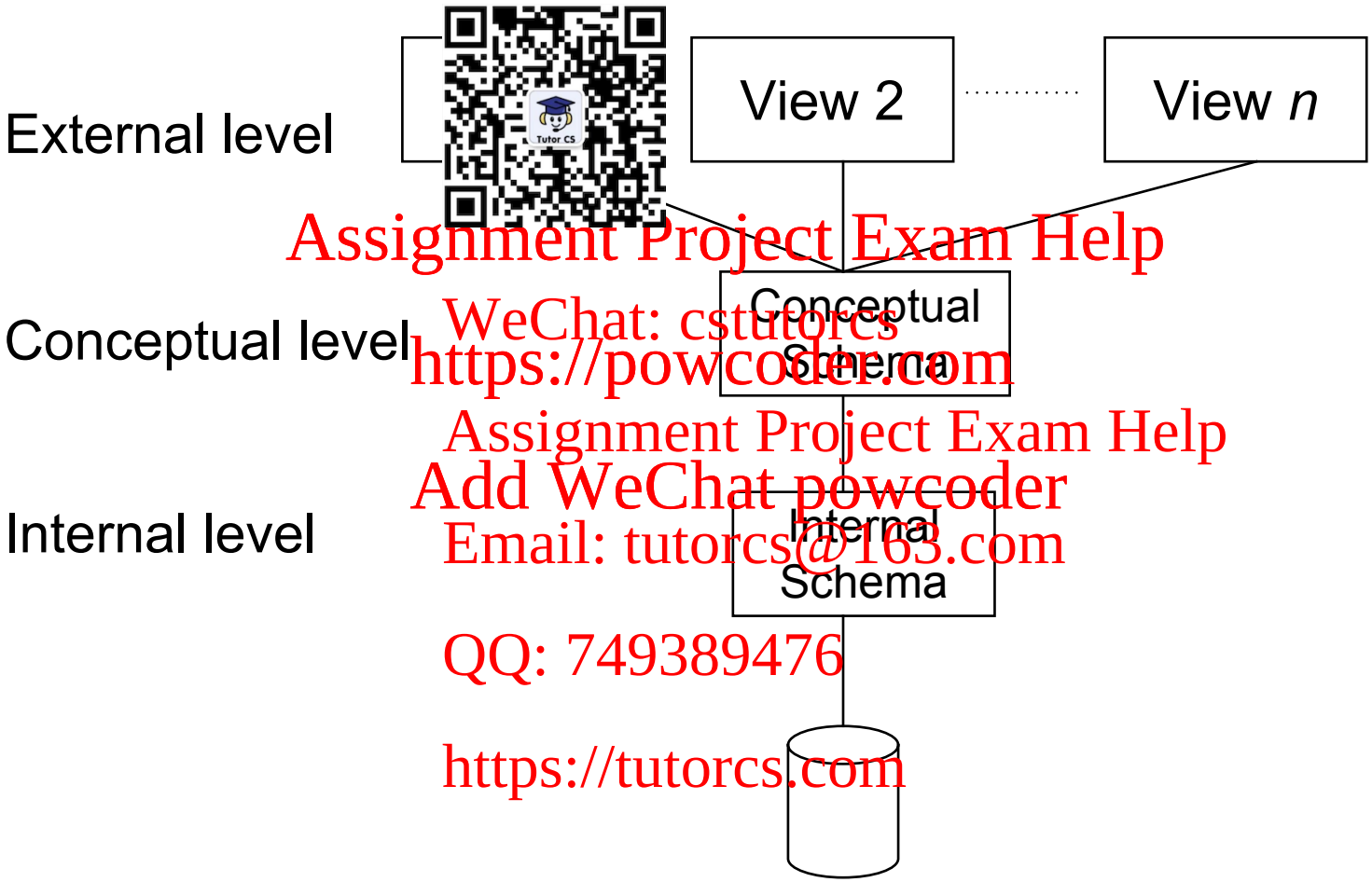
MONASH University

MONASH INFORMATION TECHNOLOGY

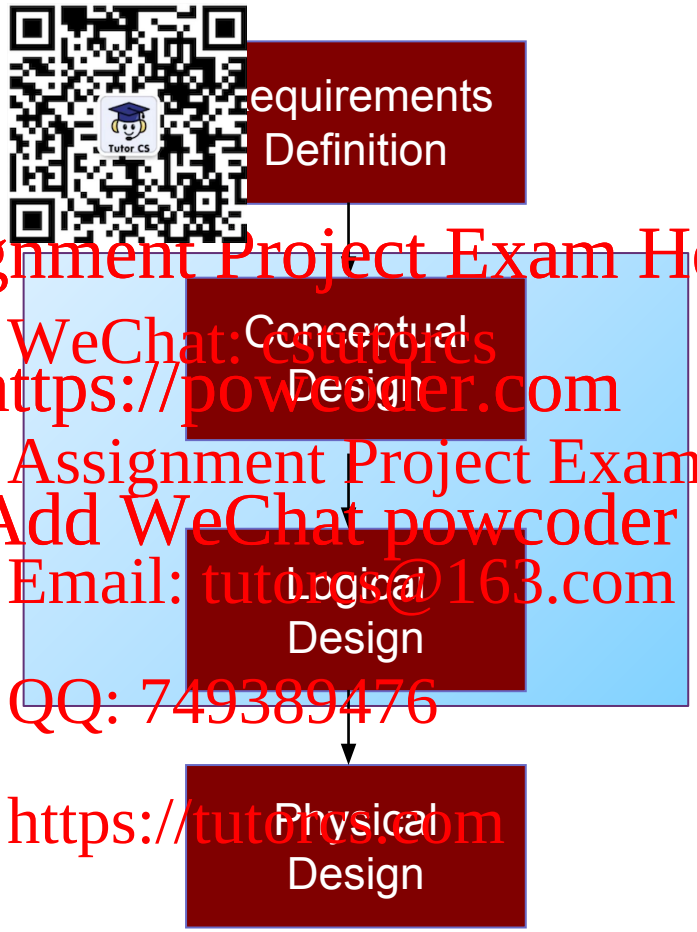
Database Design 1: Conceptual Modelling

GROUP OF EIGHT AUSTRALIA

ANSI/SPARC architecture



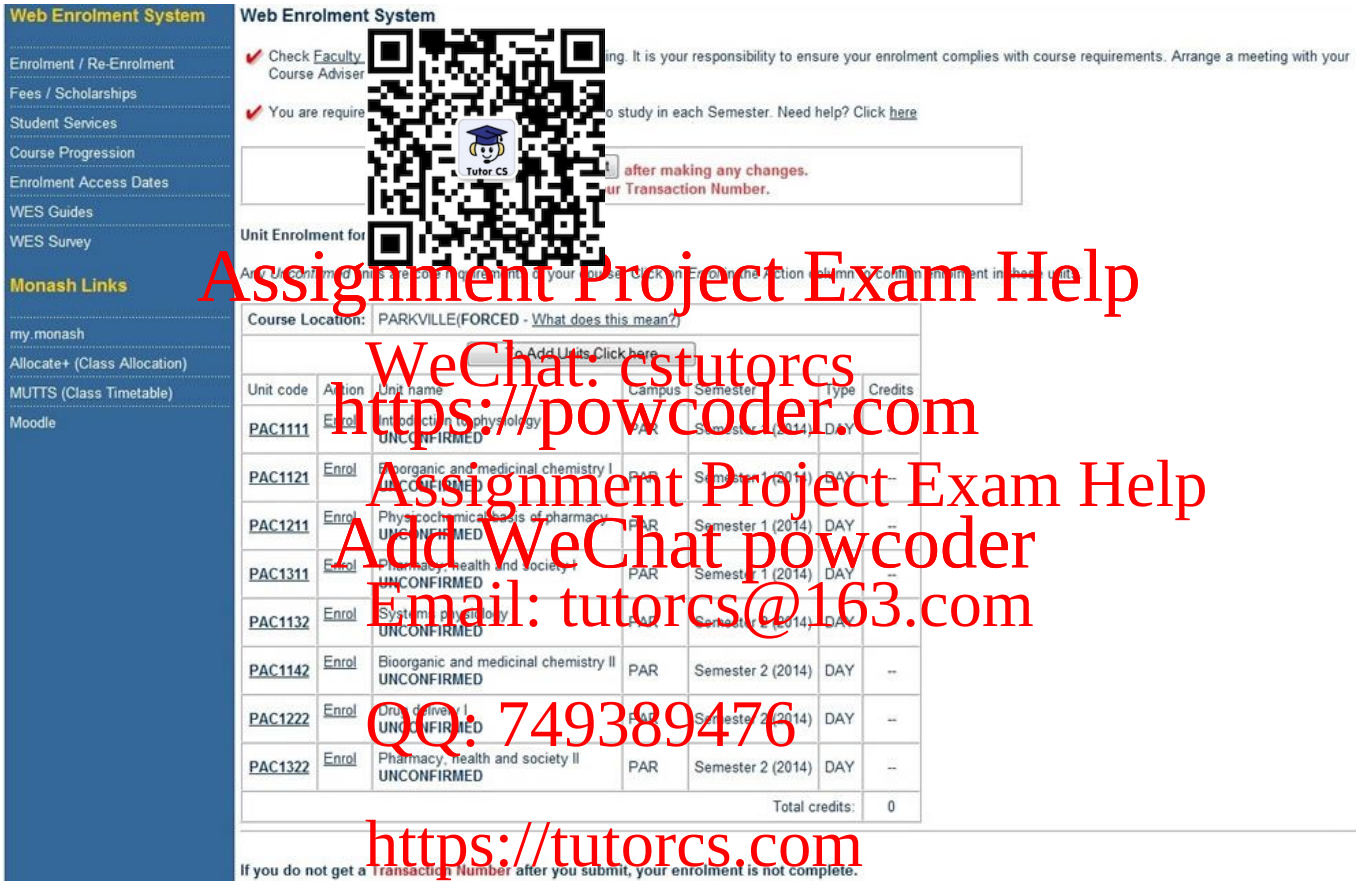
The Database Design Life Cycle



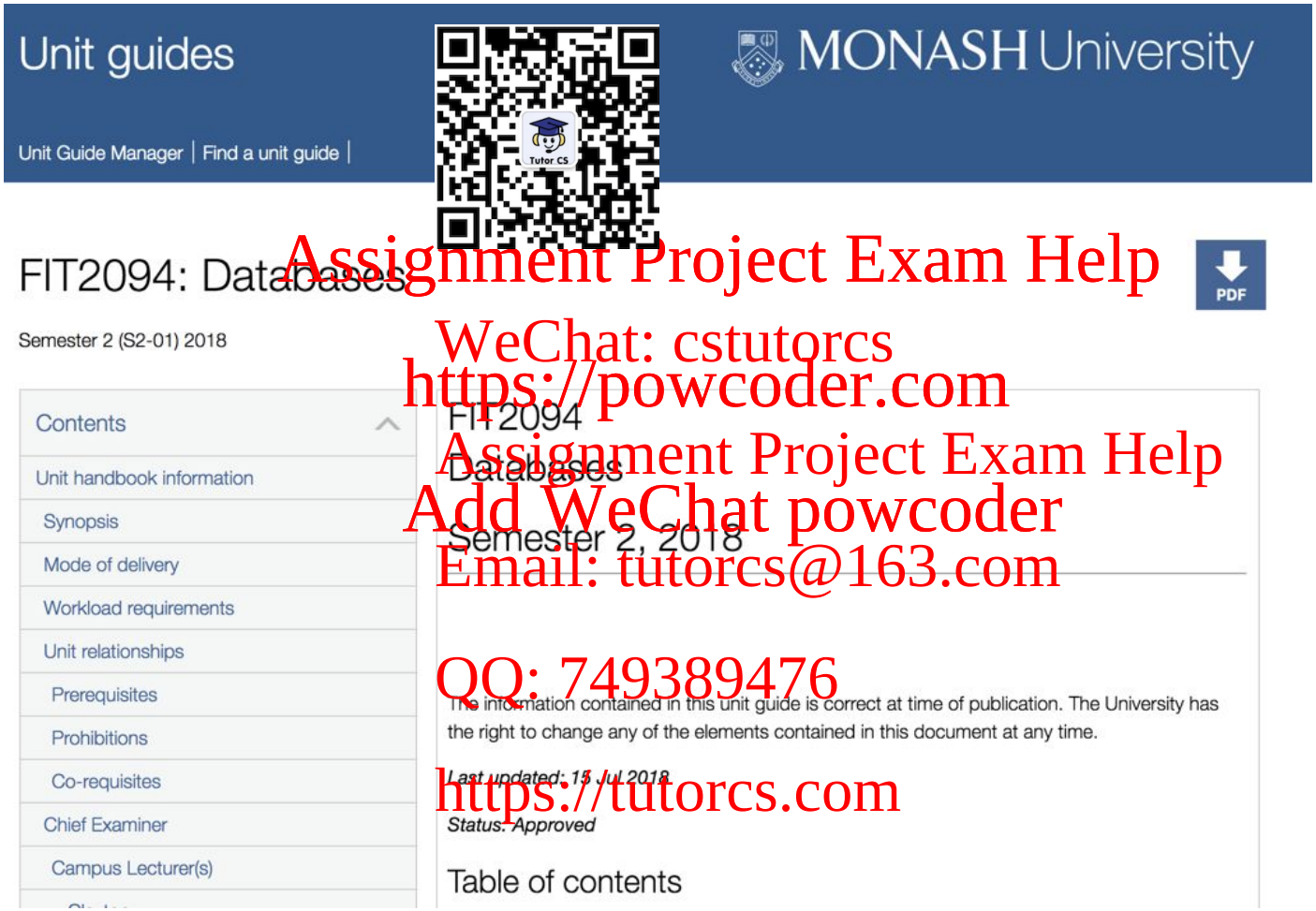
Requirements Definition

- Identify and ar[illegible]ser views.
- A 'user view' m[illegible] report to be produced or a particular type of interaction 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.

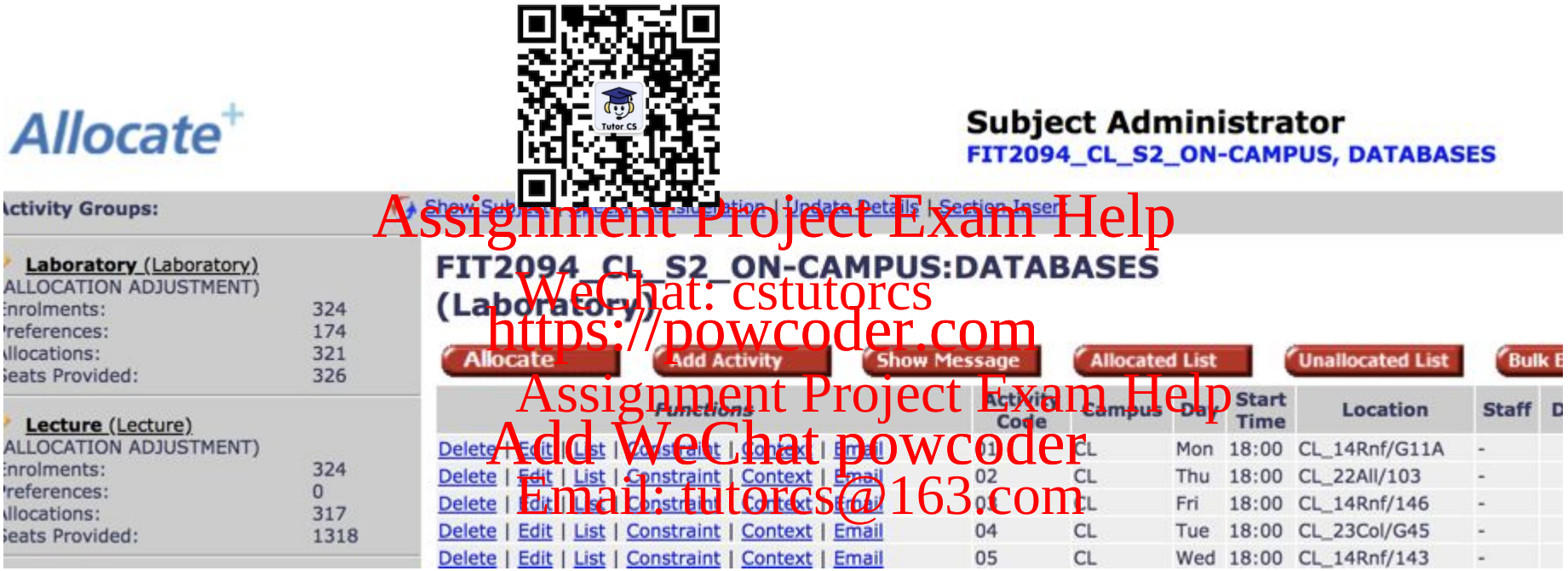
Student view



Staff and Student View



Admin View



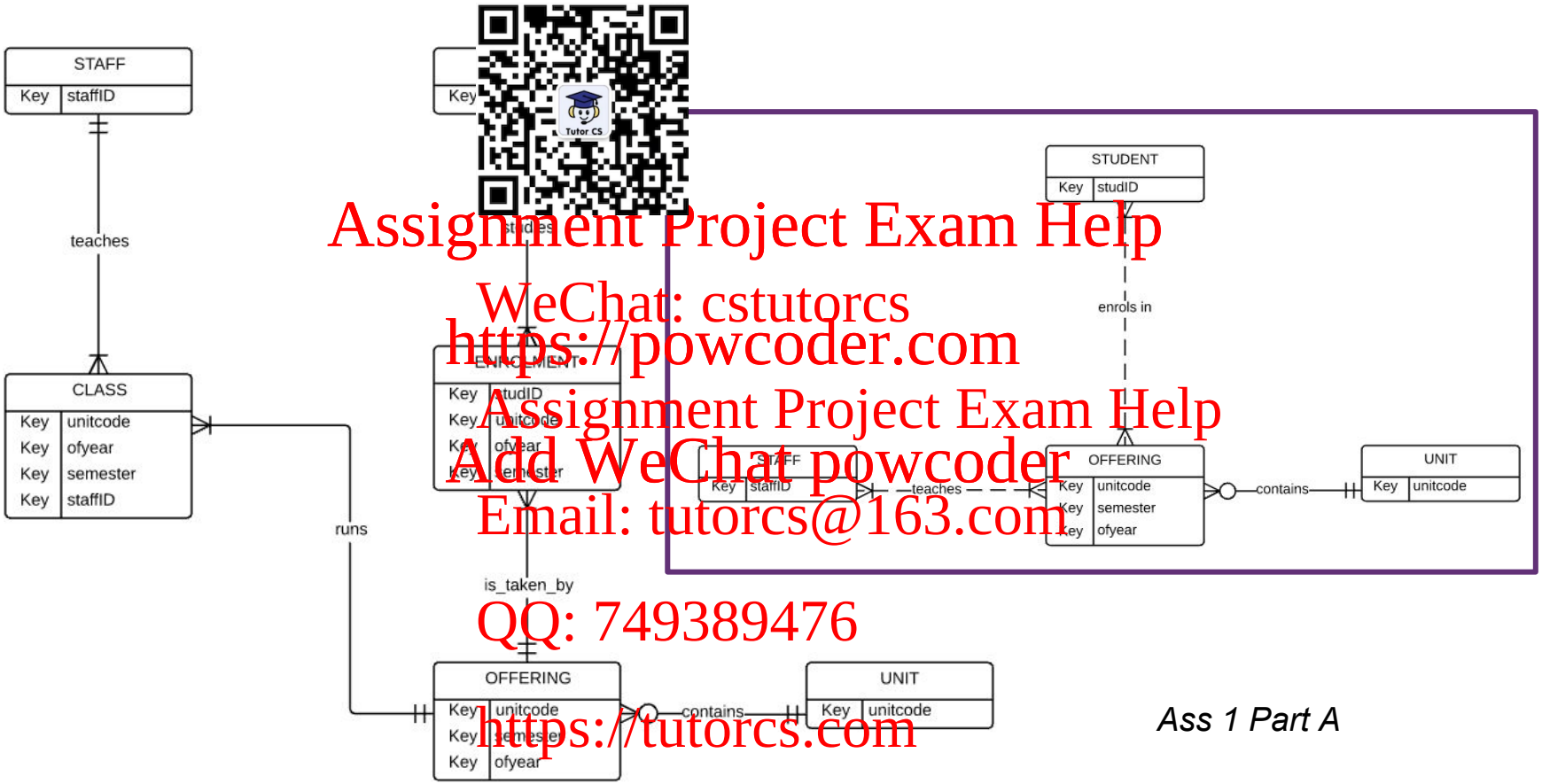
ER Modeling

- ER (Entity-Relationship) model developed by Peter Chen in 1976 for 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

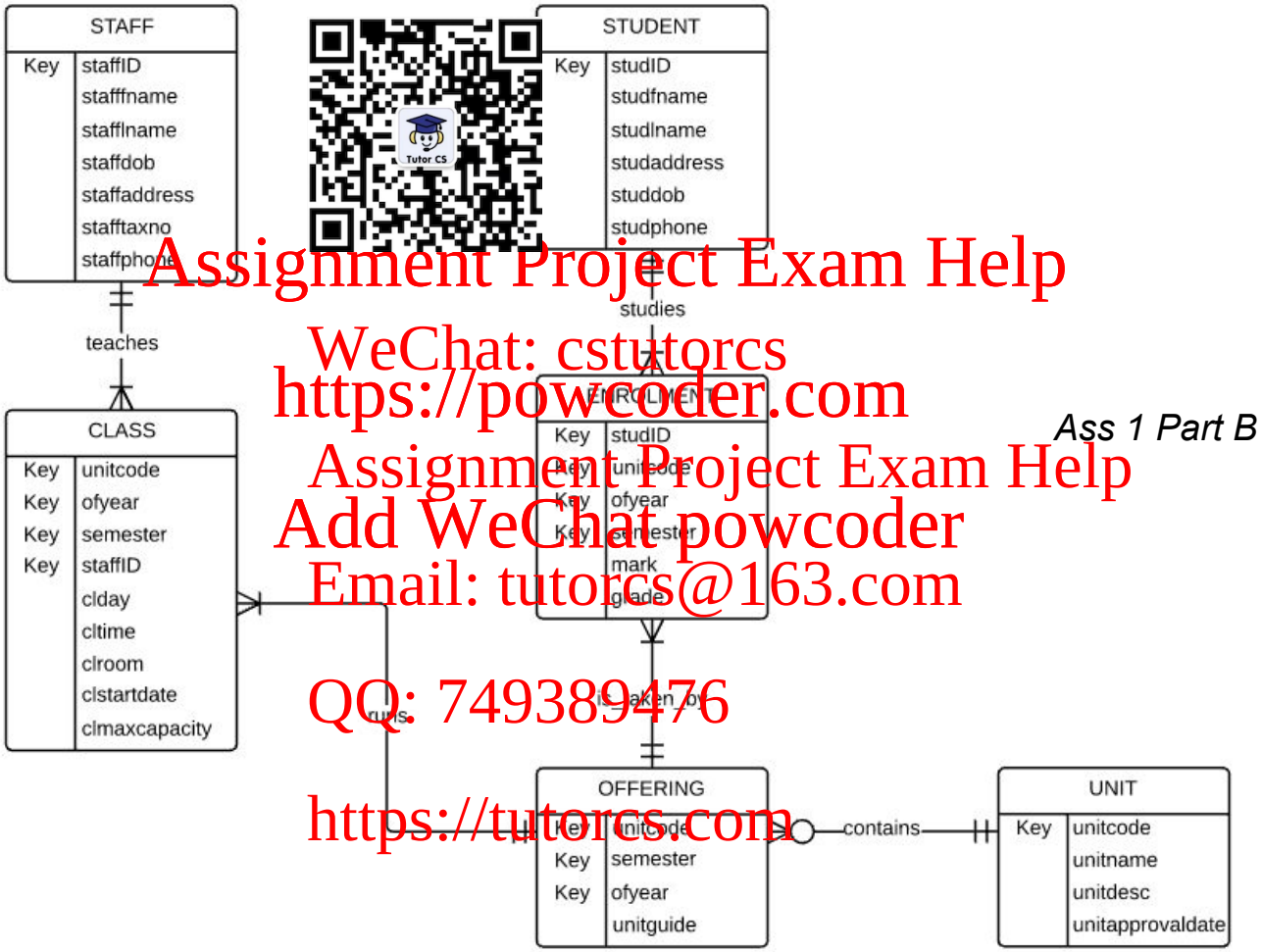
- Develop the enterprise data model.
- Corresponds to the conceptual level of the ANSI/SPARC architecture.
- Independent of all physical implementation considerations.
- Various design methodologies may be employed, including the ER (Entity-Relationship) approach.

Conceptual Level (ER Model) - Keys only



Ass 1 Part A

Conceptual Level (ER Model) – All Attributes

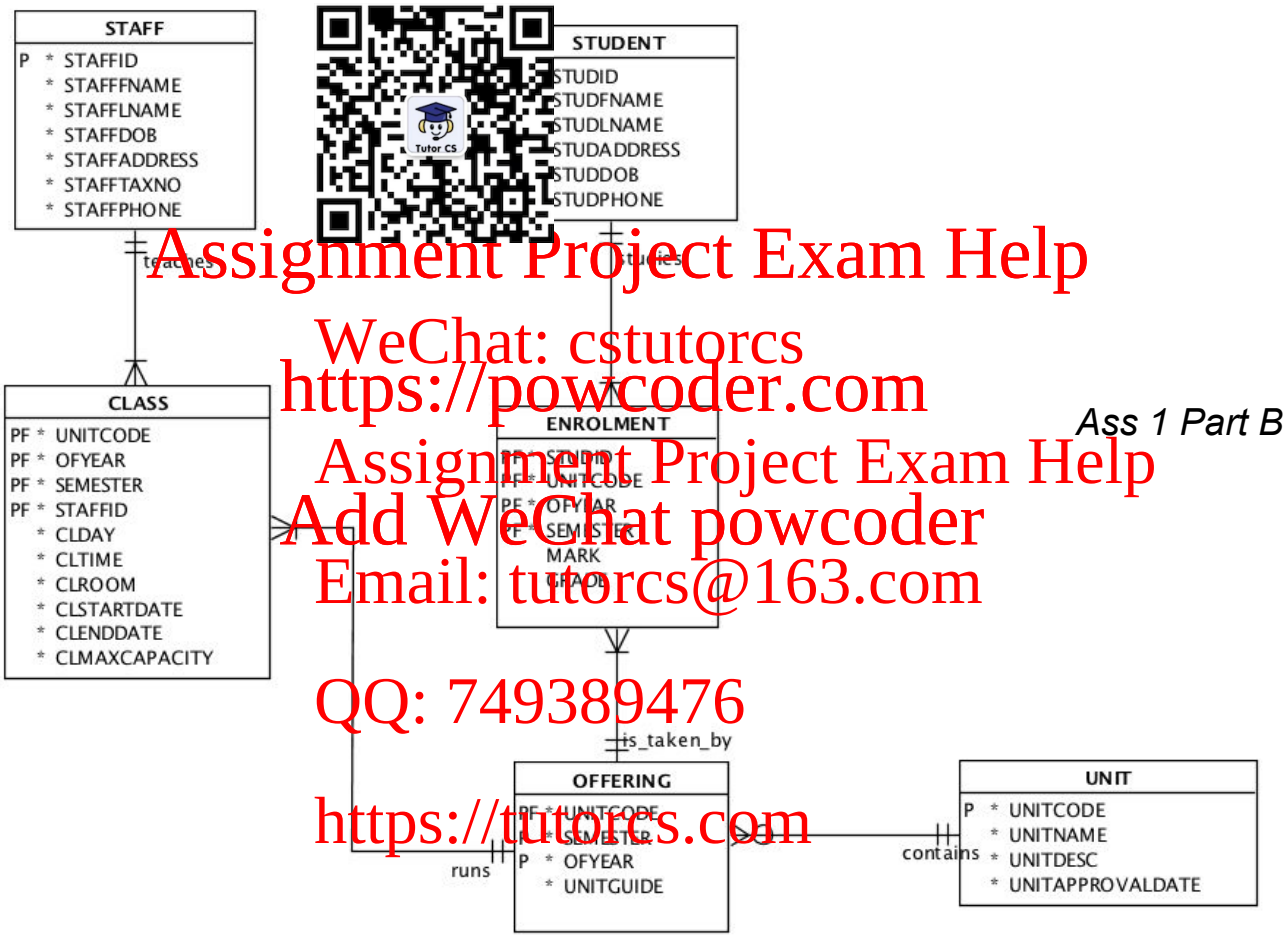


Ass 1 Part B

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)



Ass 1 Part B

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

```
create
  table enrolm
  (
    unitcode cl
    semester nu
    ofyear   da
    studid   nu
    mark     nu
    grade    cl
  ) ;

alter table enrolment add constraint enrol_mark_chk check (mark between 0 and
100) ;

alter table enrolment add constraint enrol_grade_chk check (grade in ('N','P',
'C','D','HD')) ;

alter table enrolment add constraint enrol_pk primary key ( semester, ofyear,
studid, unitcode ) ;

create
  table offering
  (
    unitcode  char (10) not null ,
    semester  number (1) not null ,
    ofyear    date not null ,
    chiefexam number (10) not null
  ) ;

alter table offering add constraint semester_chk check (semester between 1 and
3) ;


alter table offering add constraint offering_pk primary key ( unitcode,
semester, ofyear ) ;

create
  table prereq
  (
    unitcode    char (10) not null
```

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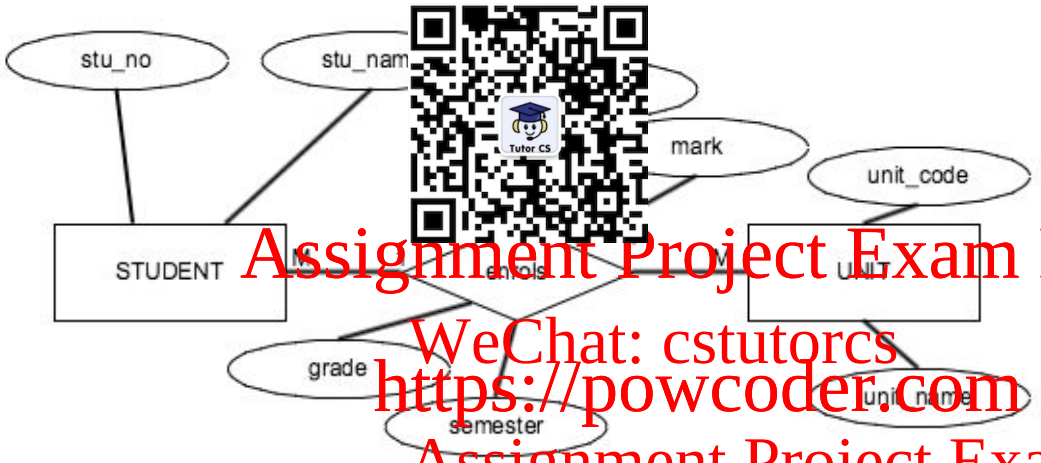
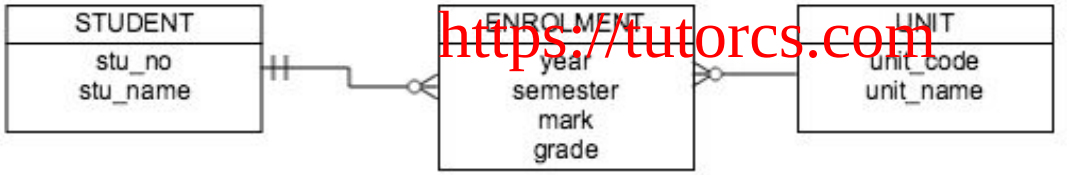
ENTITY RELATIONSHIP DIAGRAM

ERD - Notation



Chen

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

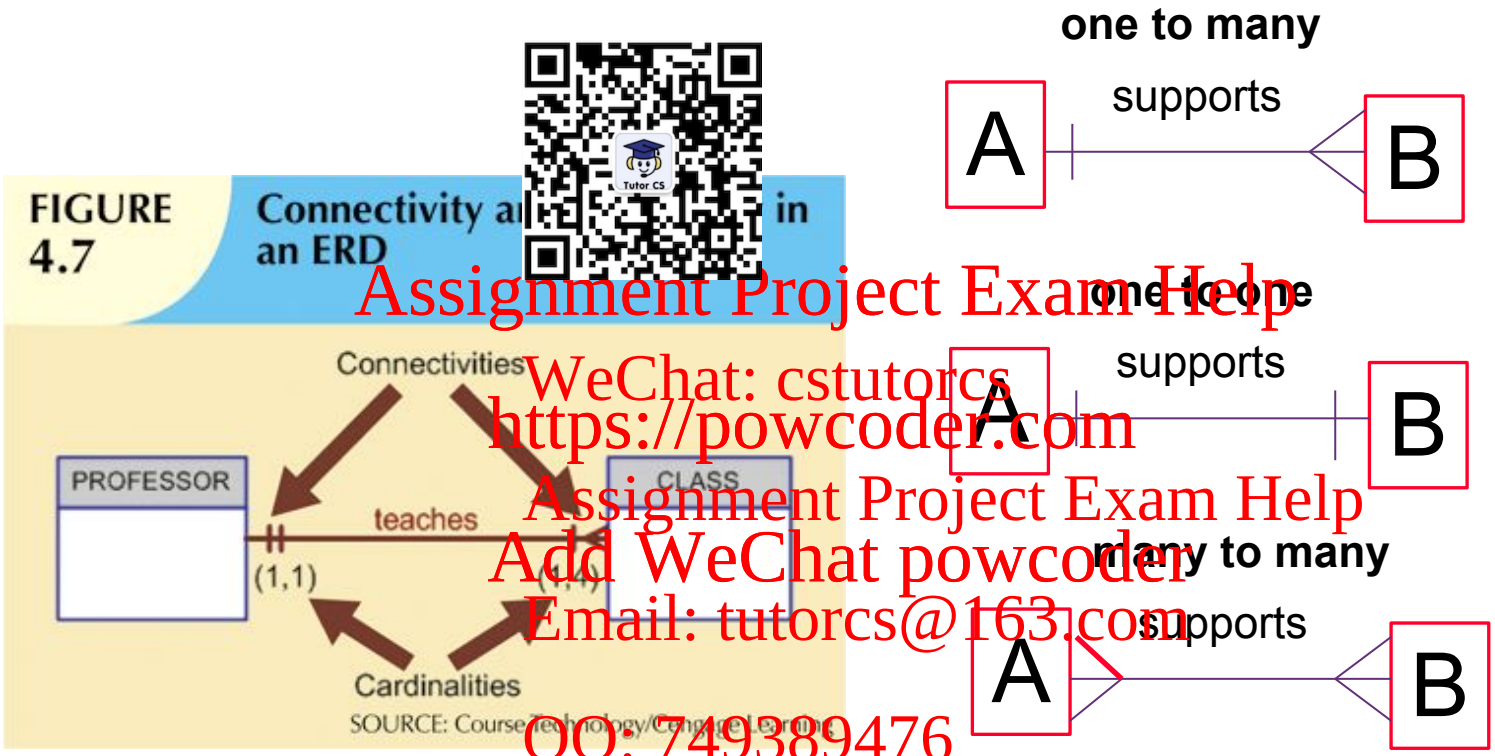
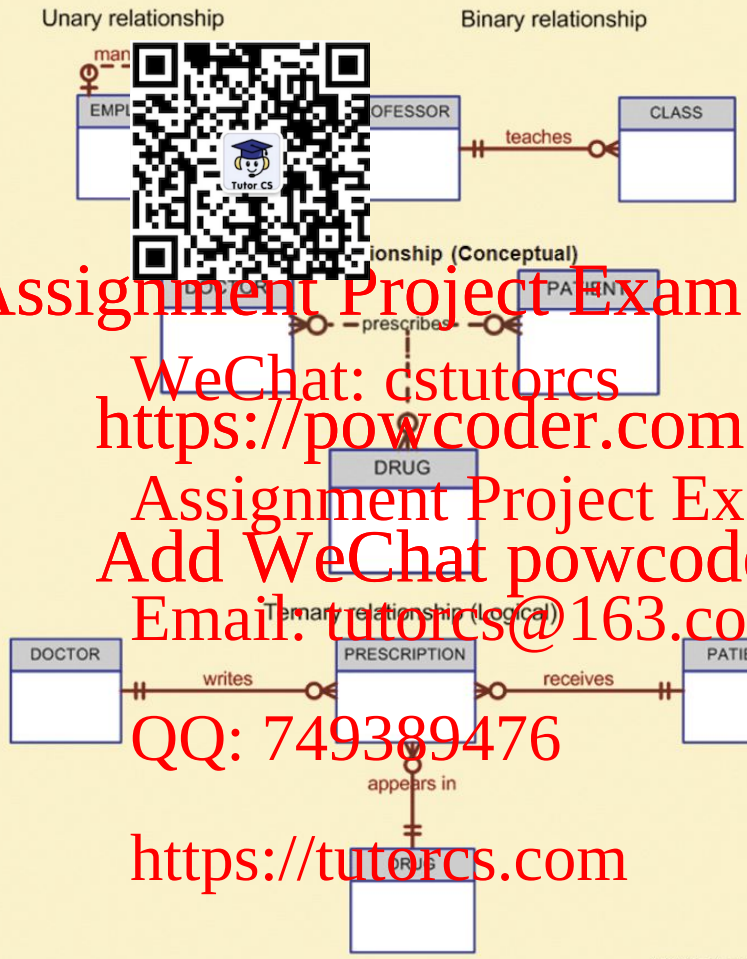


FIGURE 4.15 Three types of relationship degree

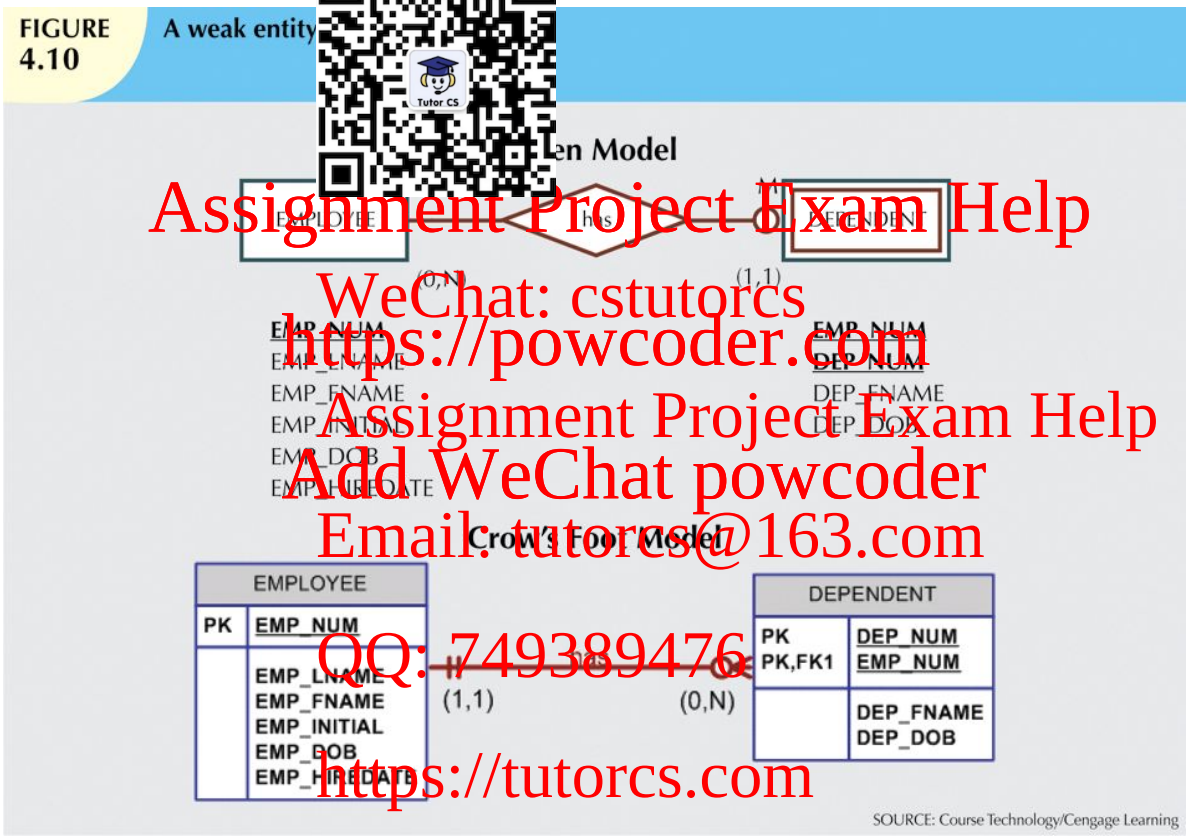


SOURCE: Course Technology/Cengage Learning

Weak vs Strong Entity

- Strong entity
  - Has a key which can 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)

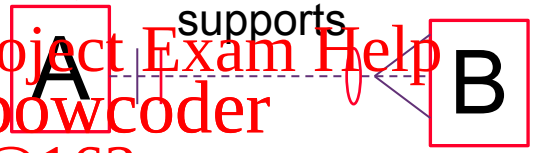
Weak vs Strong Entity



Identifying vs Non-Identifying Relationship

- **Identifying**
  - Identifier of A is part 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.

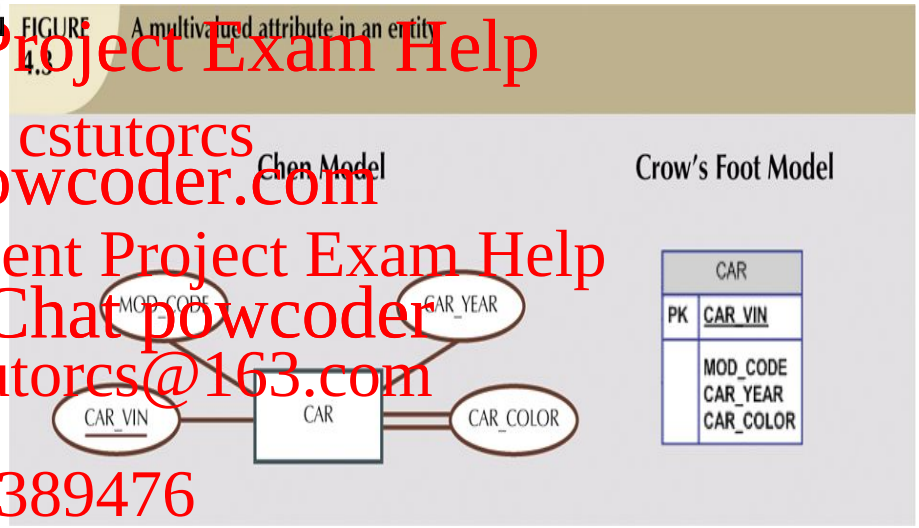


Types of Attributes

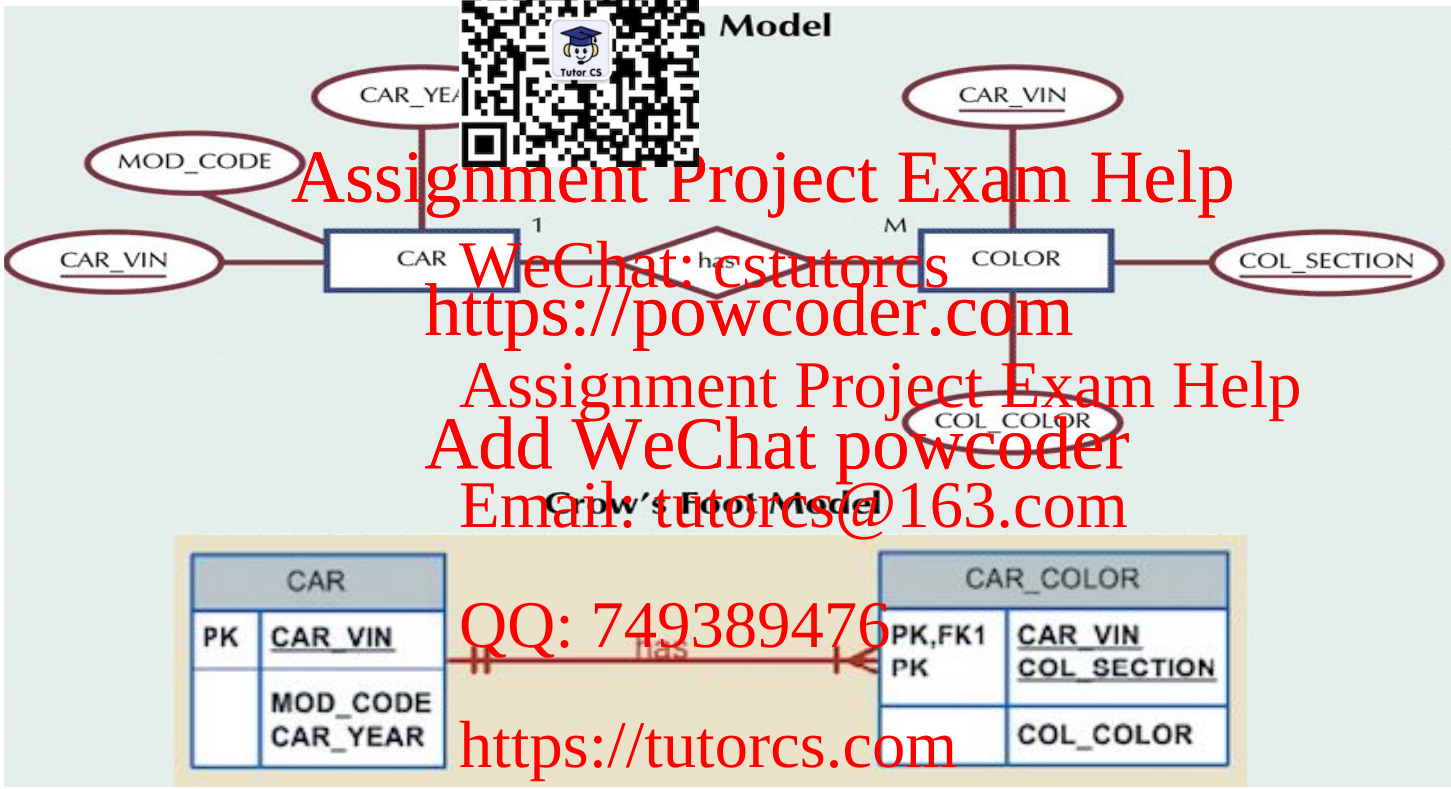
- Simple
  - Cannot be subdiv
  - Age, sex, marital status
- Composite
  - Can be subdivided into additional attributes
  - Address into street, city, zip
- Single-valued
  - Can have only a single value
  - Person has one social security number
- Multi-valued
  - Can have many values
  - Person may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

Multivalued Attribute

- An attribute th
  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



Associative (or Composite) Entity