Entity Relationship Model/Diagram

Database model and ERD

- **Database model**
    - a model that determines the logical structure of a database and
    - fundamentally determines in which manner data can be
        - stored,
        - organised, and
        - manipulated
- **ERD** is the basic building block for database modelling
- ERD consists of THREE main components
    - Entity
    - Attributes
    - Relationship
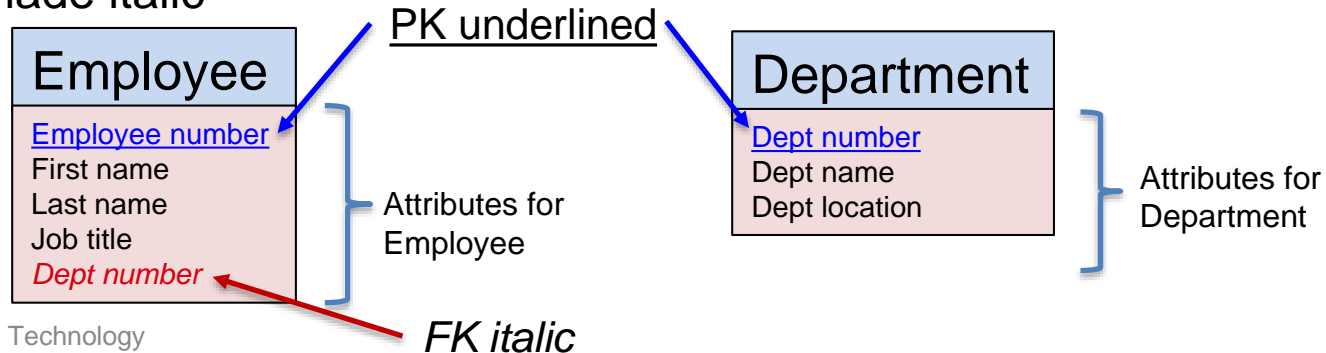
Entity

- Each entity corresponds to a table in which we store data about a particular thing, e.g., Student, Course, Lecturer {they are **Nouns & Singular**!}
- Drawn as a box
  - *How to keep track of data regarding which [employee](#) works in which [department](#)?*
  - In fact, we have to collect data on both employees and departments in TWO tables, thus we have TWO entities:
    - Employee
    - Department

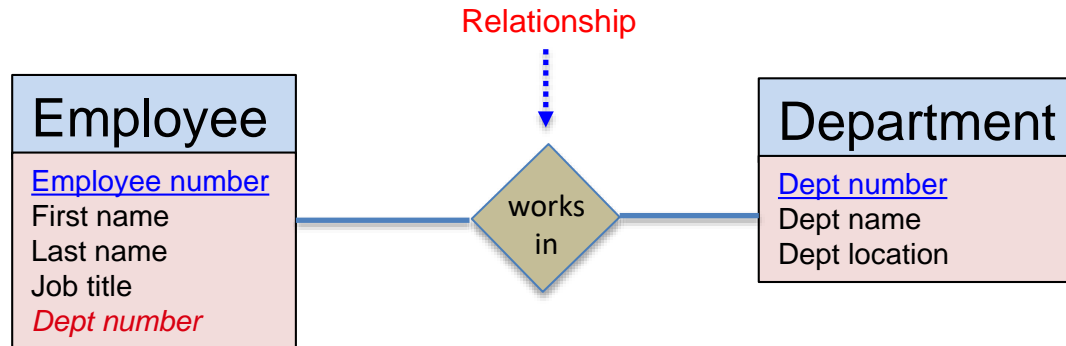Entity → Employee

Entity → Department
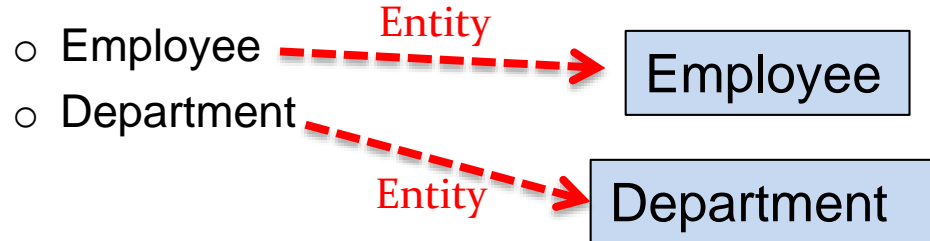
Attributes

- Describe characteristics of an entity, e.g. attributes for the Employee entity are employee number, first name, last name, job title etc.

  o Attributes of an entity are listed within the entity box

 o Primary key is underlined

  o Foreign key is made italic

PK underlined

Employee

Employee number
First name
Last name
Job title
Dept number

Attributes for Employee

Department

Dept number
Dept name
Dept location

Attributes for Department

FK italic

Relationship

- Illustrates an association (business rule) between two entities

- A relationship has a name that is a verb

- Example: What is the relationship between Employee and Department?
   - Employee works in Department

Relationship (continued)

- But what is an actual business rule between Employee and Department entities?
    - An employee works in a department and
    - A department can employ many employees.
- Connectivity specifies
    - The type of relationship between 2 entities: 1:1; 1:M; M:N
    - The maximum number of times an instance of an entity can be related to instances of the other entity in a relationship between 2 entities.
- Participation specifies the minimum number of times an instance of an entity can be related to instances of the other entity in a relationship between 2 entities: optional and mandatory.
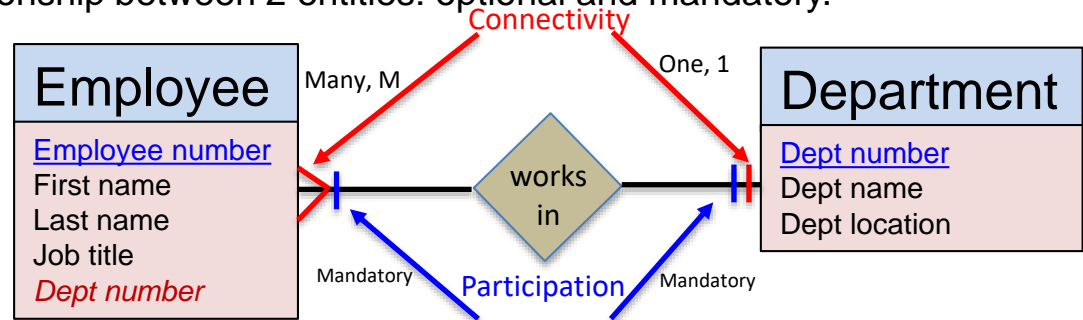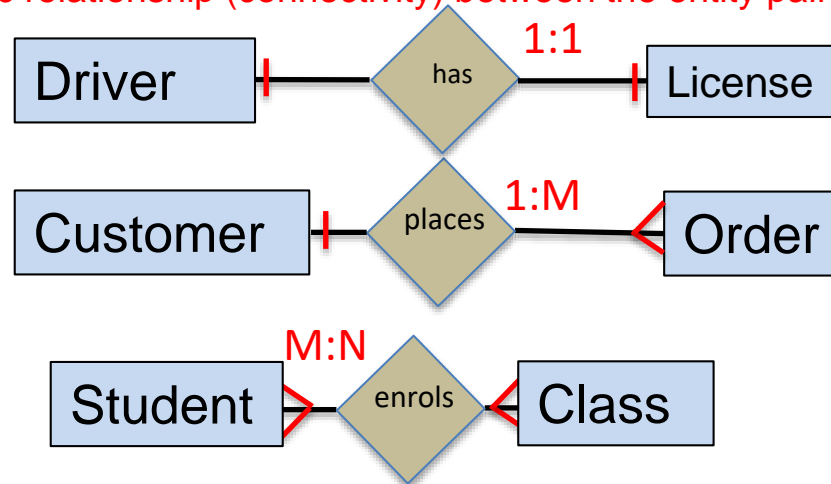
Relationship (continued)

- Now business rules are there:
  - An employee works in a department and
 - A department can employ many employees.
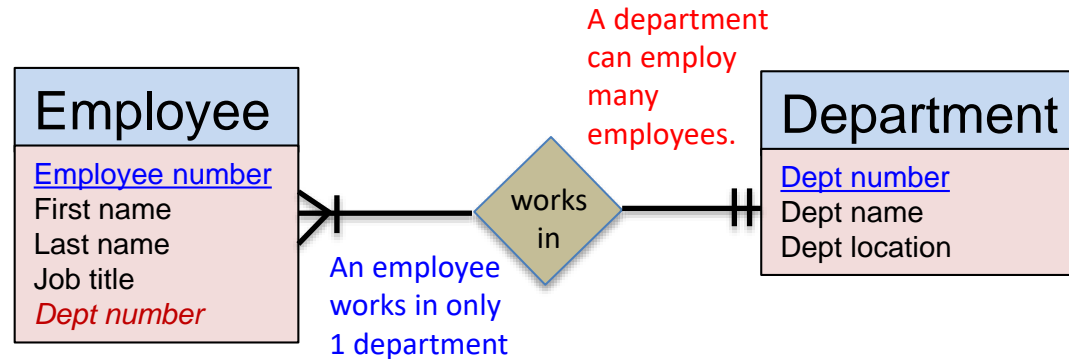
Connectivity types: 1:1, 1:M, M:N

- Total **THREE** types of relationships exist based on connectivity:

  - one-to-one or 1:1,

  - one-to-many or 1:M,

  - many-to-many or M:N

- Identify a specific relationship (connectivity) between the entity pair below
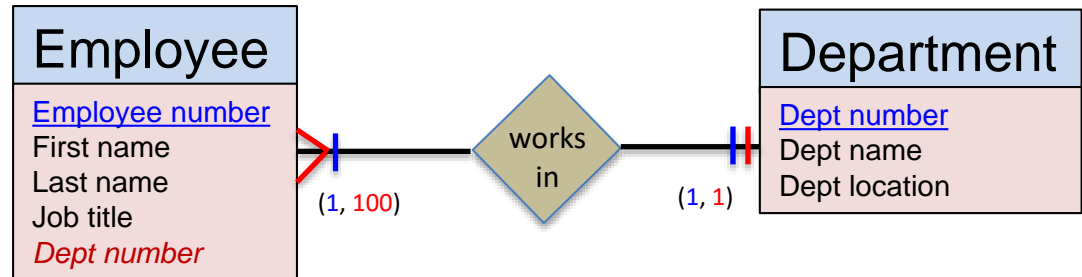
Participation types: '0' or '1'

- Total **TWO** types of participation exist in a relationship:

  - Optional = 0,

  - Mandatory = 1,

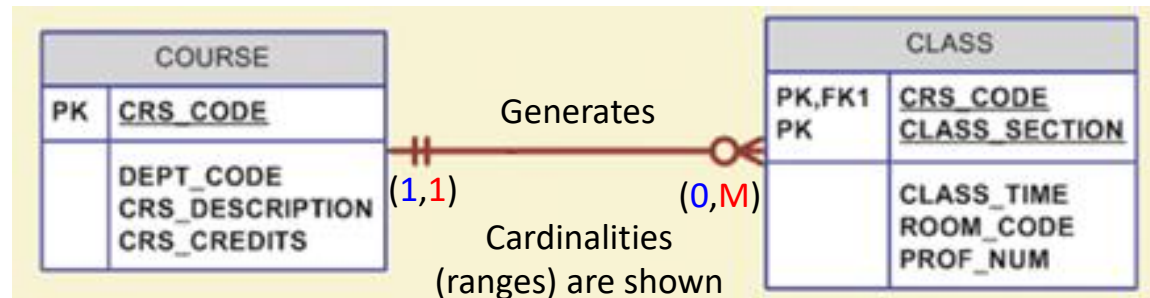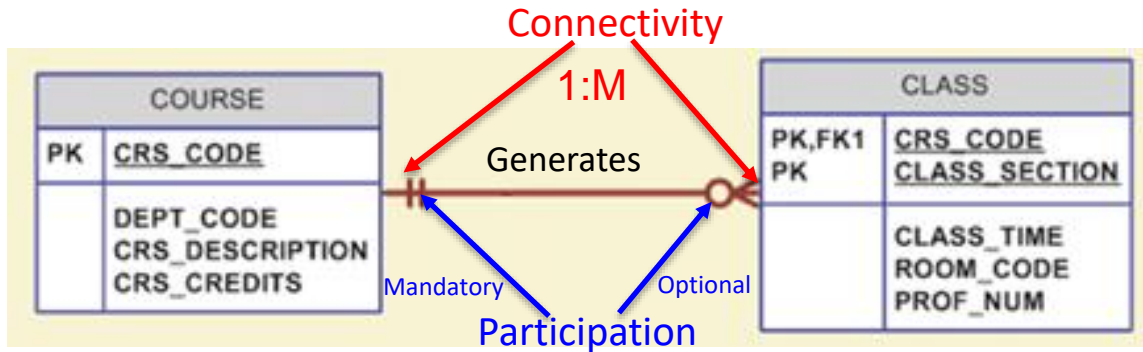- Identify a specific participation between the entity pair below

- Depends on given business rule
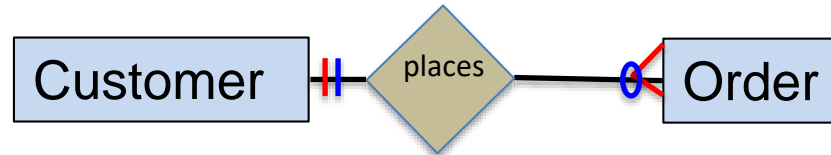
- Cardinality
  - Assigns a specific range of values (min, max) for each entity in a relationship between 2 entities.
  - The range (min, max) values for each entity specify its maximum and minimum occurrences associated with a single occurrences of the other entity in the relationship.
    - **Example:** A department can employ at least employee but not more than 100, whereas an employee works in one and only one department.
  - In Crow's Foot notations, cardinality is expressed by the symbols of connectivity (max) and participation (min).

Employee		Department
Employee number	works in	Dept number
First name	(1, 100) (1, 1)	Dept name
Last name		Dept location
Job title		
Dept number		

Relationship (continued) – another example

Business rules:

- A COURSE may generate many CLASSES, but a CLASS is generated by only one COURSE.

Table name: COURSE — **Database name: Ch04_TinyCollege_Alt**

CRS_CODE	DEPT_CODE	CRS_DESCRIPTION	CRS_CREDIT
ACCT-211	ACCT	Accounting I	3
ACCT-212	ACCT	Accounting II	3
CIS-220	CIS	Intro. to Microcomputing	3
CIS-420	CIS	Database Design and Implementation	3
MATH-243	MATH	Mathematics for Managers	3
QM-261	CIS	Intro. to Statistics	3
QM-362	CIS	Statistical Applications	4

Table name: CLASS

CRS_CODE	CLASS_SECTION	CLASS_TIME	ROOM_CODE	PROF_NUM
ACCT-211	1	MWF 8:00-8:50 a.m.	BUS311	105
ACCT-211	2	MWF 9:00-9:50 a.m.	BUS200	105
ACCT-211	3	TTh 2:30-3:45 p.m.	BUS252	342
ACCT-212	1	MWF 10:00-10:50 a.m.	BUS311	301
ACCT-212	2	Th 6:00-8:40 p.m.	BUS252	301
CIS-220	1	MWF 9:00-9:50 a.m.	KLR209	228
CIS-220	2	MWF 9:00-9:50 a.m.	KLR211	114
CIS-220	3	MWF 10:00-10:50 a.m.	KLR209	228
CIS-420	1	W 6:00-8:40 p.m.	KLR209	162
MATH-243	1	Th 6:00-8:40 p.m.	DRE155	325
QM-261	1	MWF 8:00-8:50 a.m.	KLR200	114
QM-261	2	TTh 1:00-2:15 p.m.	KLR200	114

0 class

Cardinalities are:
- One COURSE (instance) generates 0 or many CLASSES. (Left to right)
- One CLASS is generated by 1 and only 1 COURSE. (Right to Left)

Thank you.