CSC291 - Software Engineering Concepts (FALL 2019)

Lecture 23&24

Entity/Relationship Modelling

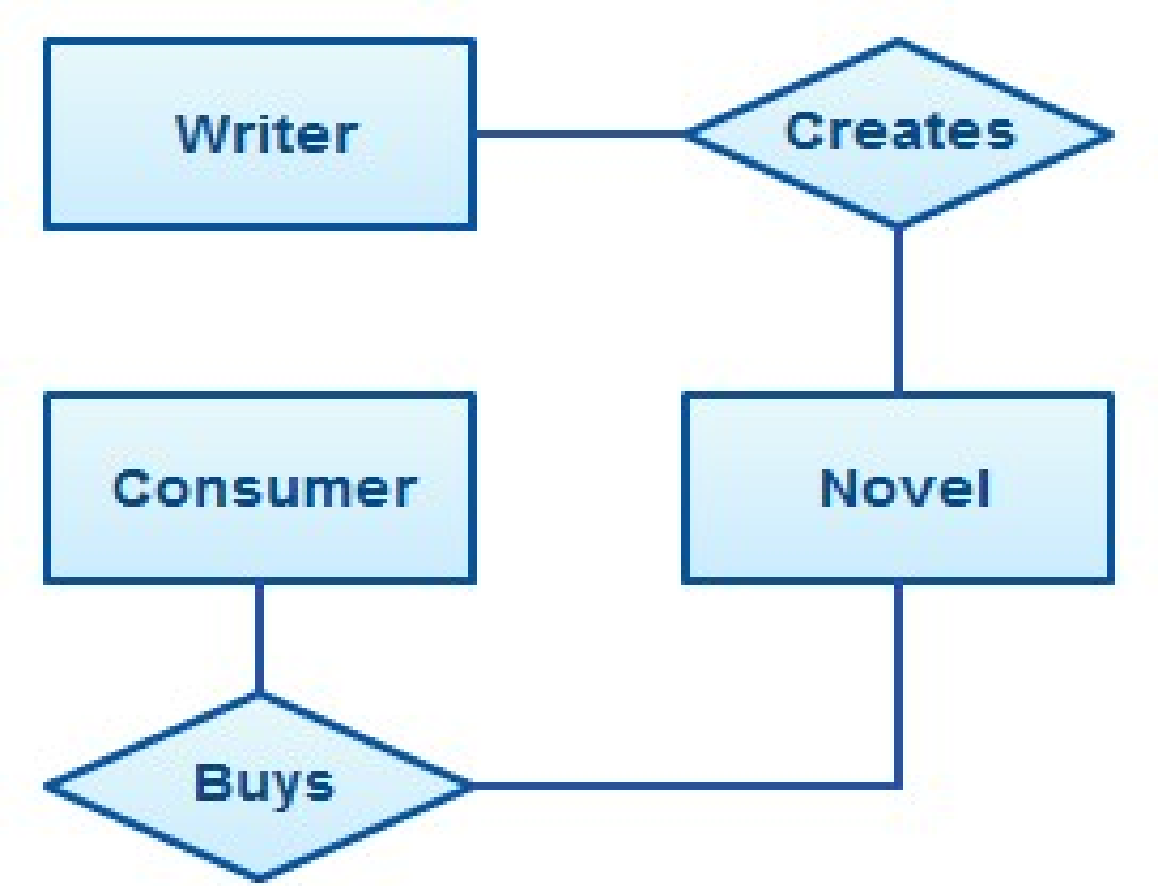
Lecture Outline

- 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



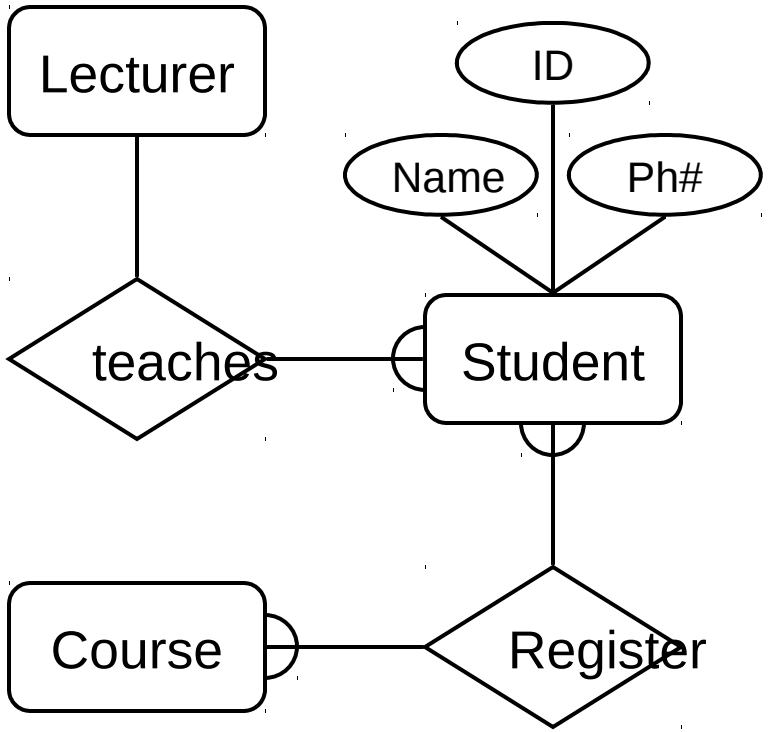
Entity/Relationship Modelling

- 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

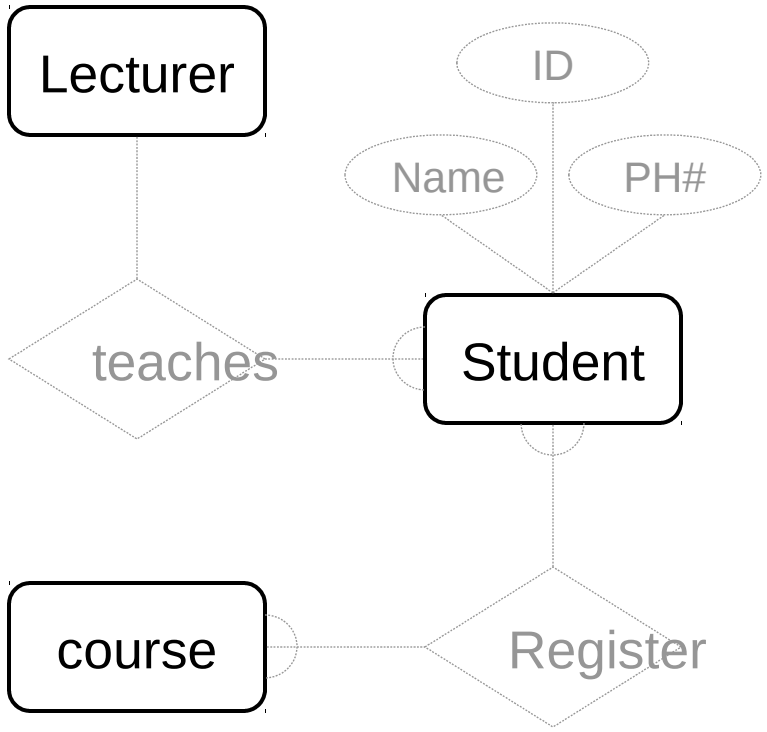


Entities

- 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

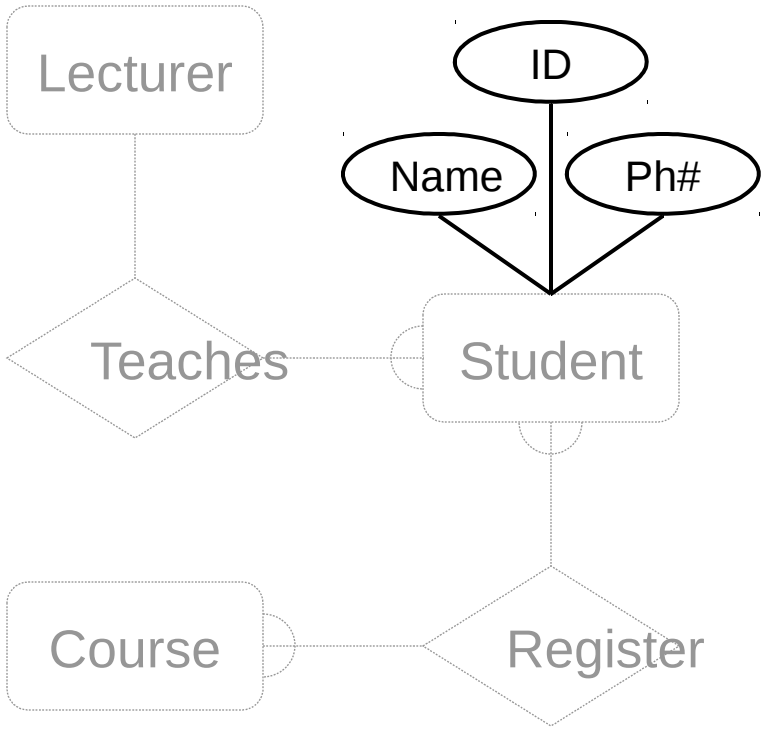


Attributes

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

Diagramming Attributes

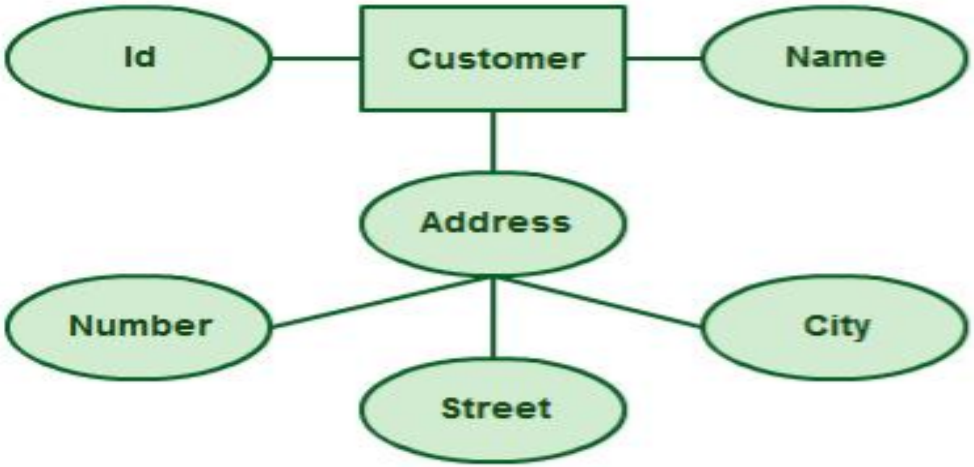
- In an E/R Diagram attributes may be drawn as ovals
- Each attribute is linked to its entity by a line
- The name of the attribute is written in the oval



Types of Attributes

- **Composite attributes**

  Attributes can also have their own specific attributes. For example, the attribute “customer address” can have the attributes “number, street, city, and state”.

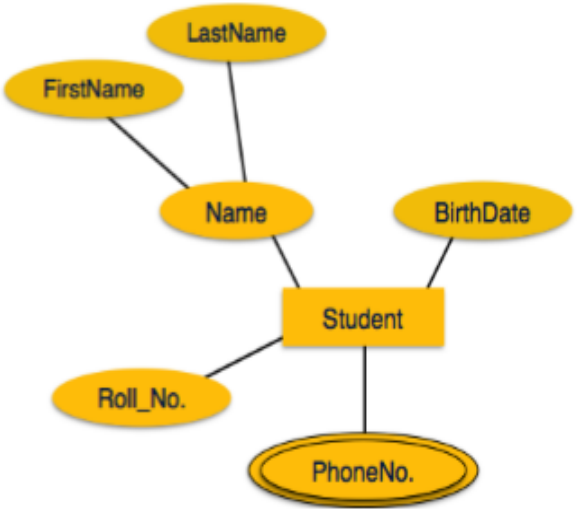


Types of Attributes

- **Multivalued Attribute**

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

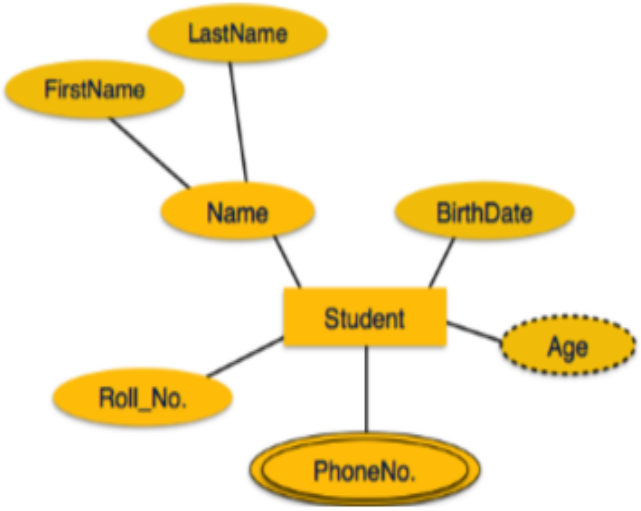
  For example a teacher entity can have multiple subject values.

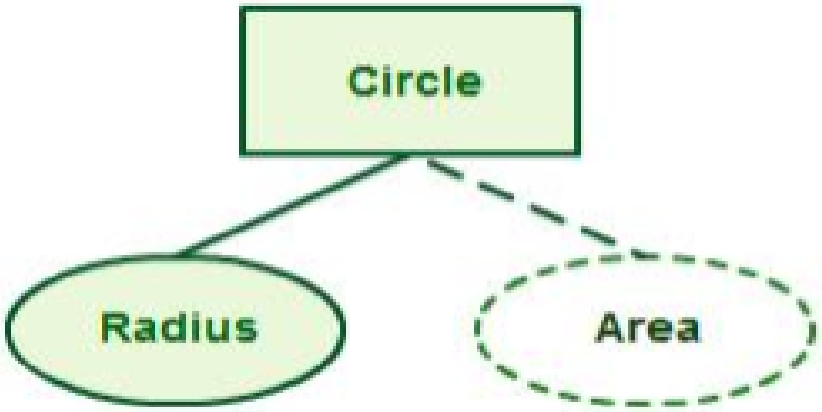


Types of Attributes

- **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

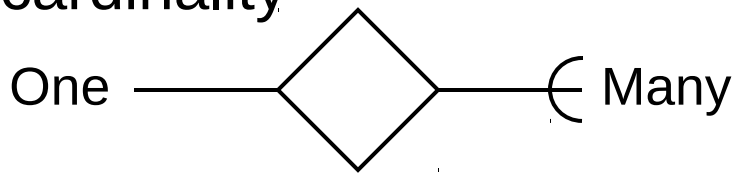
- Relationships are an association between two or more entities
  - Each Student takes several Courses
  - Each Course is taught by a Lecturer
  - Each Employee works for a single Department
- Relationships have
  - A name
  - A set of entities that participate in them
  - A degree - the number of entities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

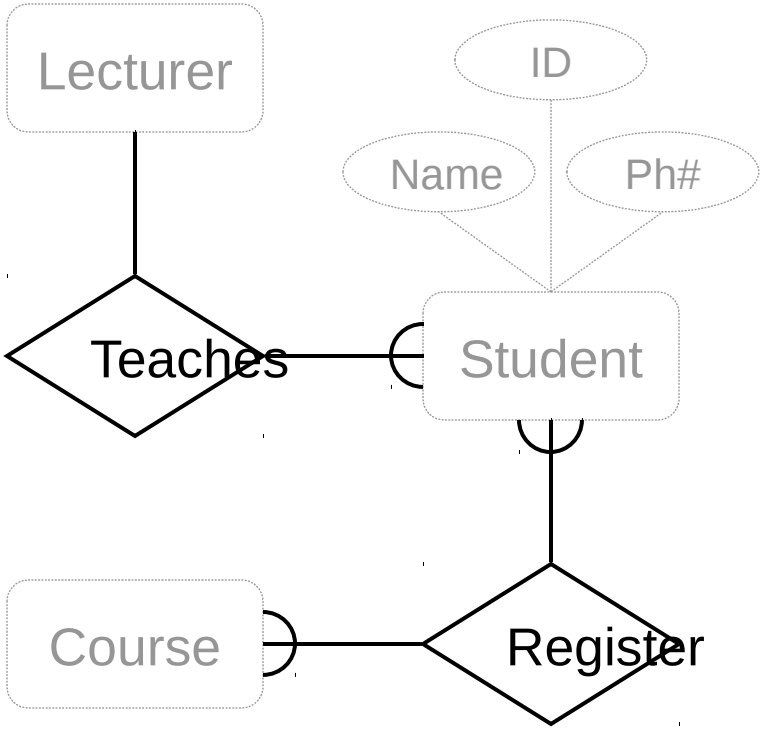
Cardinality Ratios

- 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. Supplier supply the products.

Supplier have address, phone numbers, and name. Each address is made up of a street address, a city, and a postcode.