Entity-Relationship Modelling

What is it about?

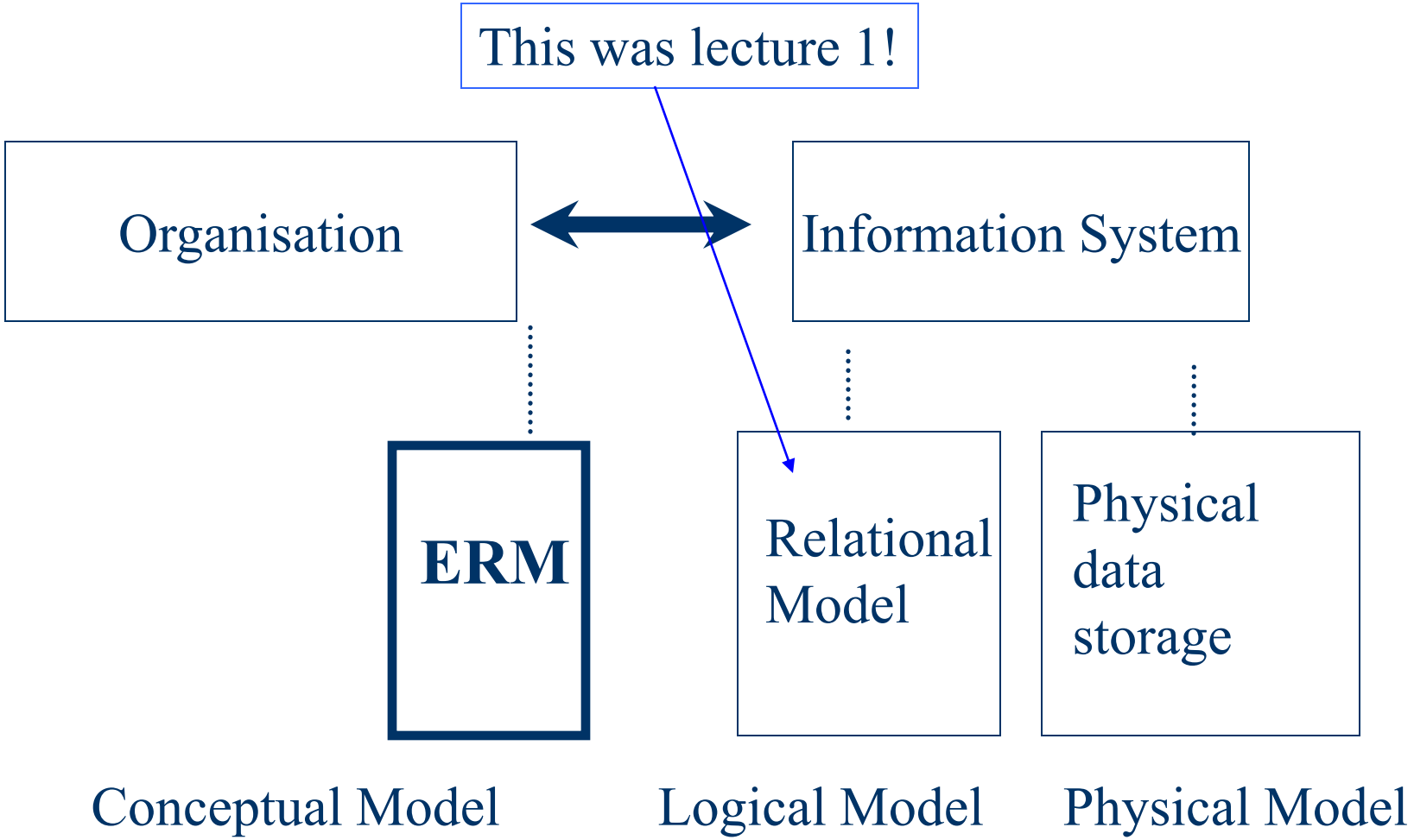
- ER model is used to show the C*onceptual* schema of an organisation.
- **Independent of specific data model or DBMS**

- The model is later transformed into a *Logical* model (e.g. relational) on which the physical database is built

- The most widely used form of *Semantic modelling*: attempt to capitalise on knowledge of *meaning* of data to inform the model
- So we need a vocabulary

The Entity Relationship Model

- Perspective

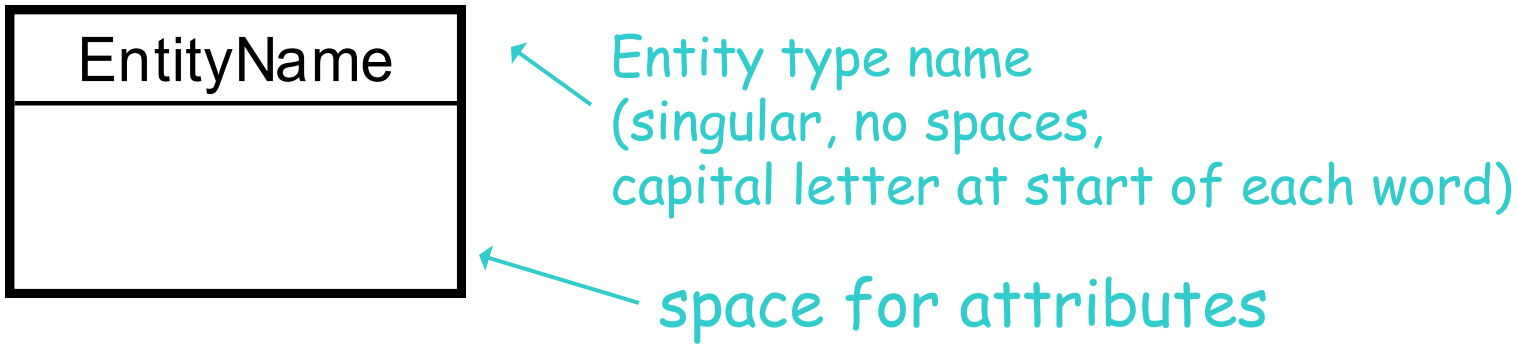


Skills and concepts

- So the concepts we want you to learn today are:
  - The basics of Entity-Relationship modelling
  - Entities
  - Relationships
  - Attributes

Entities

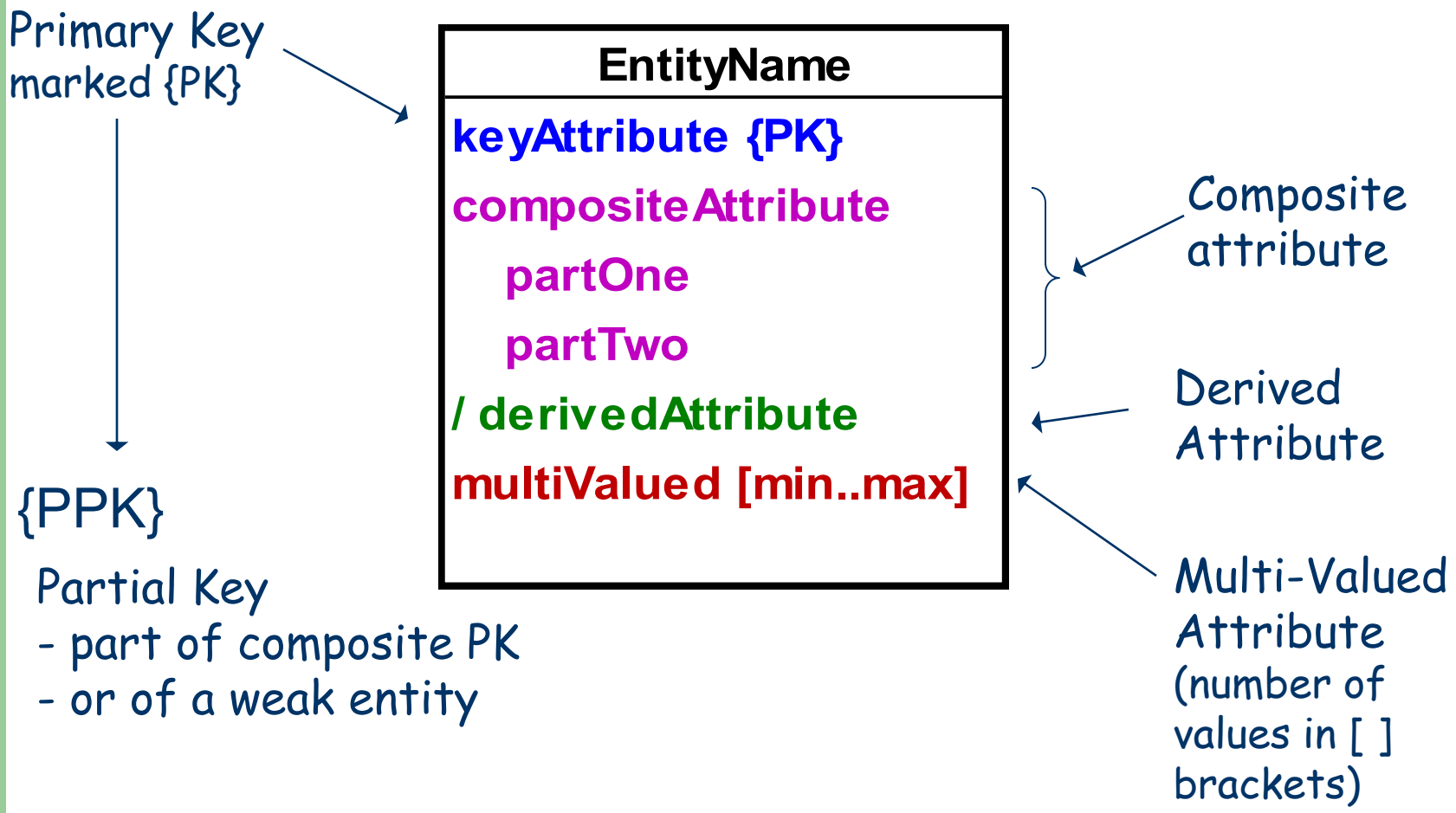
- Entity - distinguishable “thing” in the real world
  - Strong (or regular) entity - entities have an independent existence (e.g. staff)
  - Weak entity - existence dependent on some other entity (e.g. next of kin)



Attributes

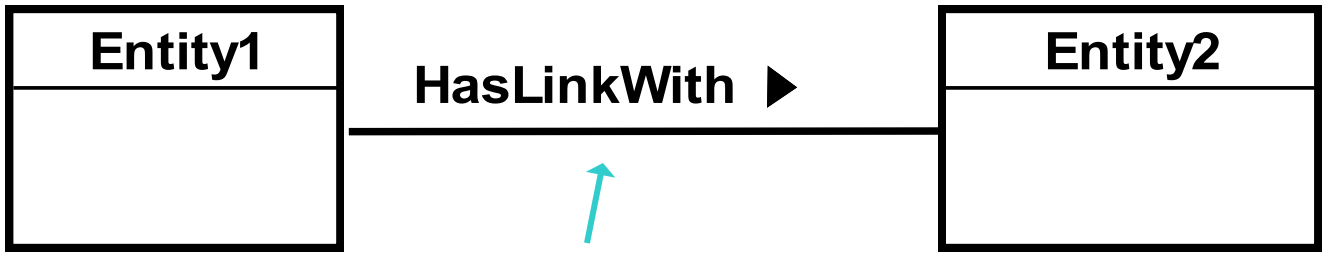
- Entity types have ***Attributes*** (or properties) which associate each entity with a value from a *domain* of values for that attribute
- Attributes can be
  - simple (atomic) — e.g. Surname; date of birth
  - composite — e.g. address (street, town, postcode)
  - multi-valued — e.g. phone number
  - complex — nested multi-valued and composite
  - base or derived — e.g. D.O.B. ; age
  - key
- Relationship types can also have attributes! (see later)

Notation for attributes



Relationships

- A relationship is
  ".. An association among entities (the participants).."
- Relationships link entities with each other



Relationships: constraints

- The ***degree*** of a relationship type
  - binary (connects 2 entity types)
  - unary/ recursive (connects 1 entity type with itself)
  - complex (connects 3 or more entity types)
    - Ternary (connects 3)

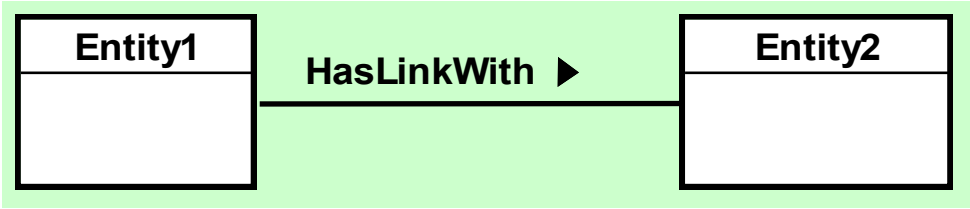
Degree

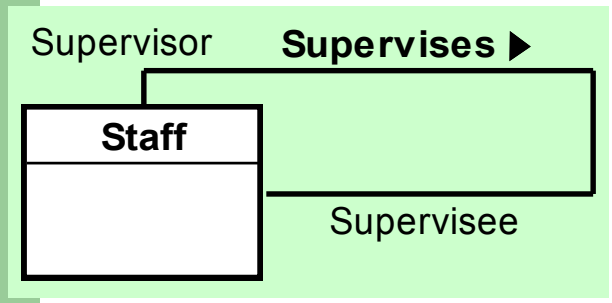
- Relationship constraints - ***cardinality***
  - one to one (1:1)
  - one to many (1:m)
  - many to many (m:n)
- Relationship constraints – ***participation***
  - full/mandatory
  - or partial/optional

Multiplicity

Relationships: Degree

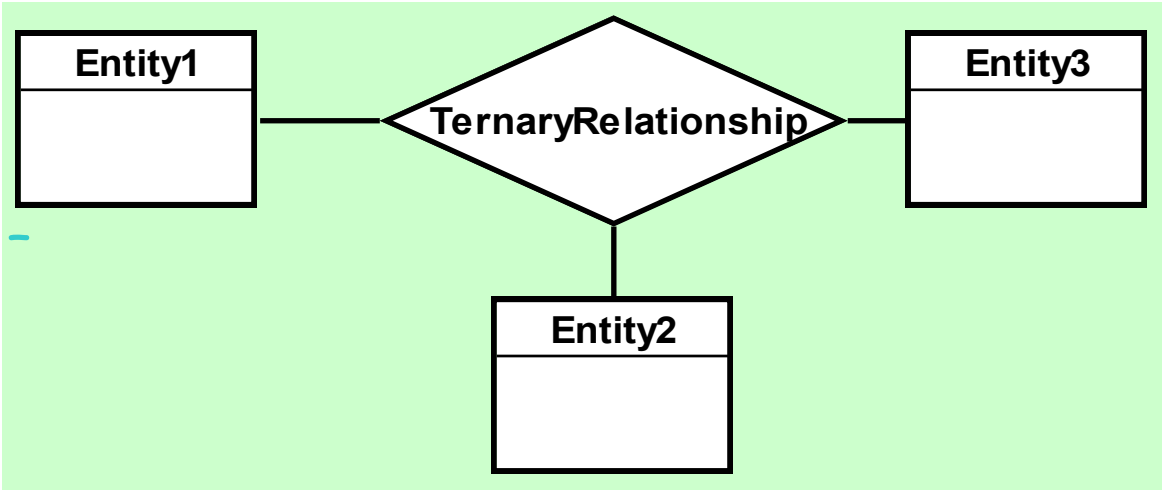
Binary relationship





Recursive (Unary) relationship - example

Complex relationship - here ternary



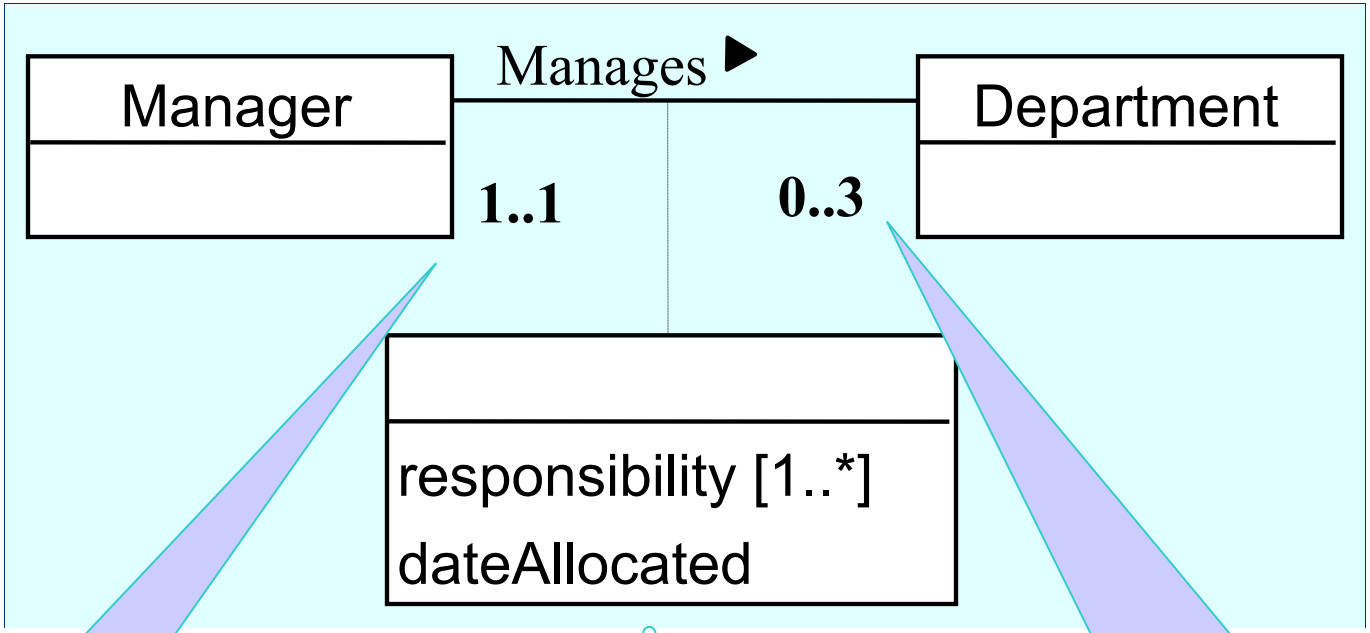
Relationships: Multiplicity

label lines to show cardinality and participation

0..1	"zero or one"	optional
0..*	"zero or more"	optional
1..1	"one"	mandatory
1..4	"between 1 and 4"	mandatory
1..*	"one or more"	mandatory

Entity1 has a 1:m relationship with Entity2;
participation for Entity2 is mandatory, for Entity1 optional.

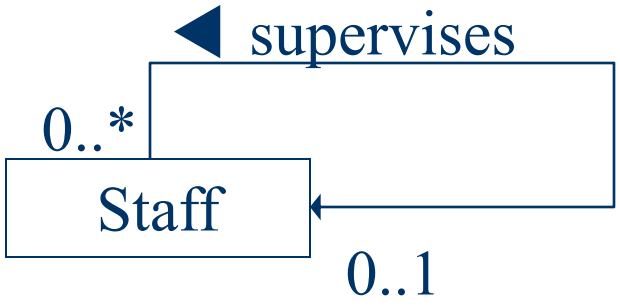
Relationships example



Over to You now!

- See if you can draw an E-R diagram for this scenario – you are already familiar with this!
  - "A student registers for up to 8 modules and each module has many students on it. Record the student ID, their full name and address and also each module ID and title. We also want to hold the grade attained by each student for each module"
    - Remember to show in your model:
      - All primary keys,
      - Entities
      - Relationships
      - Attributes

Unary Example with Data



A member of staff may supervise another staff member, but a staff member may be supervised by one or more staff members

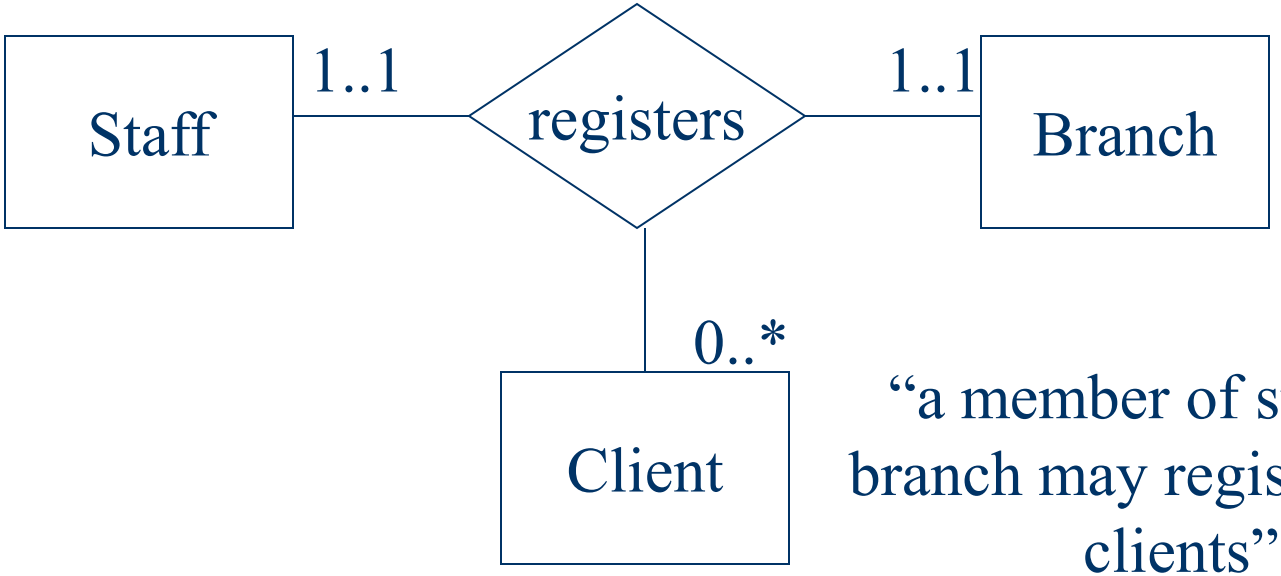
STAFF

Member	*Age*	*Supervisor*
Grey	43	Black
Black	27	
Brown	35	Black
White	33	Brown

Ternary Diagrams are Tricky!

"a client at a branch will be registered by one member of staff"

"a member of staff will register a client at one branch"



"a member of staff at a branch may register many clients"

Try to determine participation/cardinality by operating in pairs

Scenario modified from Connolly & Begg page 350

Key Points

- **ERM**
  - Entities (strong, weak)
  - Attributes (simple, composite, etc)
  - Relationships
    - Degree
    - Cardinality
    - participation
- Model with the UML notation at conceptual level

Directed Reading

- Connolly/Begg “Database Systems” (4th ed.)
  - Chapter 11
- Connolly/Begg “Database Solutions”
  - Chapter 7
  - Rob et al (chapter 5 but the notation is slightly different