which targets a particular database type (e.g. relational, hierarchical, network, object-oriented, noSQL).
- Independent of any implementation details which are specific to any particular vendors DBMS package.
- Normalisation technique (see week 4) is used to test the correctness of a relational logical model.

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# Logical Level (Logical Model - Relational)



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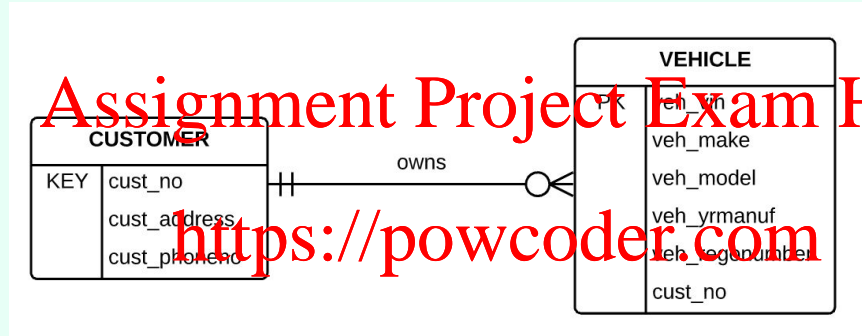
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Assignment 1B

Q2. Is the diagram shown below a valid *Conceptual Model*?

Be prepared to justify your answer with why you chose this option



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- A. Yes
  - B. No
  - C. Depends on how it is implemented in the database

# Physical Design

- Develop a strategy for the physical implementation of the logical data model.
- Choose appropriate structures, indexes, file organisations and access methods which will most efficiently support the user requirements (not part of unit).
- Physical design phase is dependent on the particular DBMS in use.
- ANSI/SPARC internal level.

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# Physical Level – Starting point

```
Oracle Database 12c  Relational_1  Generate

8 CREATE TABLE customer (
9     custno      NUMBER(7) NOT NULL,
10    custname     VARCHAR2(50) NOT NULL,
11    custaddress  VARCHAR2(50) NOT NULL,
12    custphone    CHAR(10)
13 );
14
15 COMMENT ON COLUMN customer.custno IS
16     'Customer number';
17
18 COMMENT ON COLUMN customer.custname IS
19     'Customer name';
20
21 COMMENT ON COLUMN customer.custaddress IS
22     'Customer address';
23
24 COMMENT ON COLUMN customer.custphone IS
25     'Customer phone number';
26
27 ALTER TABLE customer ADD CONSTRAINT customer_pk PRIMARY KEY ( custno );
28
29 CREATE TABLE order_product (
30     orderno      NUMBER(7) NOT NULL,
31     prodno       NUMBER(7) NOT NULL,
32     op_qtyordered NUMBER(3) NOT NULL,
33     op_lineprice  NUMBER(8, 2) NOT NULL
34 );
35
```

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The database *schema*

# Important rule for Conceptual Modelling

- ***All that is described in the brief has been included and all that has been included was described in the brief***
  - Every entity, attribute and relationship described in the brief **has been included**, and
  - **Must not add** entities, attributes and relationships which are not included as part of the brief, and
- In a real life scenario if there are concerns about features of the brief, discuss with client
  - For assignments:
    - your client will be the ed forum
    - may make assumptions provided they do not violate this rule

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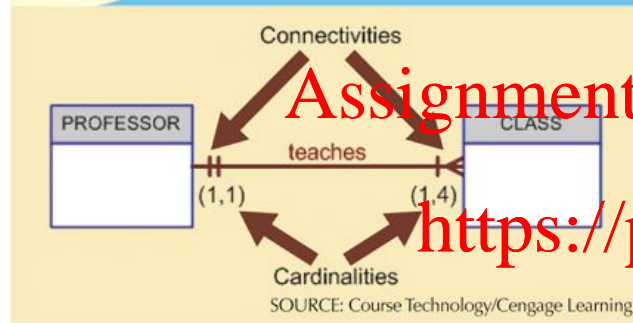
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# CONNECTIVITY/CARDINALITY

FIGURE 4.7

Connectivity and cardinality in an ERD



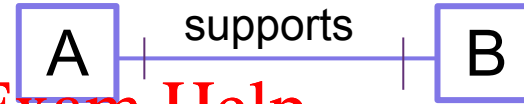
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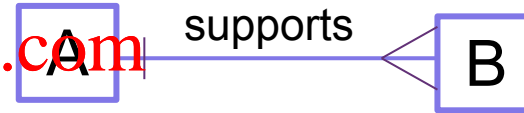
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## CONNECTIVITY

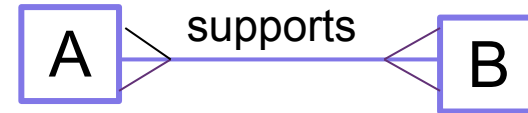
one to one



one to many



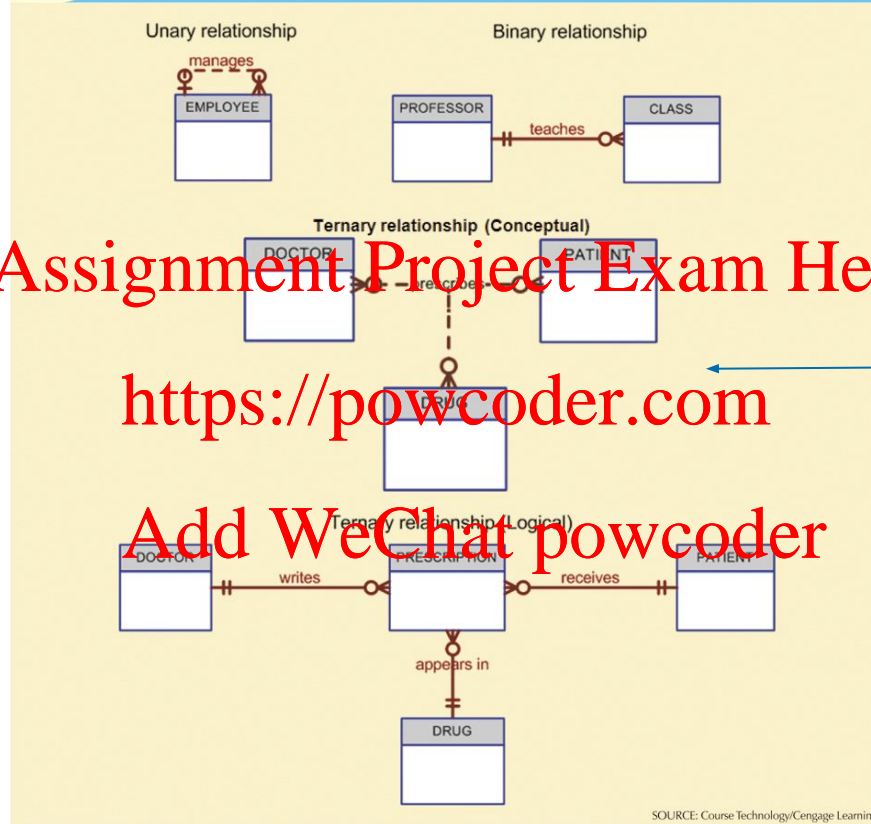
many to many



*In general for Crows Foot notation specific cardinalities are not shown as above eg. (1,4), instead cardinality is depicted via min and max using standard symbols (Inside symbol = min, outside symbol = max)*

FIGURE  
4.15

### Three types of relationship degree



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Note this is not an acceptable form of a conceptual model in Crow's Foot notation (*relationship lines cannot join*)

# Weak vs Strong Entity

- Strong entity
  - Has a key which may be defined without reference to other entities.
  - For example EMPLOYEE entity.
- Weak entity
  - Has a key which requires the existence of one or more other entities.
  - For example FAMILY entity - need to include the key of employee to create a suitable key for family
- Database designer often determines whether an entity can be described as weak based on business rules
  - customer pays monthly account
    - Key: cust\_no, date\_paid, or
    - Key: payment\_no (surrogate? – not at conceptual level)

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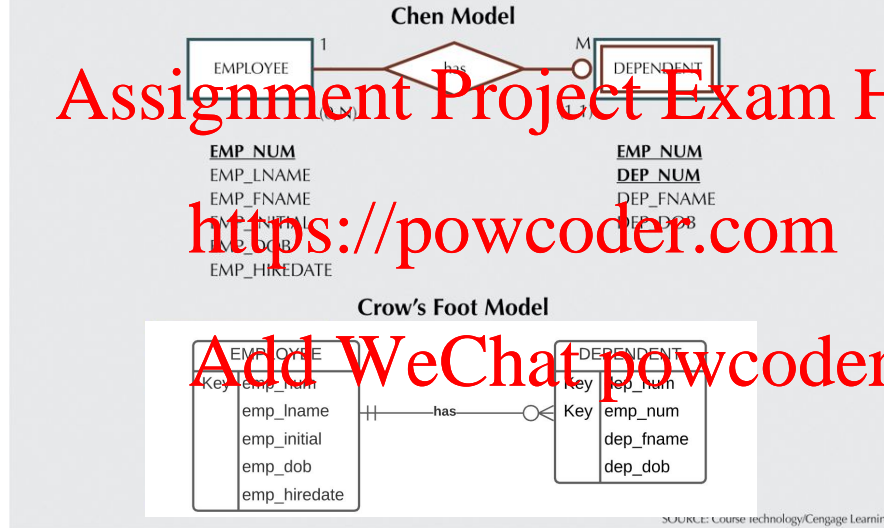
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# Weak vs Strong Entity

FIGURE 4.10

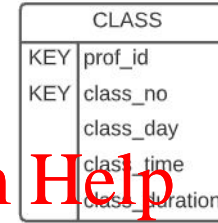
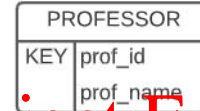
A weak entity in an ERD



*Note the Crow's Foot model shown here has been modified from the text version*

**Q3.**The client indicates that a **CLASS** is identified by a combination of the the **prof\_id** and the assigned class number for the professor (1st class, 2nd class, 3rd class etc):

prof_id	class_no	class_day	...
1,	1,	Tue	
1,	2,	Tue	
1,	3,	Wed	
2,	1,	Thu	
2,	2,	Tue	
....			



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This business rule is captured in the provided diagram. Pick the correct statement for this diagram.

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- A. Both entities are strong entities
- B. PROFESSOR is a strong entity, CLASS is a weak entity
- C. CLASS is a strong entity, PROFESSOR is a weak entity
- D. Both entities are weak entities

# Identifying vs Non-Identifying Relationship

- **Identifying**

- Identifier of A is part of identifier of B.



- **Non-identifying**

- Identifier of A is NOT part of identifier of B.



- Shown with solid line
- ENROLMENT - STUDENT  
Enrolment key includes student id, which is an identifier of student.

- Shown with broken line
- Department no (identifier of department) is not part of Employee's identifier.

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**Q4. The client indicates that a professor may teach several classes, but some professors do not have any assigned classes. Each class is taken by only one professor. Note that in this diagram, each class has a unique class id (class\_id). Pick the most appropriate relationship for this business rule.**



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- B ++ ----- ○+
- C +○- ----- ○<=
- D ++ ----- ○<=

# Types of Attributes

- Simple
  - Cannot be subdivided
  - Age, sex, marital status
- Composite
  - Can be subdivided into additional attributes
  - Address into street, city, zip
- Single-valued
  - Can have only a single value
  - Person has one social security number
- Multi-valued
  - Can have many values
  - Person may have several college degrees
- Derived
  - Can be derived with algorithm
  - Age can be derived from date of birth
- Attribute classification is driven by Client requirements
  - Phone Number?

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**Q5. The HiFlying case study indicates "*HiFlying establishes a drone hire rate as a cost per hour for customers to rent this particular drone (rates per hour are often changed over the life of the drone, as it ages, although they are only interested in recording the current cost per hour for the drone).*" Note that although the hire rate may change over the life of the drone, it is not directly related to the hours flown.**

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**What type of attribute is the drone hire rate?**

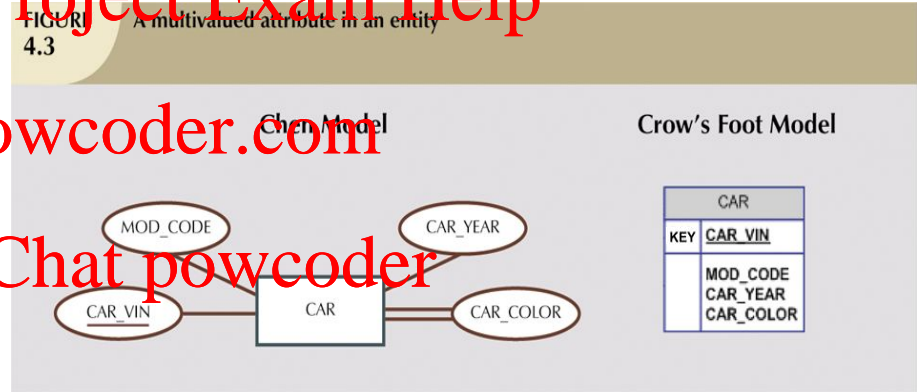
<https://powcoder.com>

- A. Simple
- B. Composite
- C. Single-valued
- D. Multi-valued
- E. Derived

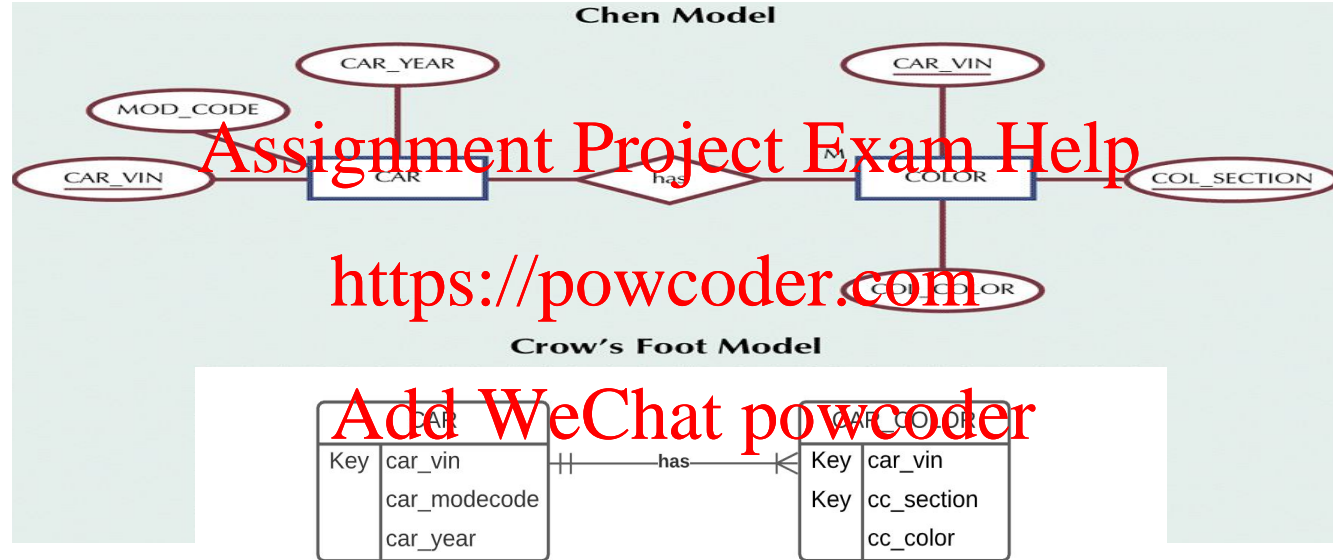
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# Multivalued Attribute

- An attribute that has a list of values.
- For example:
  - Car colour may consist of body colour, trim colour, bumper colour.
- Crow's foot notation does not support multivalued attributes. Values are listed as a separate attribute.

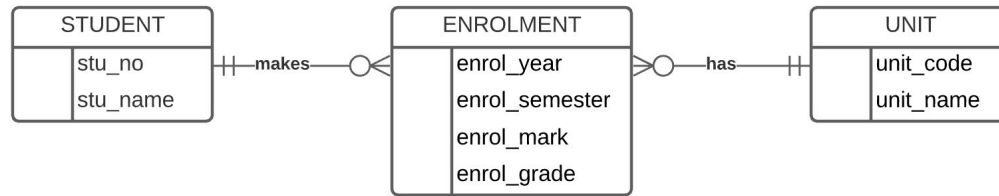
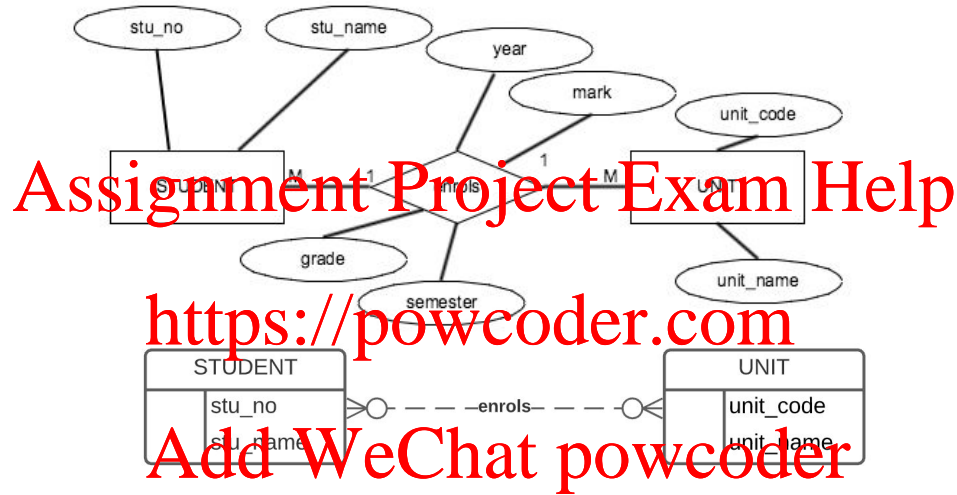


# Resolving Multivalued Attributes

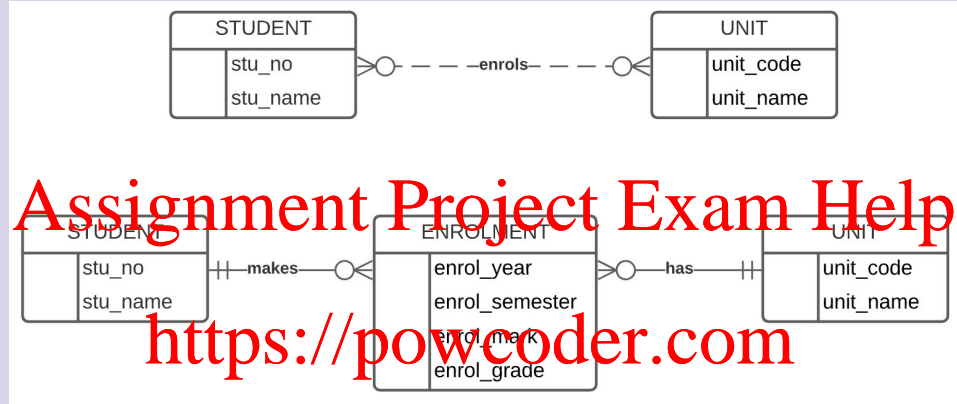


*Note the Crow's Foot model shown here has been modified from the text version*

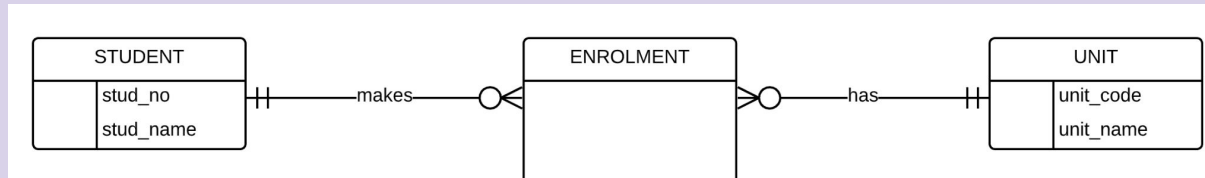
# Associative (or Composite) Entity



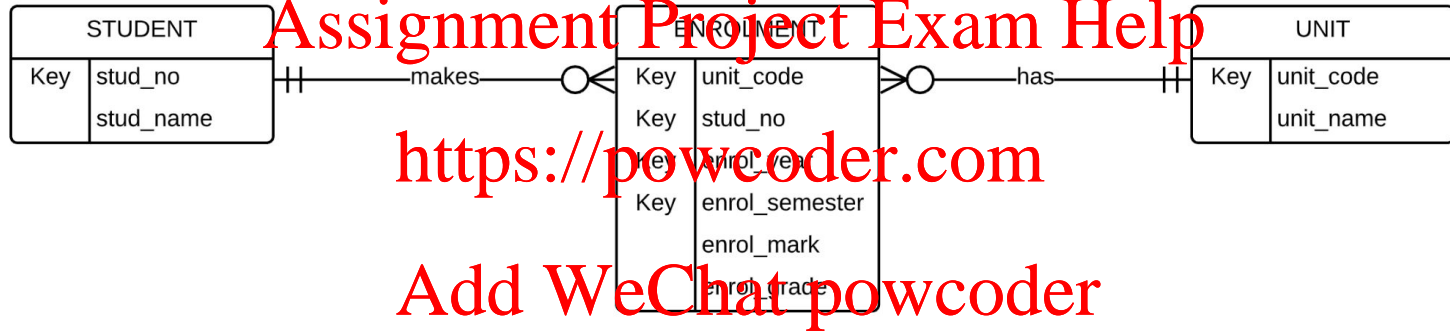
# Associative (or Composite) Entity



Q6. Show all attributes for the three entities and add KEYS:




# Associative or Composite Entities



## Q7. STEP 1: List ALL entities and their key attribute/s which exist in the case study.

For example:

HiFlying Drones



HiFlying Drones

HiFlying Drones is a company which rents drones out to customers.

The company purchases a range of different types of drones in order to meet their customers' requirements. Each type of drone they purchase is assigned a drone type code (e.g. PH4) as the identifier for this type.

To keep track of the drones they purchase, HiFlying identifies each drone with a drone id. When a new drone is added to the system the type of the drone, the date it was purchased and the purchase price are recorded. In addition, HiFlying establishes a cost per hour for each drone type, which can be changed over the life of the drone.

DRONE	
KEY	drone_id

# HiFlying Drones - Step 1 Identify Main Entities

DRONETYPE	
KEY	dt_code

TRAINING	
KEY	train_code

DRONE	
KEY	drone_id

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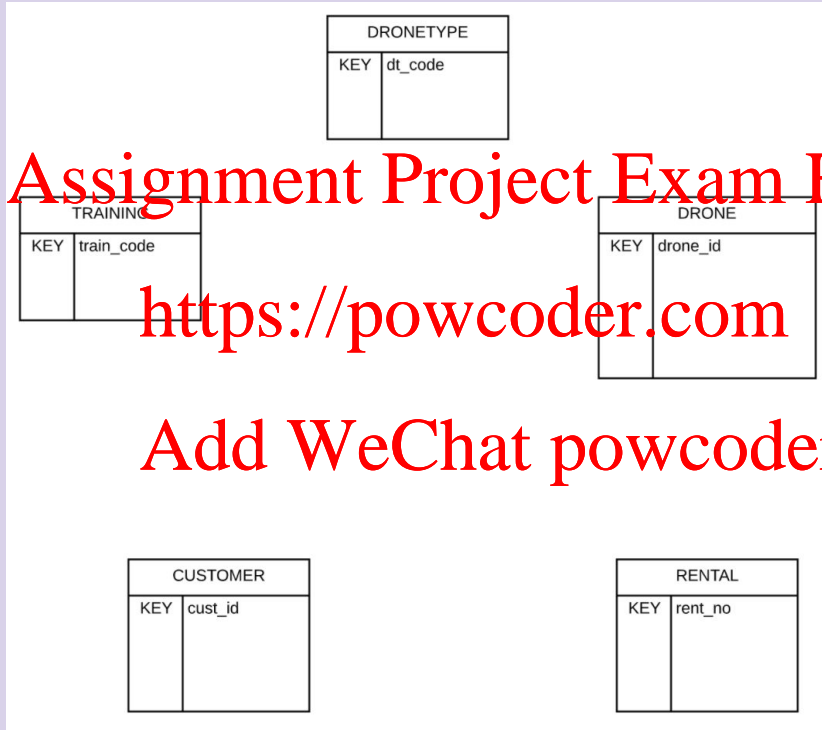
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CUSTOMER	
KEY	cust_id

RENTAL	
KEY	rent_no



**Q8. STEP 2: Identify the relationships which exist between these entities (remember to add an appropriate verb):**

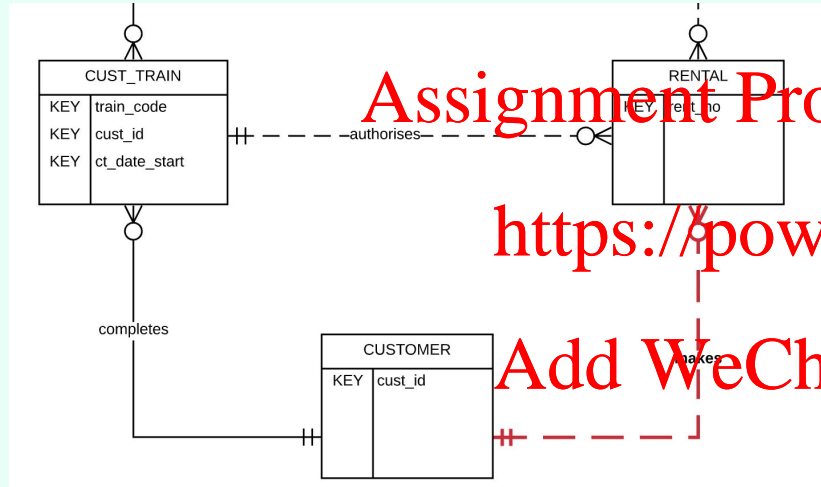


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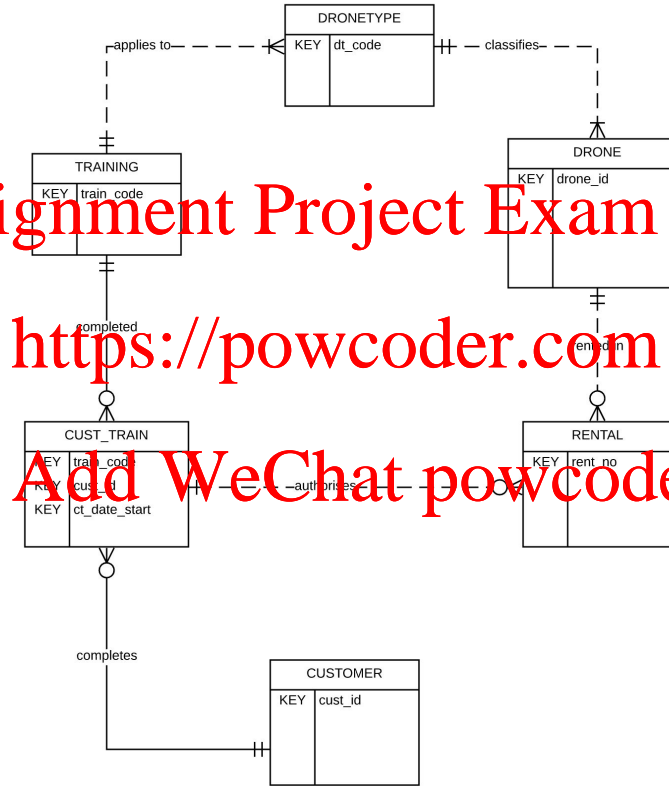
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**Q9. Since a customer makes a rental, should the database designer include a relationship between RENTAL and CUSTOMER?**



- A. Yes, it is an important relationship to capture
- B. No, it is redundant information
- C. It depends on the client's requirements

# HiFlying Drones - Step 2 Identify Relationships

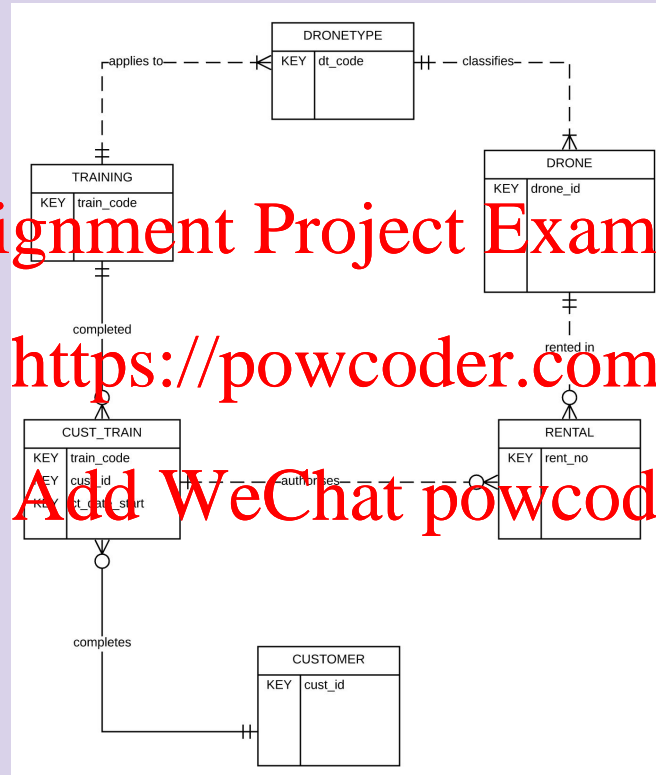


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## Q10. HiFlying Drones - Step 3 Add Non-Key Attributes

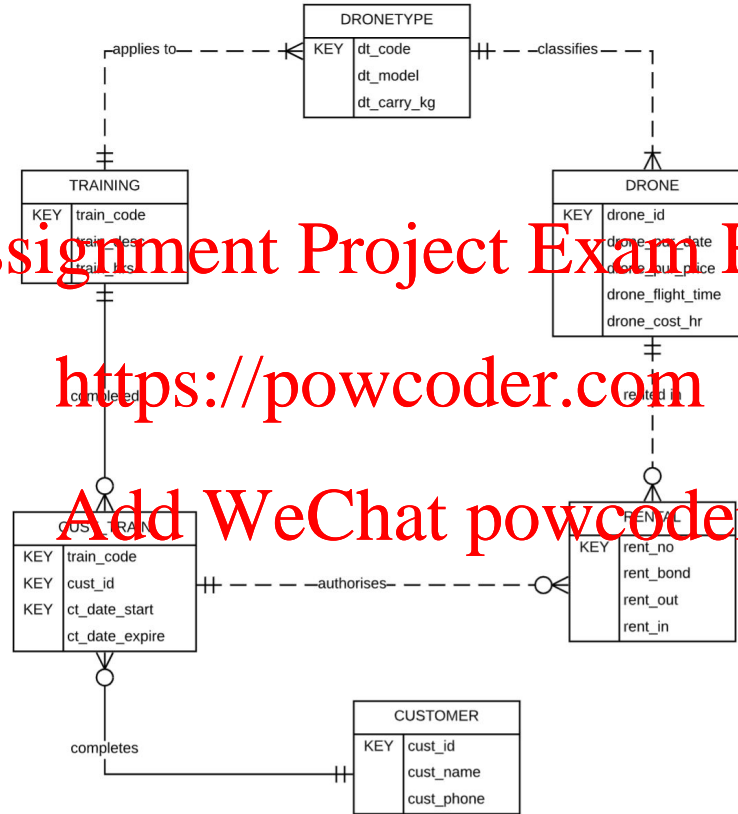


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# HiFlying Drones - Step 3 Add Non-Key Attributes - Final Model



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# Conceptual Model (Monash Software)

You have completed

TRAINING	
Key	training_code

- **Step 1 identify entities and keys**

of the modelling process for Monash Software

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TEAM	
Key	team_no

EMPLOYEE	
Key	emp_no

After the workshop please proceed and complete:

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- **Step 2 Identify Relationships**, and
- **Step 3 Add all non key attributes**

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FAMILY_MEMBER	
Key	

*A video will be provided showing the full process (available from Sunday 5pm).*