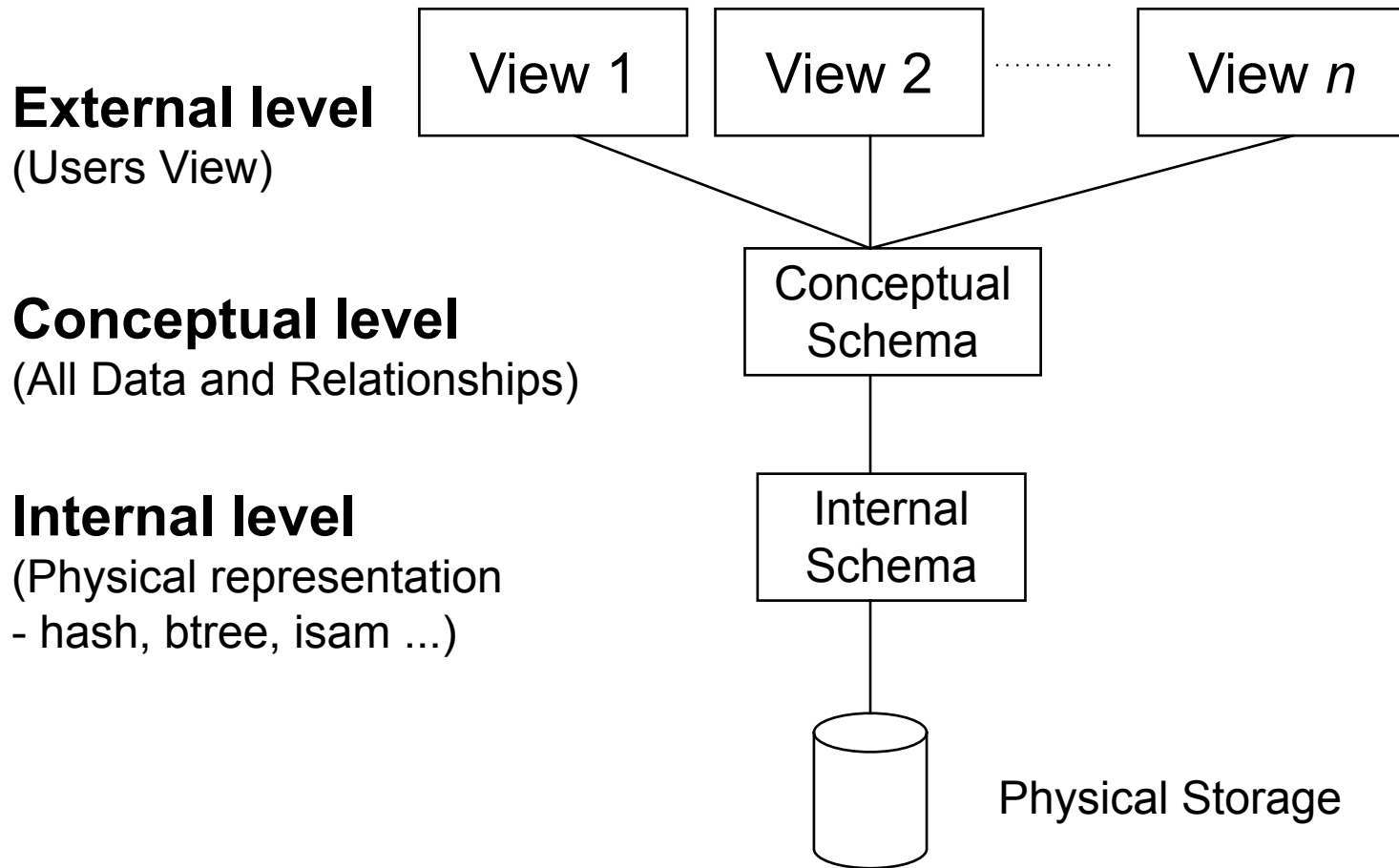


Database Design 1: Conceptual Modelling

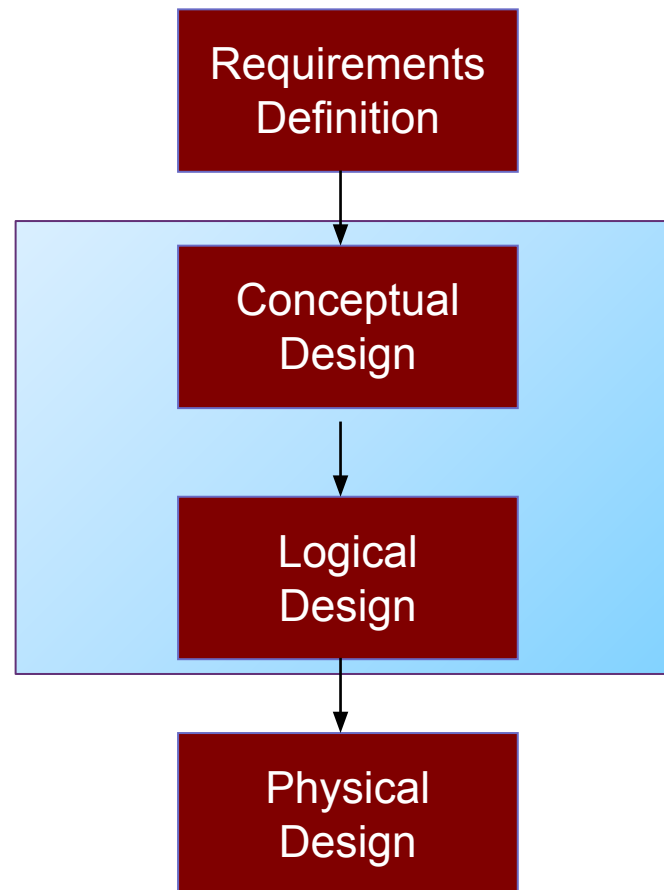
FIT2094-FIT3171



ANSI/SPARC architecture - proposed 1975



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.

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](#)

Student

[To Add Units Click here](#)

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 1 (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

Allocate⁺

Activity Groups:

Applied_PASS

(READ ONLY)

Enrolments: 826
 Preferences: 0
 Allocations: 0
 Seats Provided: 180
Warning: Not enough seats provided

Tutorial

(ALLOCATION ADJUSTMENT)

Enrolments: 826
 Preferences: 260
 Allocations: 826
 Seats Provided: 840

Workshop

(ALLOCATION ADJUSTMENT)

Enrolments: 826
 Preferences: 259
 Allocations: 826
 Seats Provided: 840

Subject Administrator

FIT9132_CL_S1_ON-CAMPUS, INTRO TO DATABASES

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

FIT9132_CL_S1_ON-CAMPUS:INTRO TO DATABASES Tutorial

[Allocate](#)

[Add Activity](#)

[Show Message](#)

[Show Allocated](#)

[Waitlist](#)

[Show Unallocated](#)

Functions							Activity Code	Campus	Day	Start Time	Location	Staff	Duration	Planned Size	Buffer
Delete	Edit	List	Constraint	Context	Email		01	CL	Tue	12:00	CL_20Exh/G15	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		02	CL	Tue	14:00	CL_20Exh/G15	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		03	CL	Tue	16:00	CL_20Exh/G05	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		04	CL	Mon	18:00	CL_20Exh/104	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		05	CL	Wed	14:00	CL_20Exh/G05	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		06	CL	Thu	08:00	CL_20Exh/G15	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		07	CL	Thu	10:00	CL_20Exh/G15	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		08	CL	Mon	08:00	CL_20Exh/104	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		09	CL	Tue	08:00	CL_20Exh/107	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		10	CL	Tue	18:00	CL_20Exh/G05	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		11	CL	Mon	16:00	CL_20Exh/G06	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		12	CL	Mon	10:00	CL_20Exh/104	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		13	CL	Mon	12:00	CL_20Exh/107	-	120	60	0
Delete	Edit	List	Constraint	Context	Email		14	CL	Mon	14:00	CL_20Exh/G05	-	120	60	0

3 of workshops
hour tutorial

Unit guides



[Unit Guide Manager](#) | [Find a unit guide](#)

FIT9132: Introduction to databases

Semester 1 (S1-01) 2020

Contents
Unit handbook information
Synopsis
Location(s) and mode(s) of delivery
Workload requirements
Class Timetable
Unit relationships
Prerequisites
Prohibitions
Co-requisites
Enrolment rules

We acknowledge and pay respects to the Traditional Owners and Elders - past, present and emerging - of the lands and waters on which Monash University operates.

The information contained in this unit guide is correct at time of publication. The University has the right to change any of the elements contained in this document at any time.

Last updated: 23 Feb 2020

Status: Approved

Table of contents

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, in of relational database using SQL will be covered.

in(s) and mode(s) of delivery

campus)

ad requirements

if expected workload equals 12 hours per week comprising:

ours for on-campus students:

Staff &
Student

Admin

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



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).
- 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)

Conceptual Level (ER Model)

ENTITY

Collection of "Customer(s)"

RELATIONSHIP

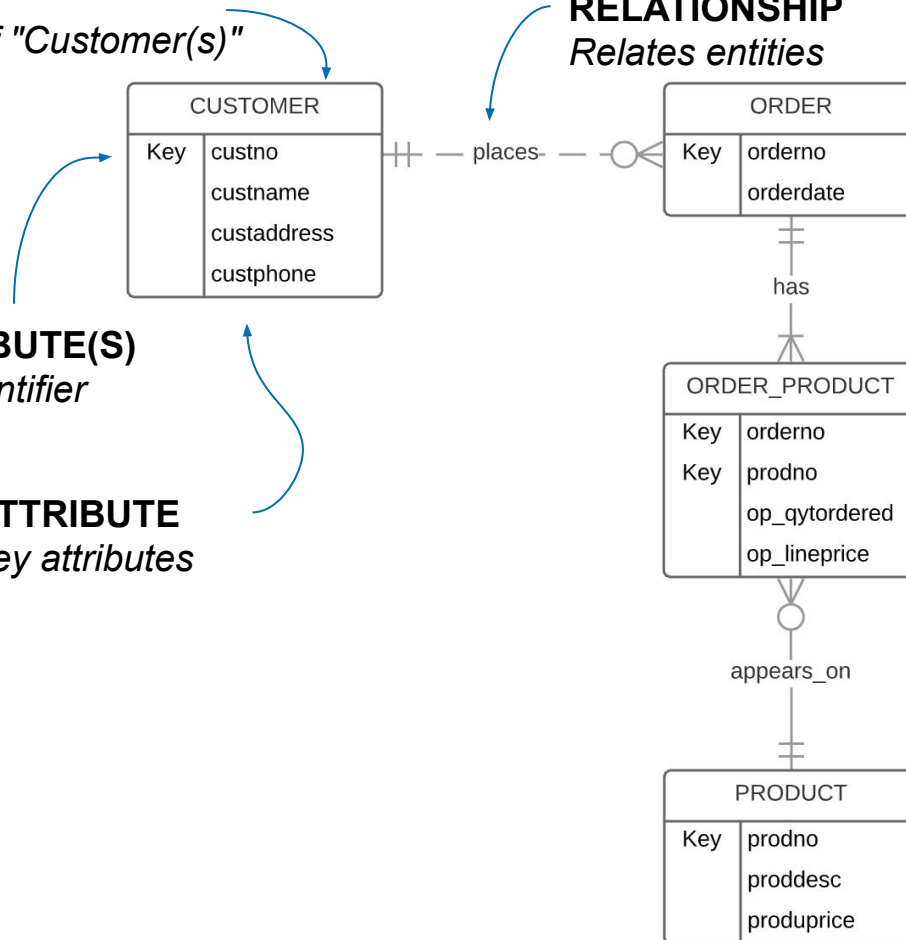
Relates entities

KEY ATTRIBUTE(S)

Instance identifier

NON KEY ATTRIBUTE

Other non-key attributes

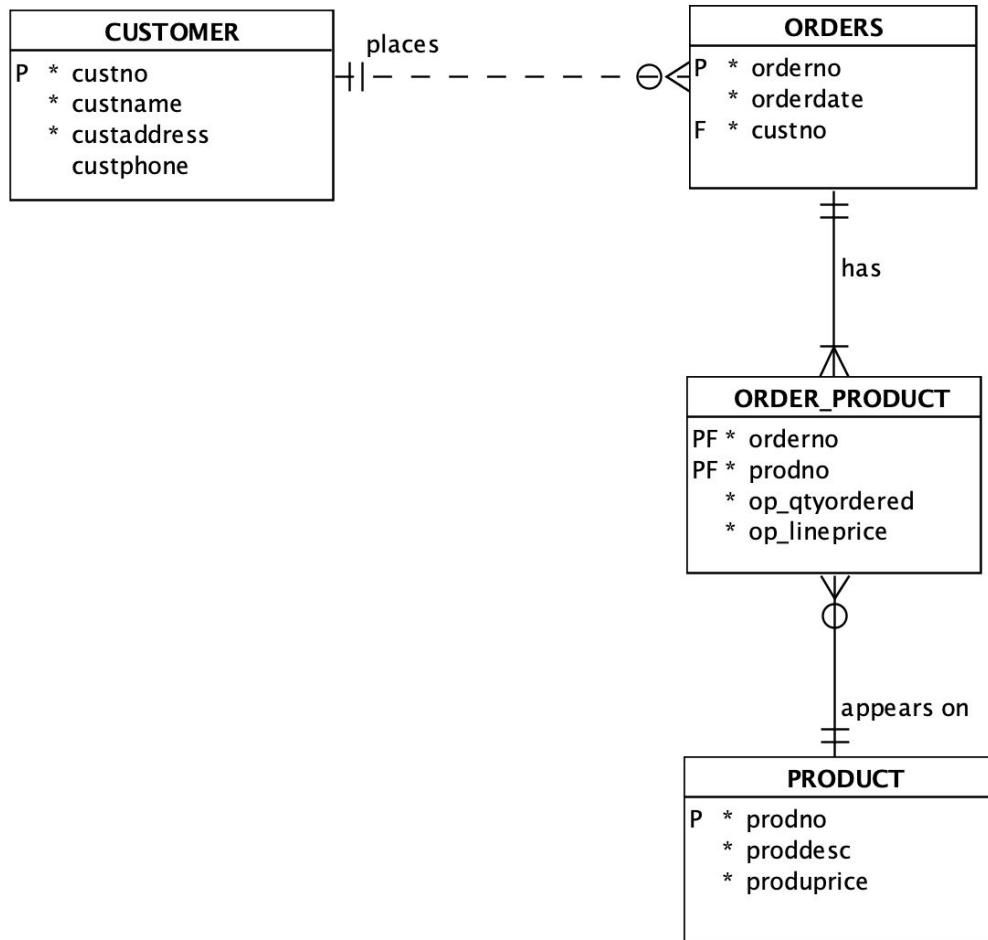


Assignment 1A

Logical Design

- Develop a data model which targets a particular database model (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.

Logical Level (Logical Model - Relational)



Assignment 1B

Physical Design

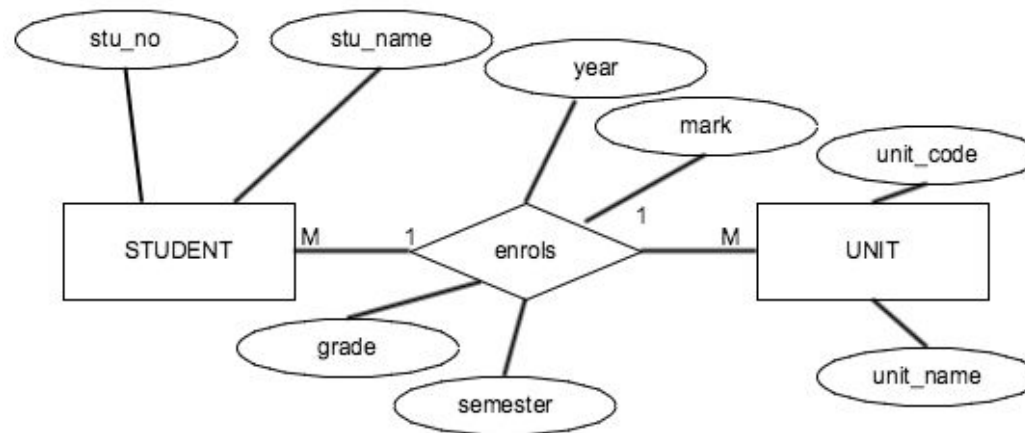
- Develop a strategy for the physical implementation of the logical data model.
- Choose appropriate storage structures, indexes, file organisations and access methods which will most efficiently support the user requirements (not part of unit).
- Physical design phase is dependent on the particular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

Physical Level – Starting point

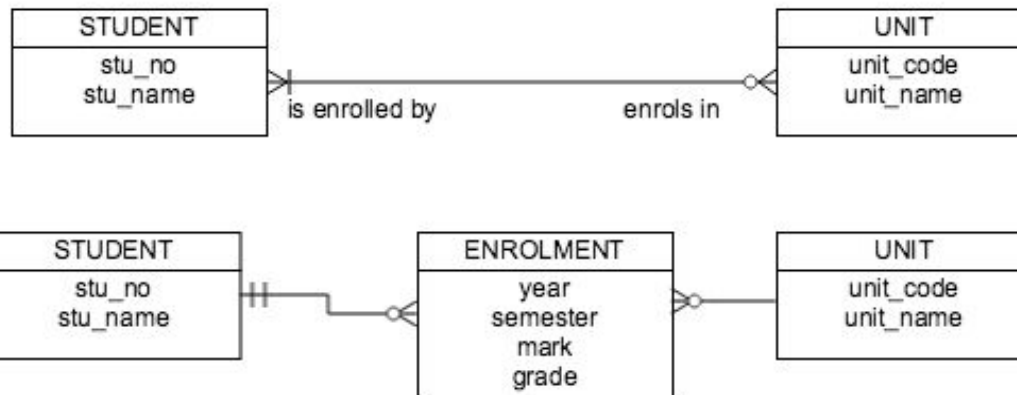
```
Oracle Database 12c Relational_1 Generate

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
```

ERD - Notation



Chen



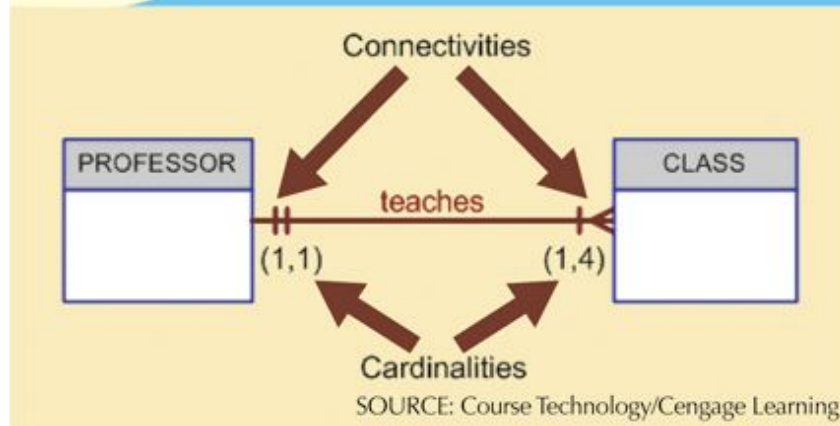
Information

**Engineering/James
Martin/Crows foot**

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

FIGURE 4.7

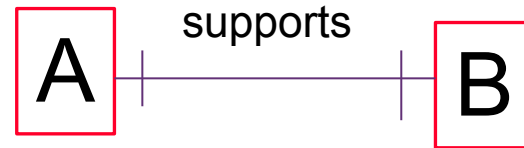
Connectivity and cardinality in an ERD



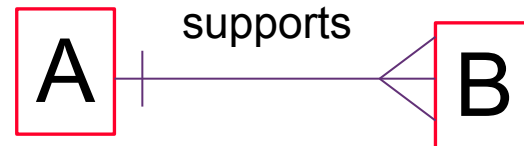
In general for Crows Foot notation specific cardinalities are not shown as above eg. (1,4), instead participation is depicted via min and max participation using the standard symbols (Inside symbol = min, outside symbol = max)

CONNECTIVITY

one to one



one to many



many to many

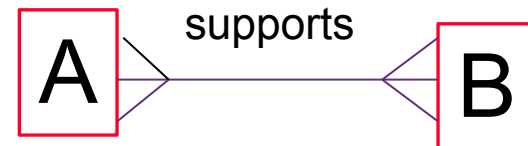
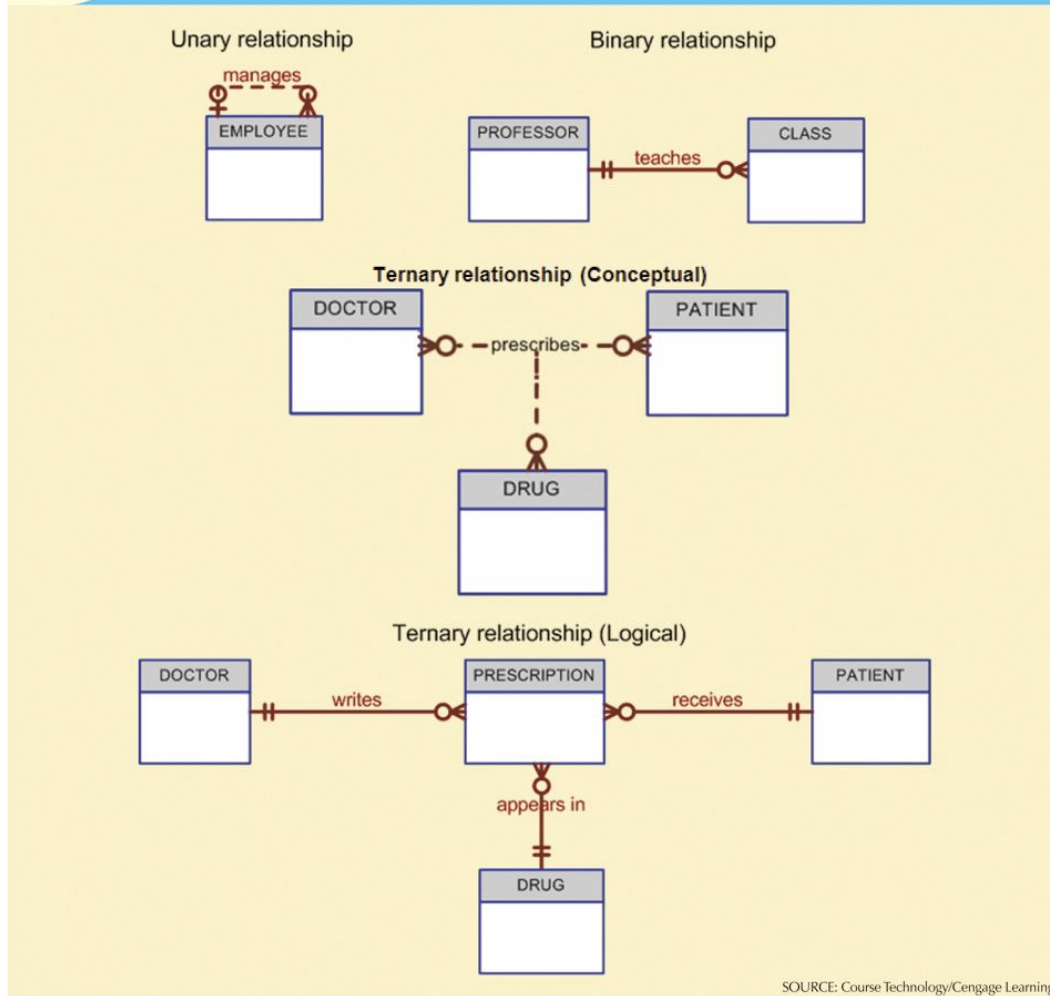


FIGURE 4.15

Three types of relationship degree



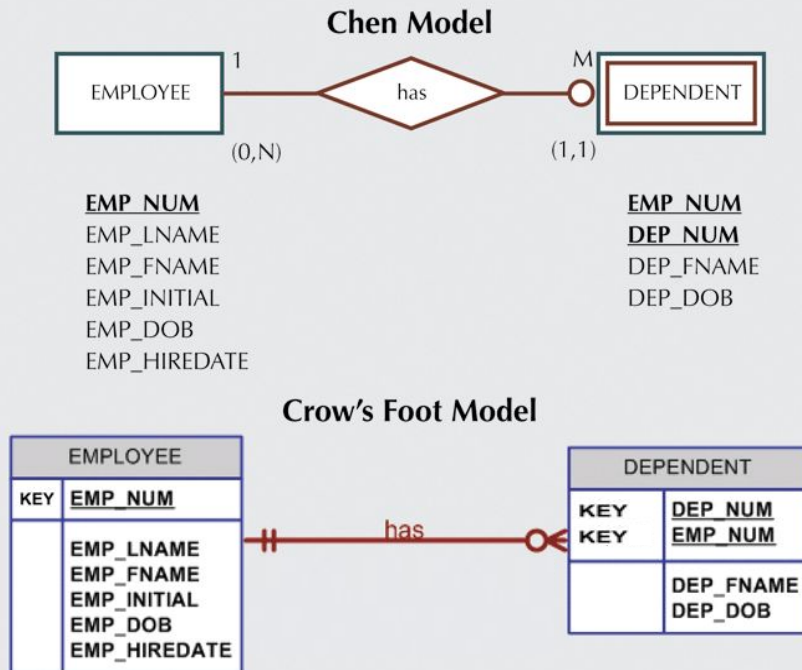
Weak vs Strong Entity

- 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)

Weak vs Strong Entity

FIGURE 4.10

A weak entity in an ERD



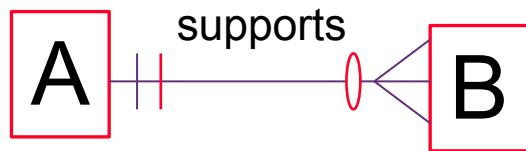
SOURCE: Course Technology/Cengage Learning

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

Identifying vs Non-Identifying Relationship

- **Identifying**

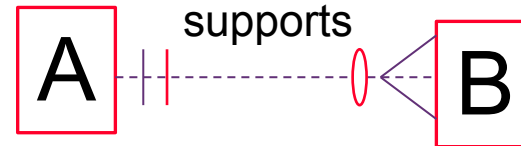
- Identifier of A is part of identifier of B.



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

- **Non-identifying**

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



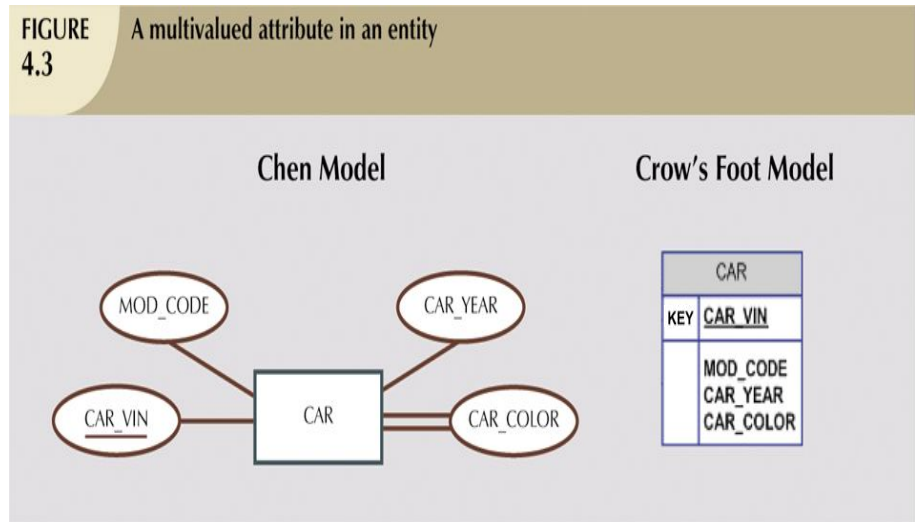
- Shown with broken line
- Department no (identifier of department) is not part of Employee's identifier.

Types of Attributes

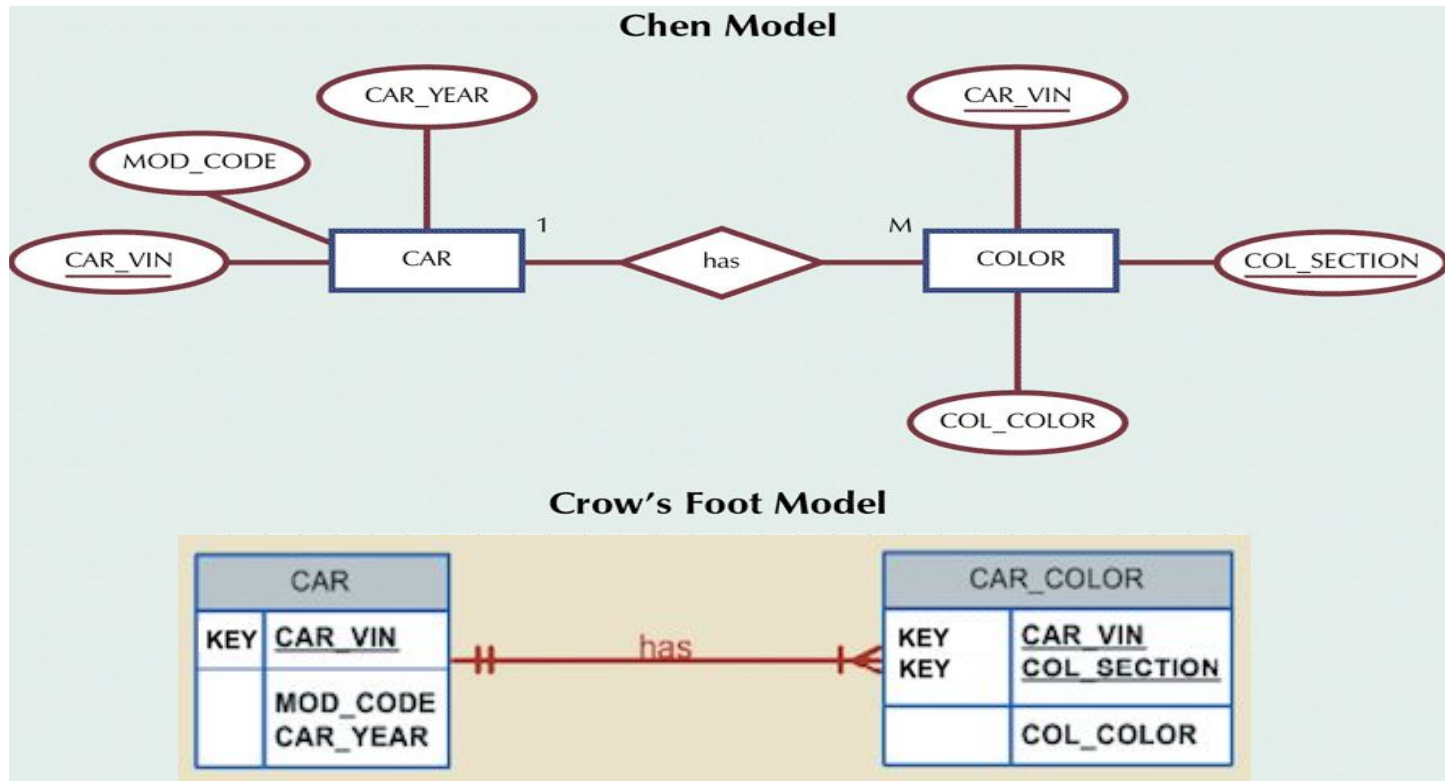
- Simple
 - Cannot be subdivided
 - Age, sex, marital status
 - Composite
 - Can be subdivided into additional attributes
 - Address into street, city, zip
 - Single-valued
 - Can have only a single value
 - Person has one social security number
- Multi-valued
 - Can have many values
 - Person may have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

Multivalued Attribute

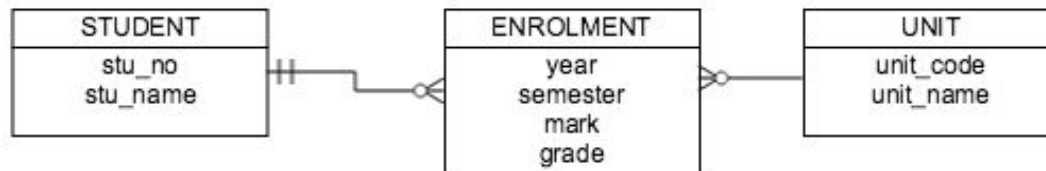
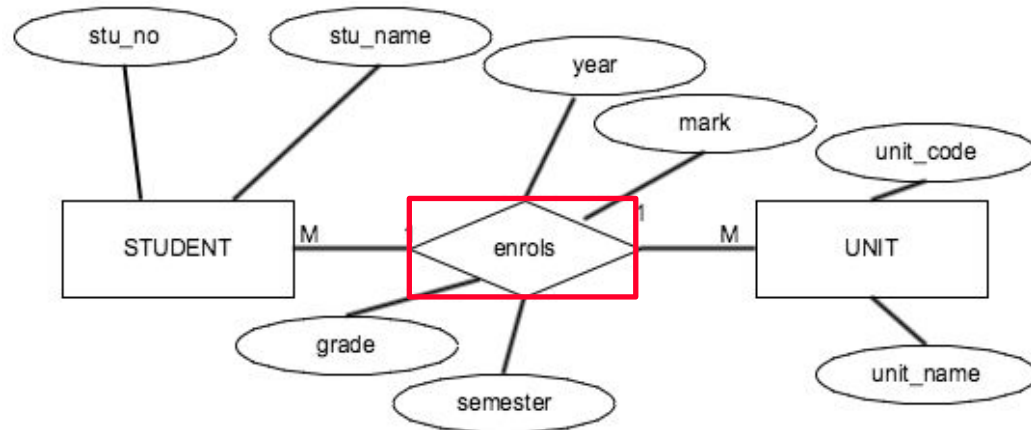
- An attribute that has a list of values.
- For example:
 - Car colour may consist of body colour, trim colour, bumper colour.
- Crow's foot notation does not support multivalued attributes. Values are listed as a separate attribute.



Resolving Multivalued Attributes



Associative (or Composite) Entity



Unified Modeling Language (UML)

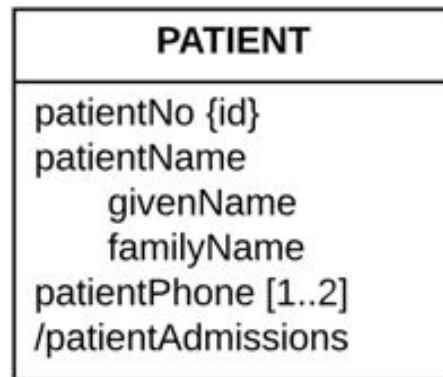
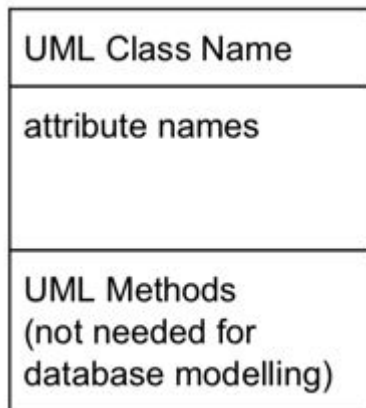
- No assessment on UML for FIT2094
- FIT3171 will be examined on UML:
 - submit a UML diagram along with crow's foot ER Diagram in Assignment 1a
 - some questions in exam

Unified Modeling Language (UML)

- The way that data is organised in a database is very different to the way it is organised in an OO program
 - eg. inheritance
- Use a **subset** of UML notation for database modelling
- Several vendors support Database Modelling via UML, some examples:
 - Star UML
 - Altova UModel
- Variety of standards adopted, not widely used in practice

UML Notation for the unit

Standard UML Diagram is used as the basic structure:

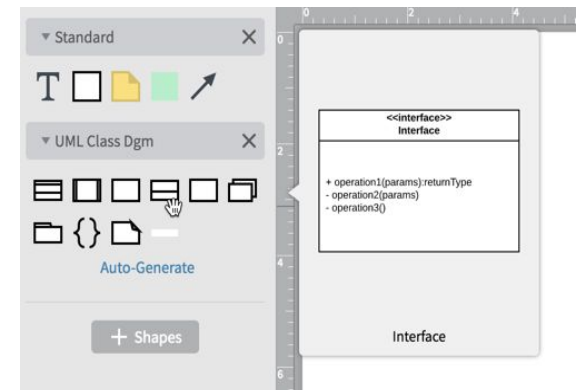


{id} - indicates KEY

Indentation for composite attribute

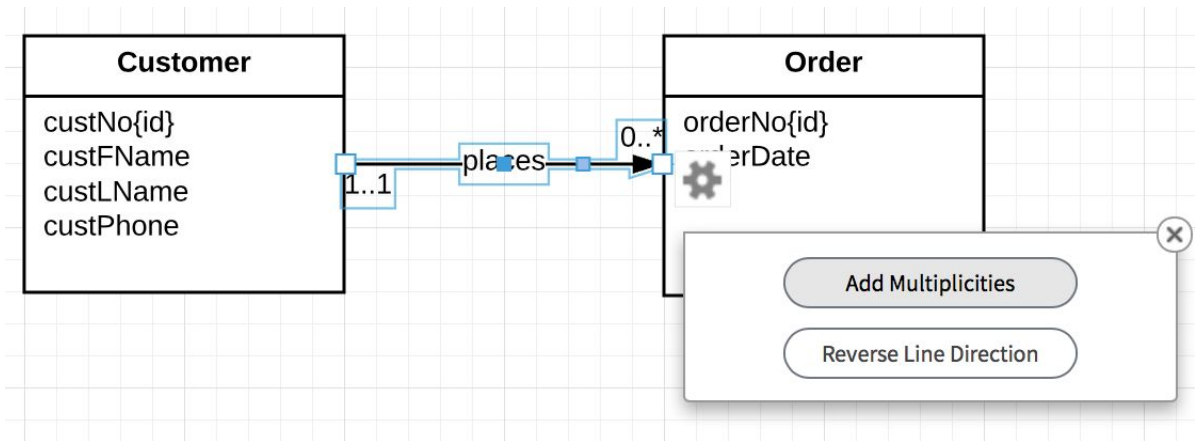
[n..m] - multivalued attribute

/ - calculated attribute



use Interface shape as no
methods being added

UML - Relationship



Relationship lines - directed line, arrowhead at M end,
add Multiplicities (minimal and maximal on each side)