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INFORMATION  
TECHNOLOGY

# Database Design 1: Conceptual Modelling

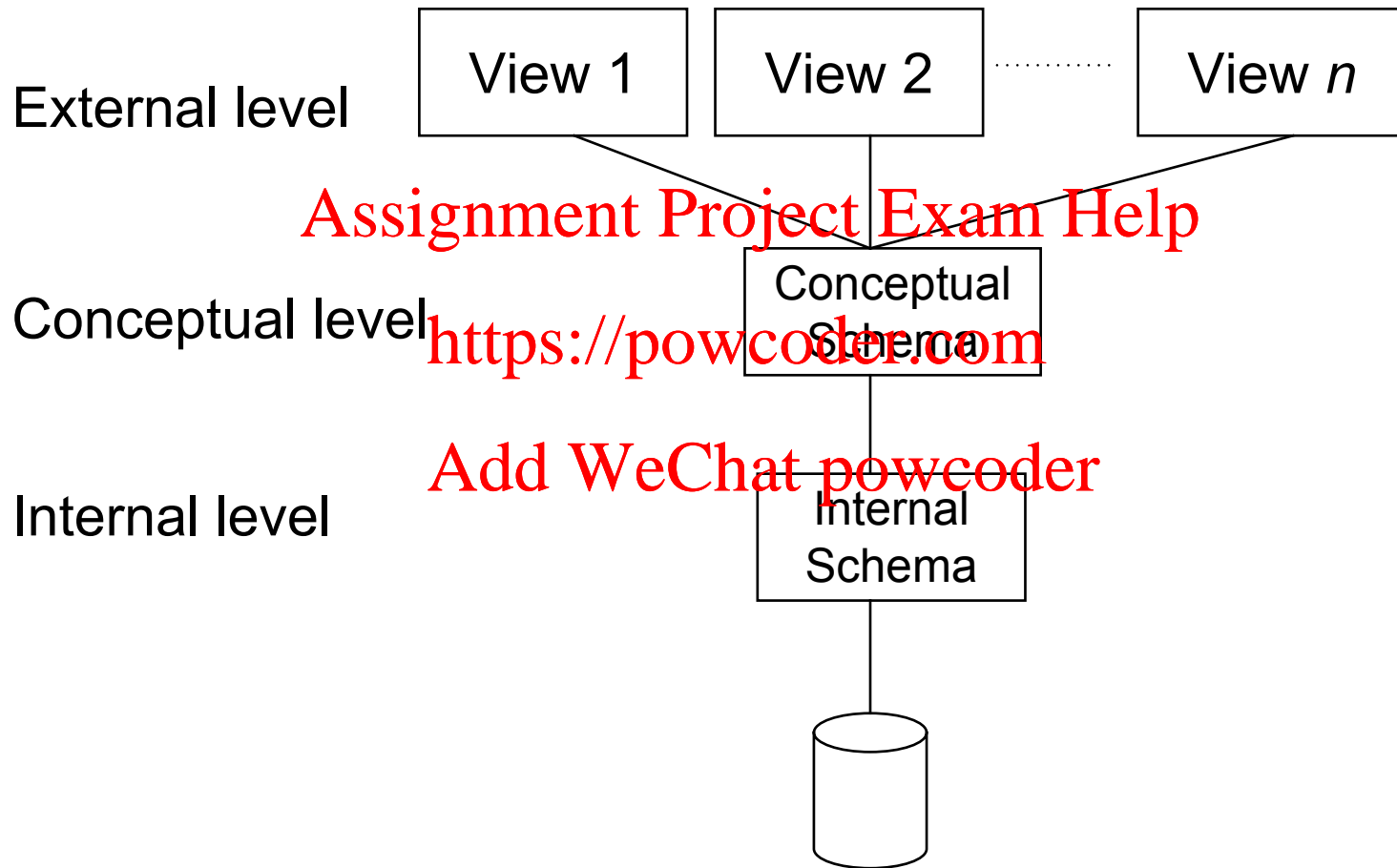
Lindsay Smith

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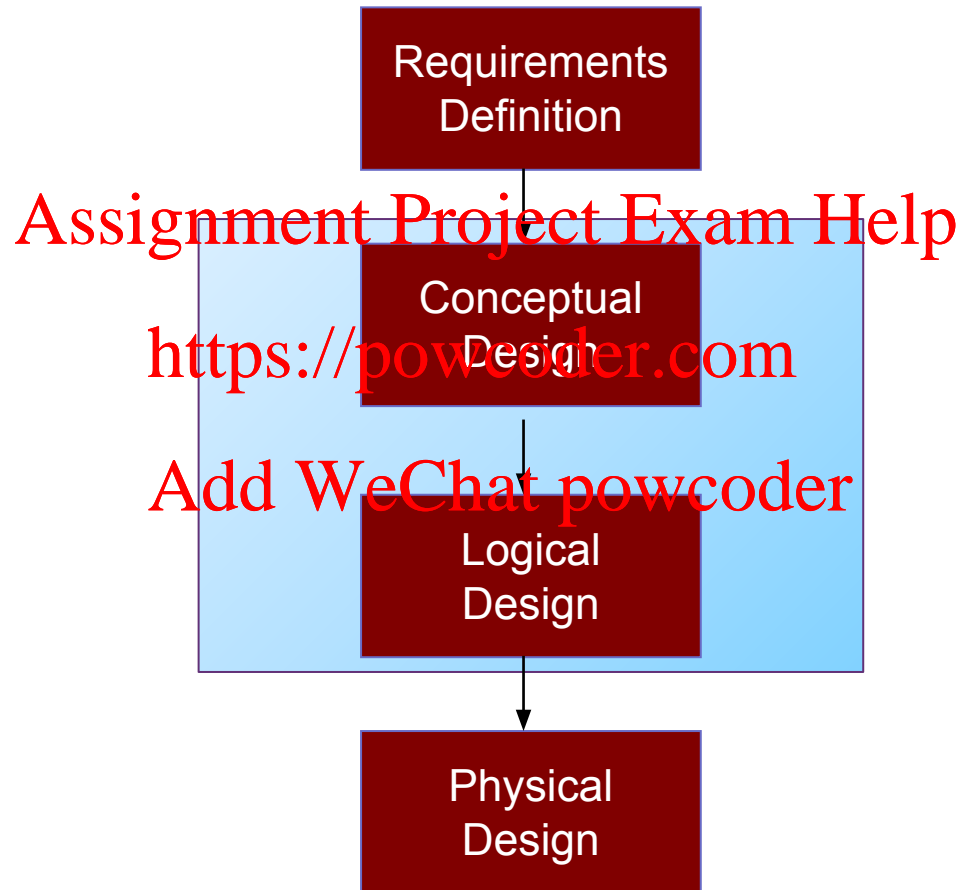
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# ANSI/SPARC architecture



# 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.

# Student view

**Web Enrolment System**  


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Enrolment / Re-Enrolment  


---

Fees / Scholarships  


---

Student Services  


---

Course Progression  


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Enrolment Access Dates  


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WES Guides  


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WES Survey  


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**Monash Links**  


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my.monash  


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Allocate+ (Class Allocation)  


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MUTTS (Class Timetable)  


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Moodle

**Web Enrolment System**  

✓ Check [Faculty and Course](#) requirements before enrolling. It is your responsibility to ensure your enrolment complies with course requirements. Arrange a meeting with your Course Adviser if you are unsure.

✓ You are required to enrol in all units that you expect to study in each Semester. Need help? Click [here](#)

Remember to  after making any changes.  
Then wait for your Transaction Number.

**Unit Enrolment form**

Are you ready to enrol in this course? If you are ready to enrol in this course, click on Enrol in the Action column. You will be notified in the unit.


Course Location: PARKVILLE(FORCED - [What does this mean?](#))

Unit code	Action	Unit name	Campus	Semester	Type	Credits
<a href="#">PAC1111</a>	<a href="#">Enrol</a>	Introduction to physiology UNCONFIRMED	PAR	Semester 1 (2014)	DAY	--
<a href="#">PAC1121</a>	<a href="#">Enrol</a>	Bioorganic and medicinal chemistry I UNCONFIRMED	PAR	Semester 1 (2014)	DAY	--
<a href="#">PAC1211</a>	<a href="#">Enrol</a>	Physicochemical basis of pharmacy UNCONFIRMED	PAR	Semester 1 (2014)	DAY	--
<a href="#">PAC1311</a>	<a href="#">Enrol</a>	Pharmacy, health and society I UNCONFIRMED	PAR	Semester 1 (2014)	DAY	--
<a href="#">PAC1132</a>	<a href="#">Enrol</a>	Systems physiology UNCONFIRMED	PAR	Semester 2 (2014)	DAY	--
<a href="#">PAC1142</a>	<a href="#">Enrol</a>	Bioorganic and medicinal chemistry II UNCONFIRMED	PAR	Semester 2 (2014)	DAY	--
<a href="#">PAC1222</a>	<a href="#">Enrol</a>	Drug delivery I UNCONFIRMED	PAR	Semester 2 (2014)	DAY	--
<a href="#">PAC1322</a>	<a href="#">Enrol</a>	Pharmacy, health and society II UNCONFIRMED	PAR	Semester 2 (2014)	DAY	--
Total credits:						0

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

# Staff and Student View


Unit guides

 MONASH University

[Home](#) | [Find a unit guide](#)

FIT9132: Introduction to databases

[back to top](#)

 PDF

Semester 1 2016

Contents

Unit handbook information

Synopsis

Mode of delivery

Workload requirements

Unit relationships

Prerequisites

Prohibitions

Co-requisites

Chief Examiner

Campus Lecturer(s)

Unit handbook information

Synopsis

This unit will introduce the concept of data management in an organisation through relational database technology. Theoretical foundation of relational model, analysis and design, implementation of relational database using SQL will be covered.

Mode of delivery

Caulfield (Evening)  
Caulfield (Online)

Workload requirements

Minimum total expected workload equals 12 hours per week comprising:

(a.) Contact hours for on-campus students:



# Admin View

Allocate<sup>+</sup>

Subject Administrator

FIT9132\_CA\_S2\_DAY, INTRO TO DATABASES

Activity Groups:

[Show Subject](#) | [Special Consideration](#) | [Update Details](#) | [Section Insert](#)

▶ **Lecture (Lecture)**

(READ ONLY)

Enrolments: 302  
Preferences: 128  
Allocations: 302  
Seats Provided: 328

▶ **PASS Session (PASS Session)**

(READ ONLY)

Enrolments: 302  
Preferences: 0  
Allocations: 51  
Seats Provided: 48

Warning: Not enough seats provided

▶ **Studio (Studio)**

(READ ONLY)

Enrolments: 302  
Preferences: 144  
Allocations: 302  
Seats Provided: 329

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FIT9132\_CA\_S2\_DAY-INTRO TO DATABASES  
(Studio)

Allocate

Add Activity

Show Message

Allocated List

Unallocated List

Bulk

<https://powcoder.com>

Functions	Activity Code	Campus	Day	Start Time	Location	Staff	Duration
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	01	CA	Wed	14:00	CA_B/B345	Monika Schwarz	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	02	CA	Wed	14:00	CA_B/B343	Mark Creado	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	03	CA	Wed	16:00	CA_B/B342B	Minh Vuong	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	04	CA	Wed	14:00	CA_B/B342B	Minh Vuong	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	05	CA	Wed	14:00	CA_B/B346B	Paras Sitoula	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	06	CA	Wed	16:00	CA_B/B343	Angela Zhang	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	07	CA	Wed	17:30	CA_B/B344	Mark Creado	120
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<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	09	CA	Thu	14:00	CA_B/B350	Karan Pedramrazi	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	10	CA	Thu	16:00	CA_B/B345	Minh Vuong	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	11	CA	Wed	17:30	CA_K/K107	Paras Sitoula	120
<a href="#">Delete</a>   <a href="#">Edit</a>   <a href="#">List</a>   <a href="#">Constraint</a>   <a href="#">Context</a>   <a href="#">Email</a>	12	CA	Fri	14:00	CA_B/B346	Manoi Kathopalia	120

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# ER Modeling

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

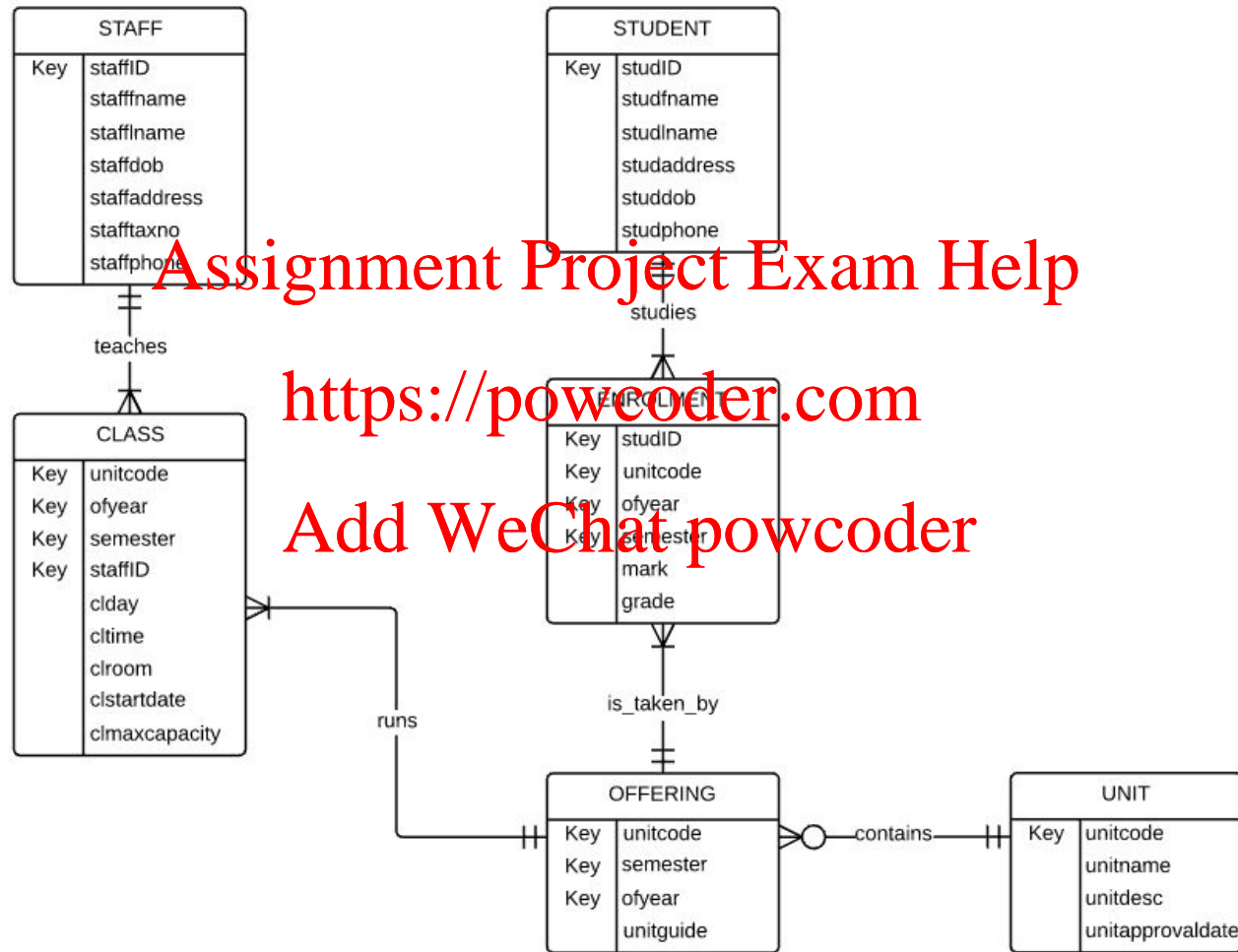




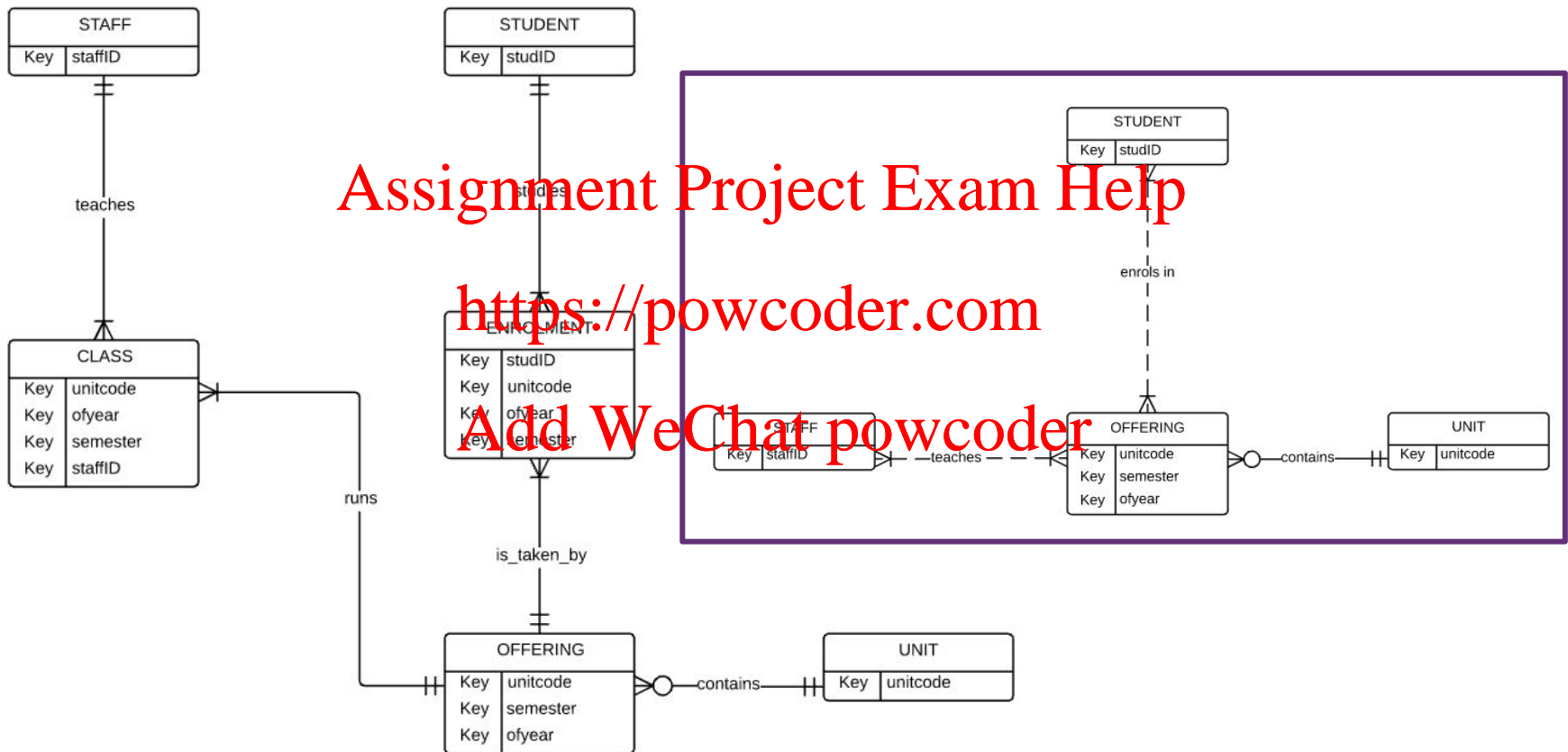
# Conceptual Design

- Develop the enterprise data model.
- Corresponds to the conceptual level of the ANSI/SPARC architecture.
- Independent of all physical implementation considerations.
- Various design methodologies may be employed, including the ER (Entity-Relationship) approach.

# Conceptual Level (ER Model)



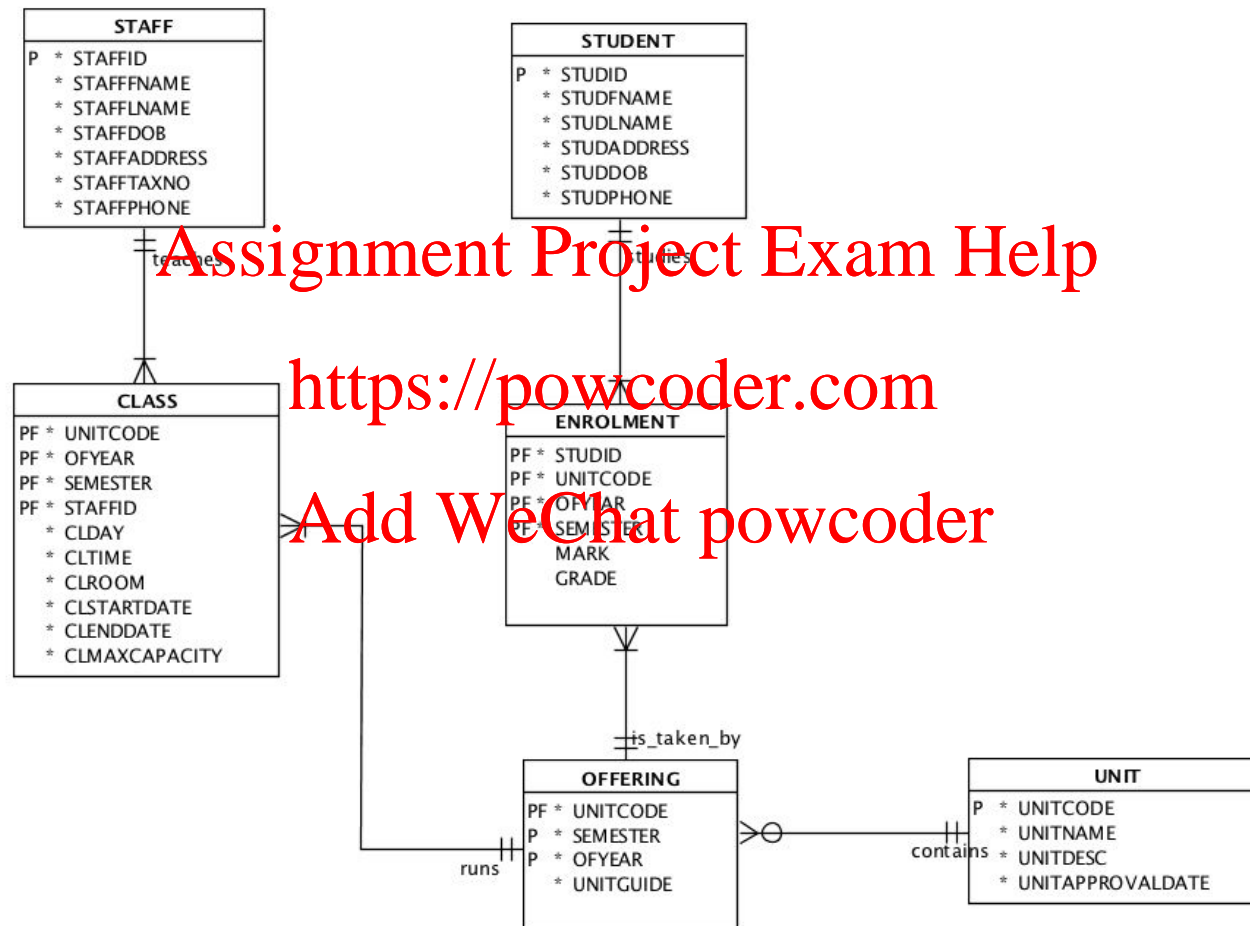
# Conceptual Level (ER Model) - Keys only



# Logical Design

- Develop a data model which targets a particular database model (e.g. relational, hierarchical, network, object-oriented).
- Independent of any implementation details which are specific to any particular DBMS package.
- Normalisation technique (see week 5) is used to test the correctness of the logical model.
- May also be considered to correspond to the conceptual level of the ANSI/SPARC architecture.

# Logical Level (Logical Model)



# Physical Design

- Develop a strategy for the physical implementation of the logical data model.
- Choose appropriate storage structures, indexes, file organisations and access methods which will most efficiently support the user requirements.
- Physical design phase is dependent on the particular DBMS environment in use.
- ANSI/SPARC internal level.
- Shown in SQL Developer Data Modeller as the Relational Model



# Physical Level – Starting point

```
Oracle Database 11g Relational_1 Generate Clear
9 create
10 table enrolment
11 (
12     unitcode char (10) not null ,
13     semester number (1) not null ,
14     ofyear date not null ,
15     studid number (10) not null ,
16     mark number (3) ,
17     grade char (2)
18 );
19
20
21 alter table enrolment add constraint enrol_mark_chk check (mark between 0 and
22 100) ;
23
24 alter table enrolment add constraint enrol_grade_chk check (grade in ('N','P',
25 'C','D','HD')) ;
26
27 alter table enrolment add constraint enrol_pk primary key ( semester, ofyear,
28 studid, unitcode ) ;
29
30 create
31 table offering
32 (
33     unitcode char (10) not null ,
34     semester number (1) not null ,
35     ofyear date not null ,
36     chiefexam number (10) not null
37 ) ;
38
39 alter table offering add constraint semester_chk check (semester between 1 and
40 3) ;
41
42 alter table offering add constraint offering_pk primary key ( unitcode,
43 semester, ofyear ) ;
44
45 create
46 table prereq
47 (
48     unitcode char (10) not null
```

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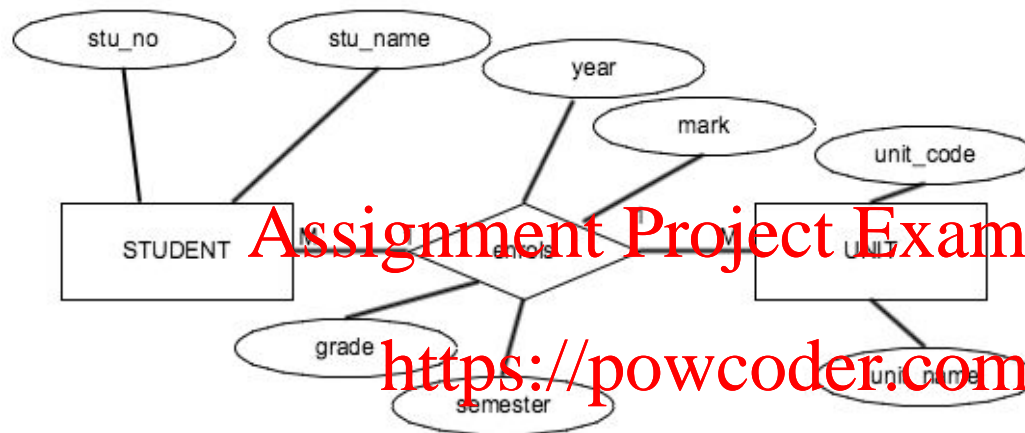
# ENTITY RELATIONSHIP DIAGRAM

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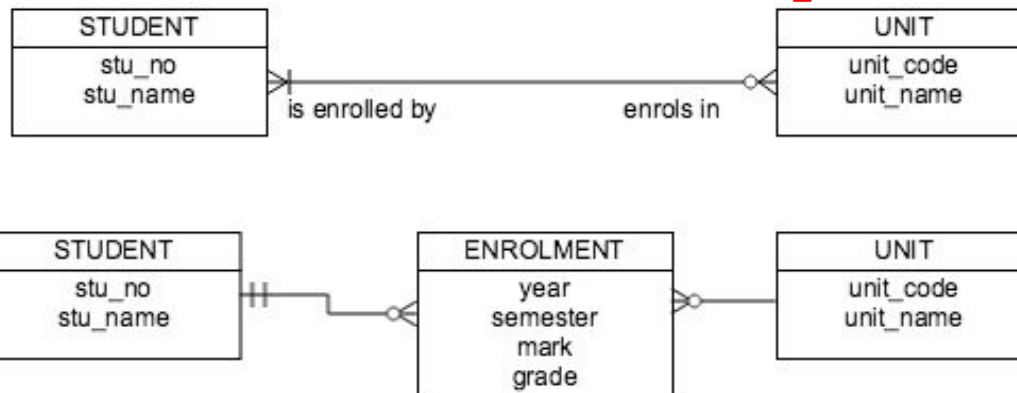
# ERD - Notation



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**Information Engineering/James Martin/Crows foot**

# ERD – Notation cont'd

## Chen's Notation

- Semantically rich.
- Complex diagram.
- 'Pure' conceptual level.

## Information Engineering

- Less semantics.
- Simpler diagram.
- Mix between conceptual and logical levels.

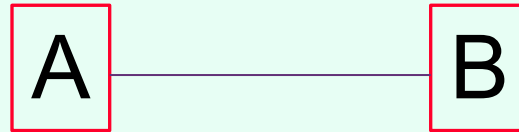
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Entity, Attributes and Relationships **Assignment Project Exam Help**  
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*Please note this diagram is incomplete*

## Assignment Project Exam Help

**Q1. How many entities are there in the above diagram?**

<https://powcoder.com>

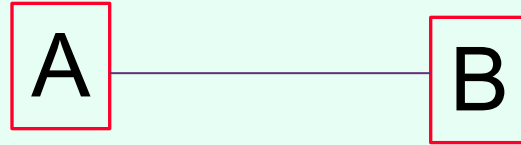
- A. 1
- B. 2
- C. 3
- D. 4

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mars.mu

Feed Code: HYT80D





*Please note this diagram is incomplete*

**Q2. How many relationships are there on the above diagram?**

**What is the degree of the relationship (the number of entities participating in the relationship) ?**

- A. 1, unary
- B. 2, binary
- C. 1, binary
- D. 3, ternary

**Q3. "An employee is assigned to be a member of a team. A team with more than 5 members will have a team leader. The members of the team elect the team leader."**

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**List the entity(s) which you can identify in the above statement. Enter them one by one - select the tick for each and then use the X to add a second entity if required.**

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**<https://powcoder.com>**

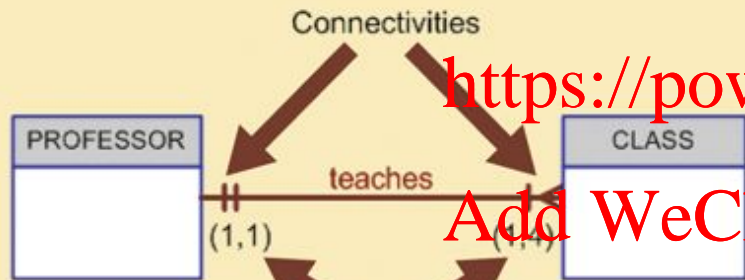
**Q4. How many relationships connect TEAM and EMPLOYEE?**

## Assignment Project Exam Help

- A. 1 <https://powcoder.com>
- B. 2
- C. 3 Add WeChat powcoder
- D. 4

FIGURE 4.7

### Connectivity and cardinality in an ERD

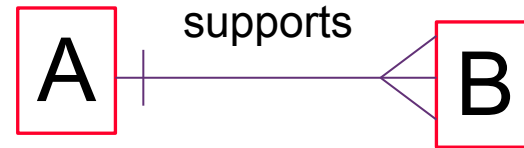


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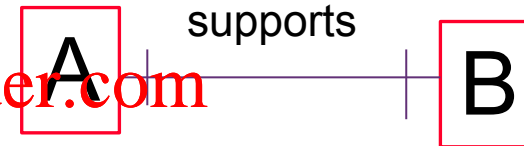
<https://powcoder.com>

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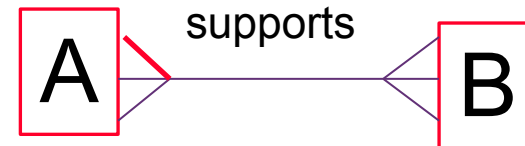
one to many



one to one



many to many



## Relationship Participation

Q5. "A Team with more than 5 members will have a team leader. The members of the team elect the team leader."

What is the relationship participation of the relationship

**TEAM --lead\_by-- EMPLOYEE**

A.

10 — lead\_by — 01

B.

10 — lead\_by — 11

C.

11 — lead\_by — 11

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**Q6. "The company also introduced a mentoring program, whereby a new employee will be paired with someone who has been in the company longer."**

**How many entity/ies do you need to model the mentoring program?**

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**<https://powcoder.com>**

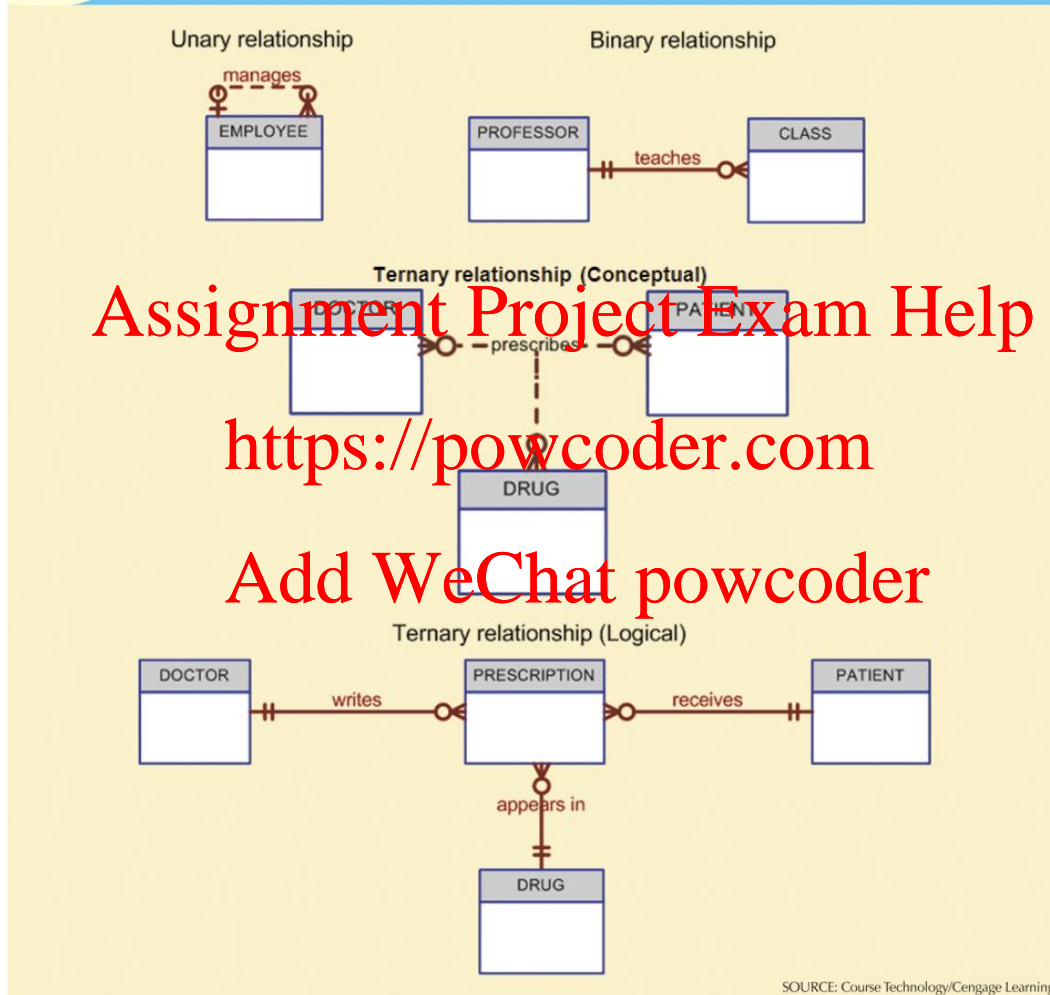
- A. 1**
- B. 2**
- C. 3**

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FIGURE  
4.15

### Three types of relationship degree



**Q7. "To attract high calibre talent, the company provides generous remuneration package as well as health insurance support for the employees and their family. To do this, the HR team needs to know the details of the family members. The family information will be recorded"**

## **Assignment Project Exam Help**

**Choose a TRUE statement.**

<https://powcoder.com>

- A. EMPLOYEE entity is a strong entity and FAMILY is a strong entity.
- B. EMPLOYEE entity is a weak entity and FAMILY is a strong entity.
- C. EMPLOYEE entity is a strong entity and FAMILY is a weak entity.
- D. EMPLOYEE entity is a strong entity and FAMILY is strong entity.

# Weak vs Strong Entity

- Strong entity
  - Has a key which may be defined without reference to other entities.
  - For example EMPLOYEE entity.
- Weak entity **Assignment Project Exam Help**
  - 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)

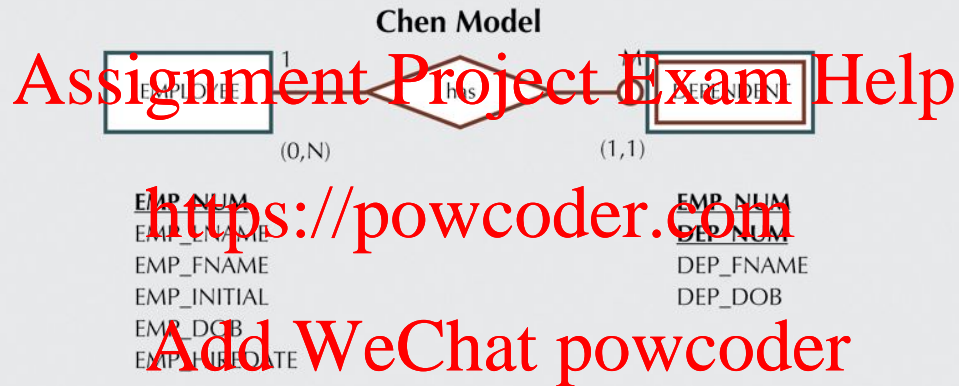
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# Weak vs Strong Entity

FIGURE 4.10

A weak entity in an ERD



SOURCE: Course Technology/Cengage Learning

# Identifying vs Non-Identifying Relationship

## Identifying

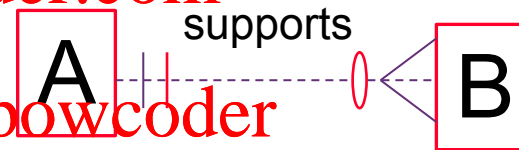
- Identifier of A is part of identifier of B.



- Shown with solid line
- Enrolment's PK includes student id, which is an identifier of student.

## Non-identifying

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



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

# 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



**Q8. The employee details that will be recorded are:**

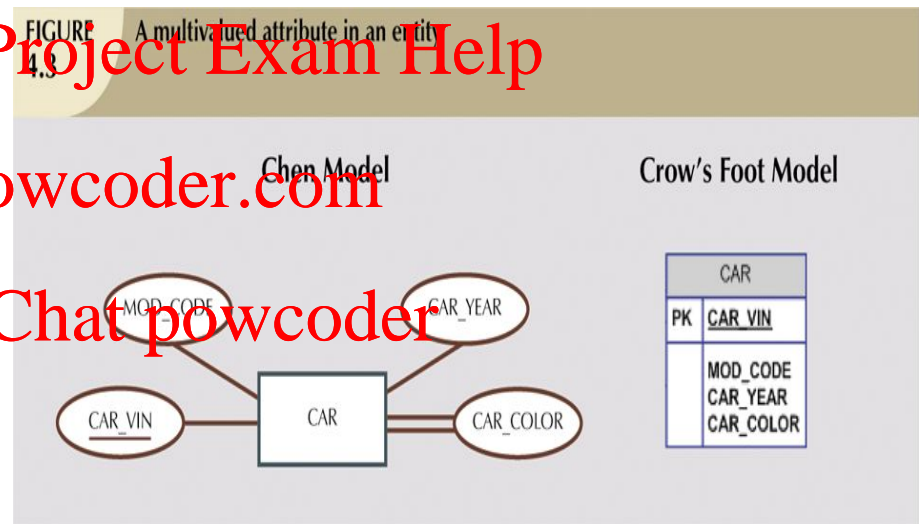
**Employee number, Full name, Address, Date of birth, Tax file number and Skill(s). Examples of skills are Java, Python, UNIX, Relational db, Mongo db, etc**

**Choose a TRUE statement.**

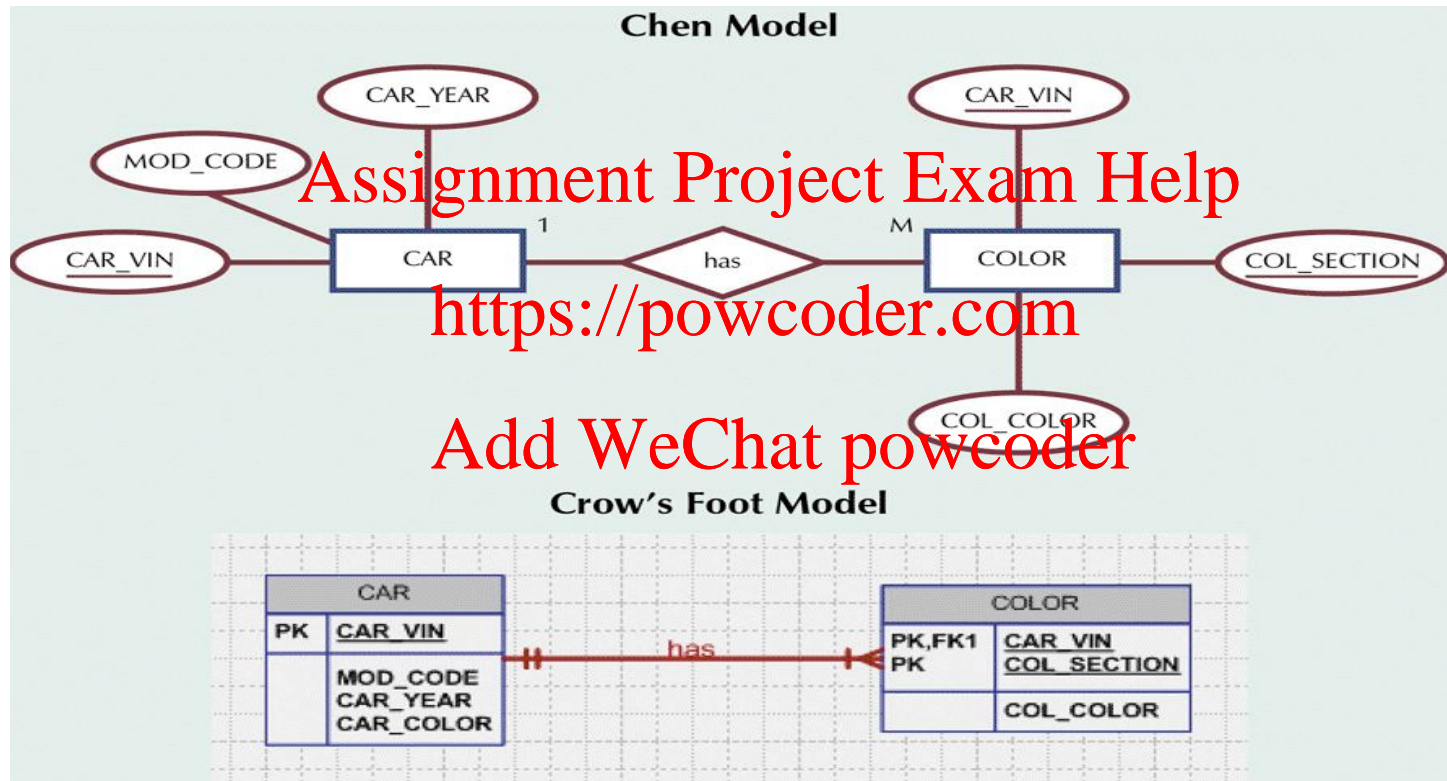
- A. ADDRESS is a multi-valued attribute and SKILL is a multi-valued attribute.
- B. ADDRESS is a composite attribute and SKILL is a composite attribute.
- C. ADDRESS is a composite attribute and SKILL is a multi-valued attribute.
- D. ADDRESS is a multi-valued attribute and SKILL is a composite attribute.

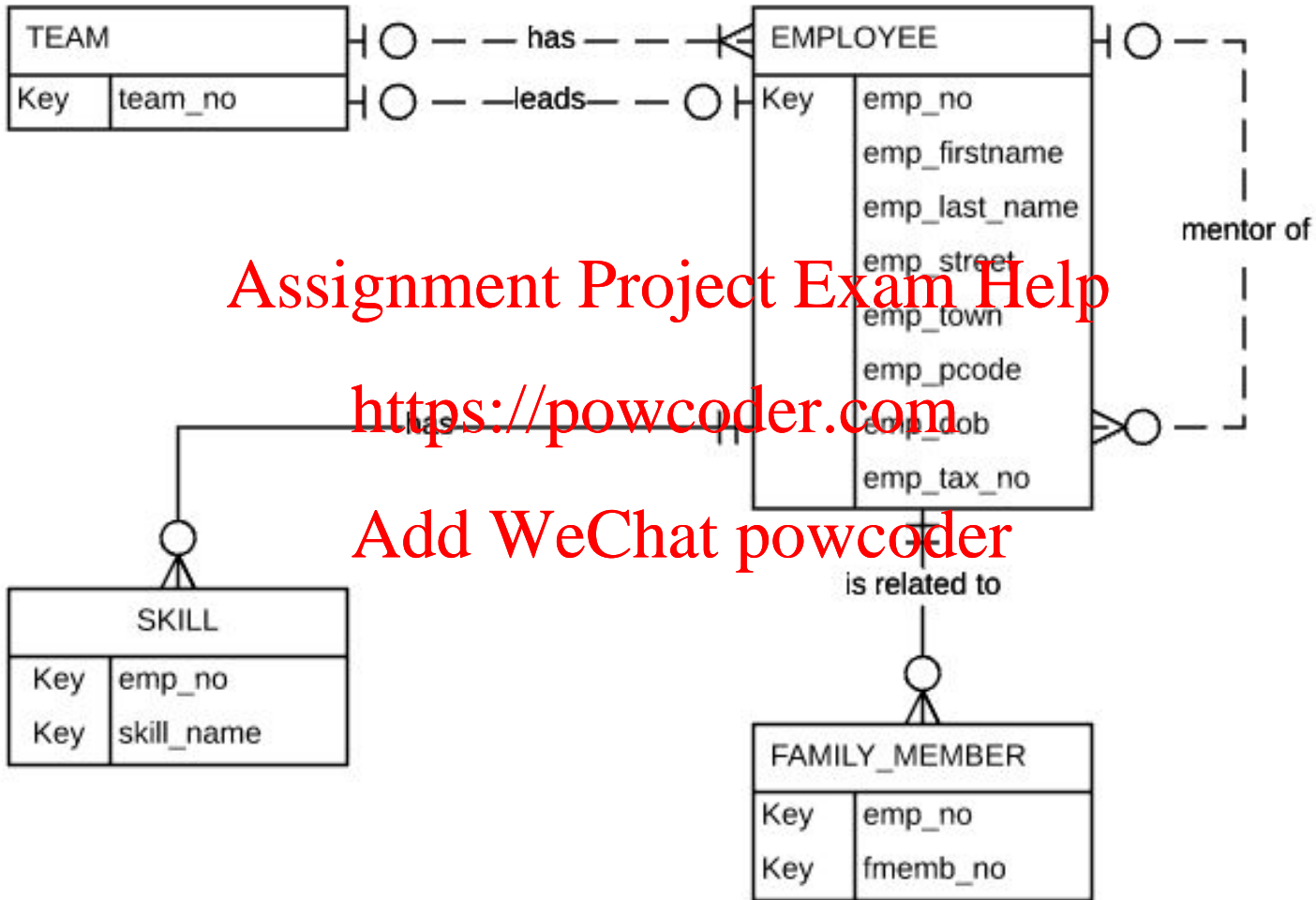
# Multivalued Attribute

- 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





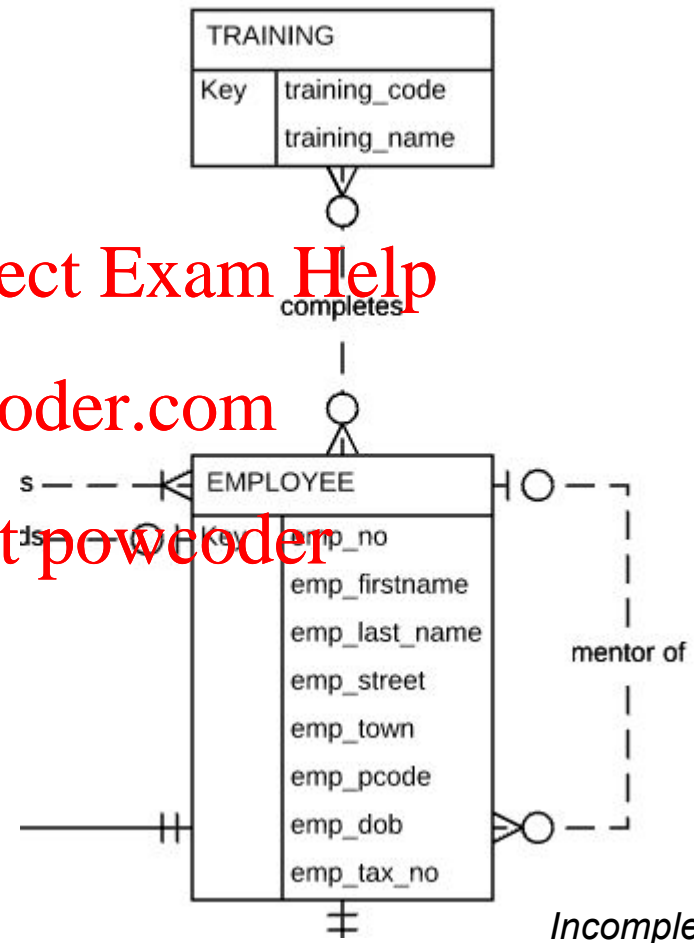
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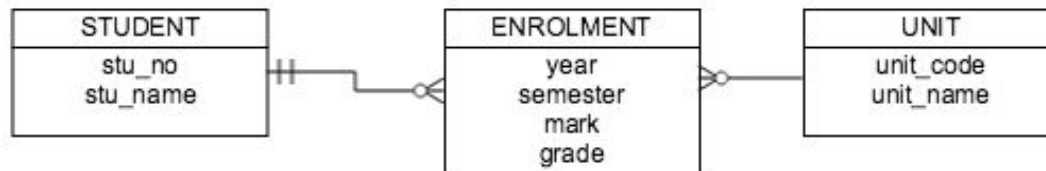
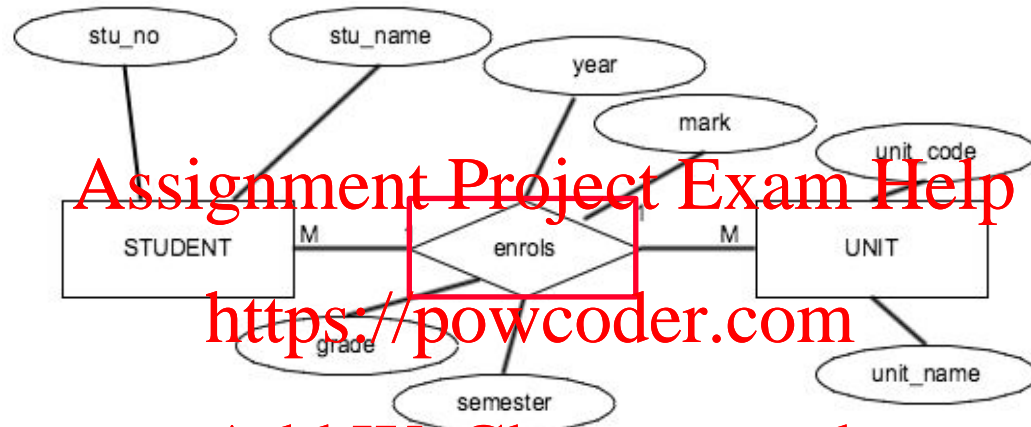
...*"the company provides several in-house training programs. The HR team needs to keep track of the details about who has done what. An employee can do several training programs.*

*At the completion of a training, a certificate will be provided to the employee containing the training name and the completion date."*...



*Incomplete model*

# Associative (or Composite) Entity



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