CSE291 - Introduction to Software Engineering (Fall 2018)

Lecture 12

Entity/Relationship Modelling

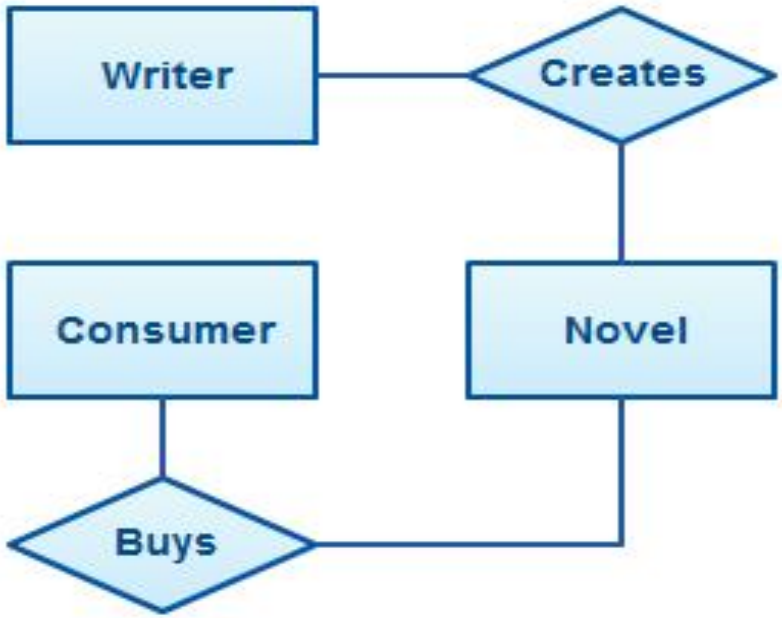
Lecture Outline

- Entity/Relationship models
  - Entities and Attributes
  - Relationships
  - E/R Diagrams

Entity/Relationship Modelling

- ERD is a data modeling technique used in software engineering to produce a conceptual data model of an information system.
- Illustrate the logical structure of database.
- It describe how these data are related to each other.
- For example, the entities writer, novel, and consumer may be described using ER diagrams this way:

Entity/Relationship Modelling

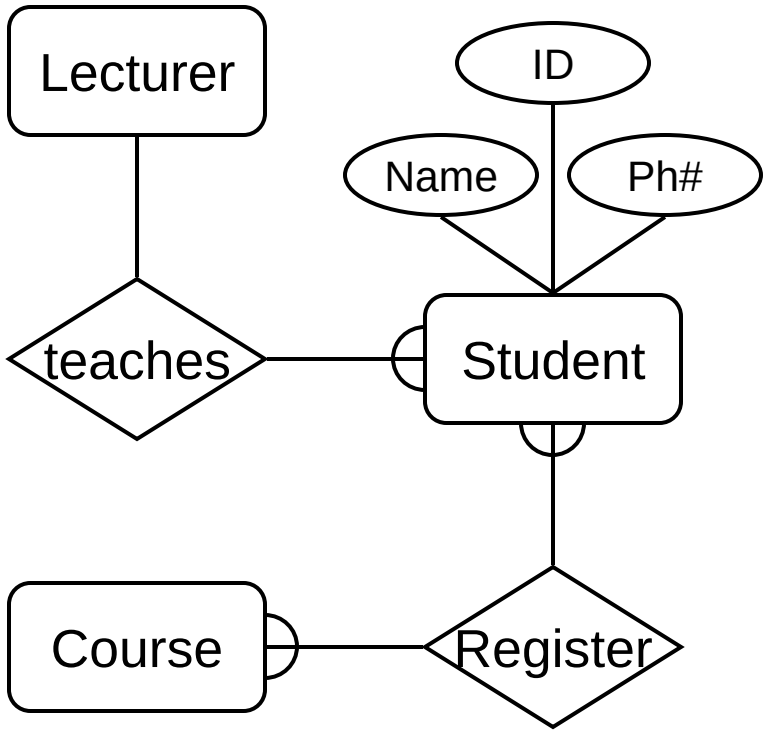


Entity/Relationship Modelling

- E/R Modelling is used for conceptual design
  - Entities - objects or items of interest
  - Attributes - Properties of an entity
  - Relationships - links between entities
- Example
  - In a University database we might have entities for Students, Modules and Lecturers. Students might have attributes such as their ID, Name, and Course, and could have relationships with Modules (enrolment) and Lecturers.

Entity/Relationship Diagrams

E/R Models are often represented as E/R diagrams

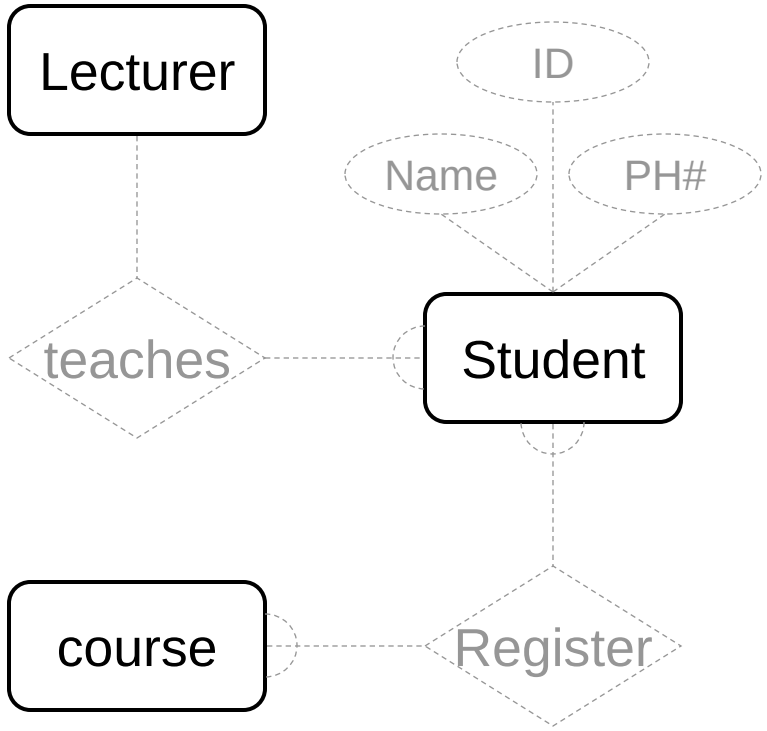


Entities

- Entities represent objects or things of interest
  - Physical things like students, lecturers, employees..
  - More abstract things like modules, orders, courses, projects
- Entities have
  - A general type or class, such as Lecturer or Module
  - Instances of that particular type, such as Steve Mills, Natasha are instances of Lecturer
  - Attributes (such as name, email address)

Entities

- In an E/R Diagram, an entity is usually drawn as a box with rounded corners or Rectangle
- The box is labelled with the name of that entity

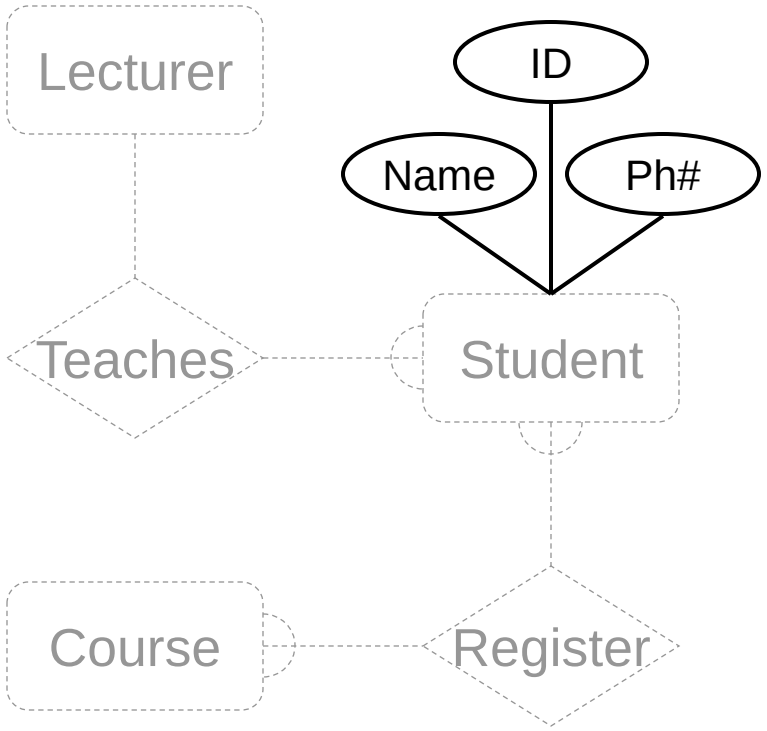


Attributes

- Attributes are properties, or details about an entity
  - Students have IDs, names, courses, addresses, …
  - Courses have codes, titles, credit weights. ….

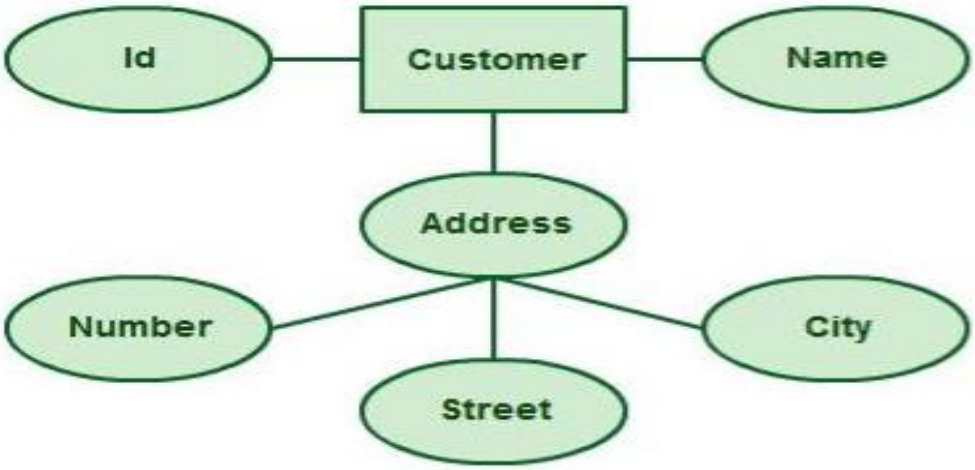
Diagramming Attributes

- In an E/R Diagram attributes may be drawn as ovals
- Each attribute is linked to its entity by a line
- The name of the attribute is written in the oval



Types of Attributes

- Attributes can also have their own specific attributes. For example, the attribute “customer address” can have the attributes “number, street, city, and state”. These are called **Composite attributes.**

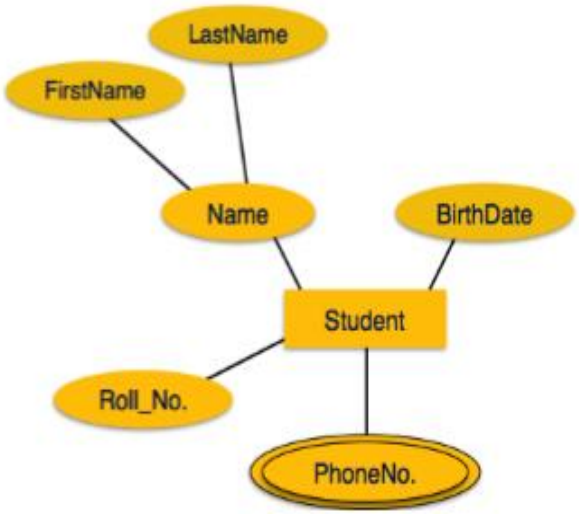


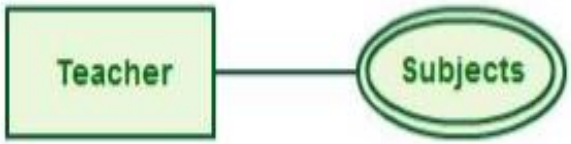
Types of Attributes

- Multivalued Attribute

  If an attribute can have more than one value it is called an multivalued attribute.

  For example a teacher entity can have multiple subject values.

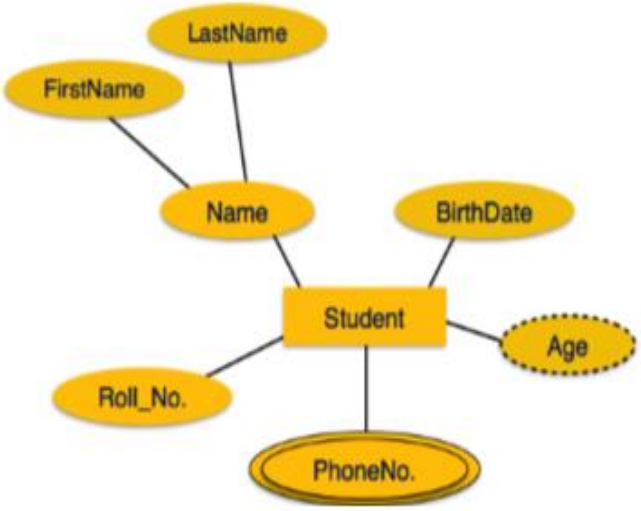


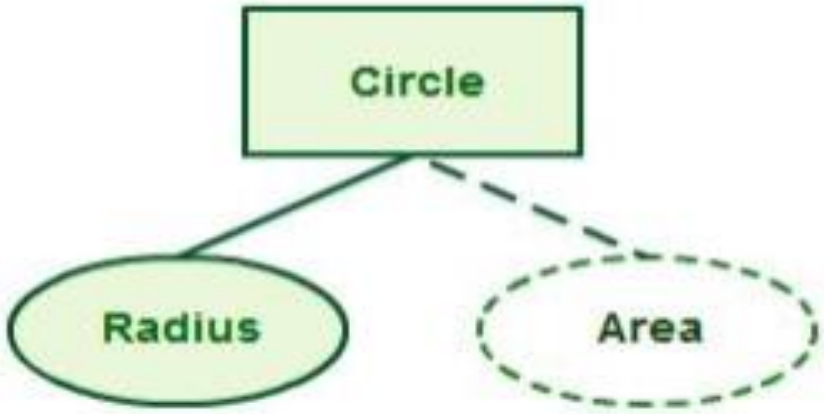


Types of Attributes

Derived Attribute

An attribute based on another attribute. This is found rarely in ER diagrams. For example for a circle the area can be derived from the radius.





Relationships

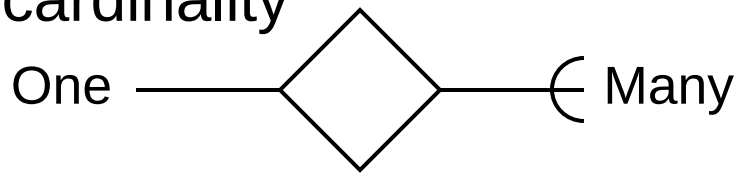
- Relationships are an association between two or more entities
  - Each Student takes several Courses
  - Each Course is taught by a Lecturer
  - Each Employee works for a single Department
- Relationships have
  - A name
  - A set of entities that participate in them
  - A degree - the number of entities that participate (most have degree 2)
  - A cardinality ratio

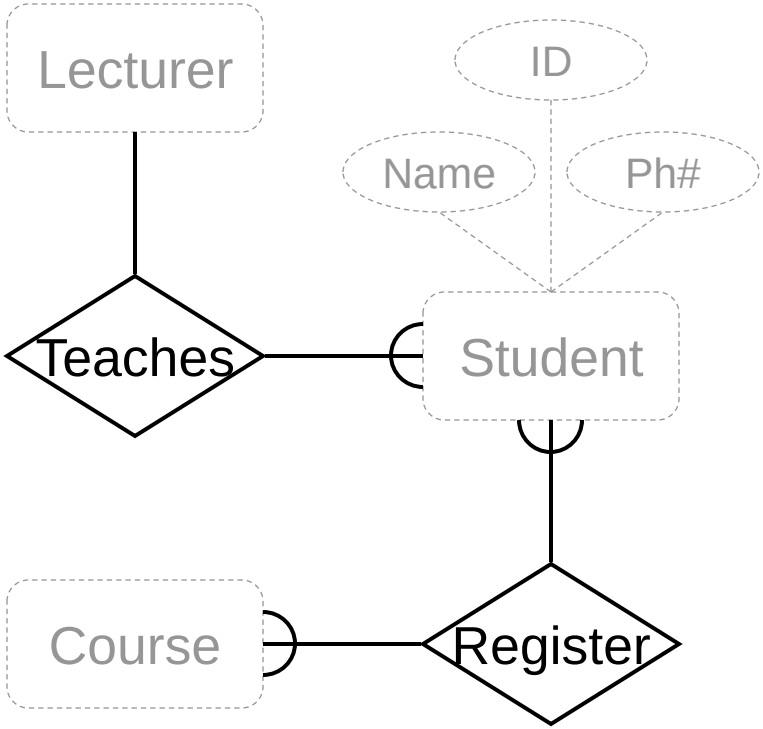
Cardinality Ratios

- Each entity in a relationship can participate in zero, one, or more than one instances of that relationship
- This leads to 3 types of relationship…
  - One to one (1:1)
    - Each lecturer has a unique office
  - One to many (1:M)
    - A lecturer may teaches many students, but each student has just one tutor for specific course
  - Many to many (M:M)
    - Each student takes several courses and each course is taken by several students

Diagramming Relationships

- Relationships are links between two entities
- The name is given in a diamond box
- The ends of the link show cardinality





Making E/R Models

- To make an E/R model you need to identify
  - Entities
  - Attributes
  - Relationships
  - Cardinality ratios
- from a description

- General guidelines
  - Since entities are things or objects they are often nouns in the description
  - Attributes are properties, and often nouns
  - Verbs often describe relationships between entities

Example

We want to represent information about products in a database. Each product has a Product id, description, and price. Suppliers supply the product.

Suppliers have addresses, phone numbers, and names. Each address is made up of a street address, a city, and a postcode.