Draw Entity Relationship Diagram

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Overview

What we have learnt so far

- The data model: Relational Model
- The design model: ER model and ER Diagram
- How to convert a design model to a data model (incomplete).

Problems:

- The design is not given to us in most of the situation.
- Need to translate problem description (English) into the design modle (ERD).

Learning Outcomes

- Draw ER Diagram based on a given problem description.
- Understand how to deal with M:M relationships in ERD.
- Understand how to deal with 1:1 relationships in ERD.
- Convert a ERD to relations.

Draw Entity Relationship Diagram

Example

“A department offers several courses. A number of modules make up each course. Each module can be included in multiple courses. Students enrol in a particular course and take modules towards the completion of that course. Each module is taught by a lecturer from the appropriate department (several lecturers work in the same department), and each lecturer tutors a group of students. Each student has only one tutor. A lecturer can teach more than one module but can work only in one department. All departments have their unique department IDs and names. Each course and module has its code and name. All students and lecturers have their IDs, names and age.”

Making ER Models

- An ER model consists of:
  - **Entities**
  - **Attributes**
  - **Relationships**
    - Degree
    - Cardinality ratio
- All these come from the problem description
- General guidelines
  - Since **entities** are things or objects, they are likely to be **nouns**.
  - **Attributes** are facts or properties, they are often **nouns** as well.
  - **Verbs** often describe **relationships** between entities

Nouns and Verbs

- A **noun** is a part of speech that denote a person, animal, place, thing, or idea.
    - Student
    - Cat
    - Age
- A **verb** is a word used to describe an action, state, or occurrence, and forming the main part of the predicate of a sentence, such as hear, become, happen.
    - Studies
    - Tutors

Example

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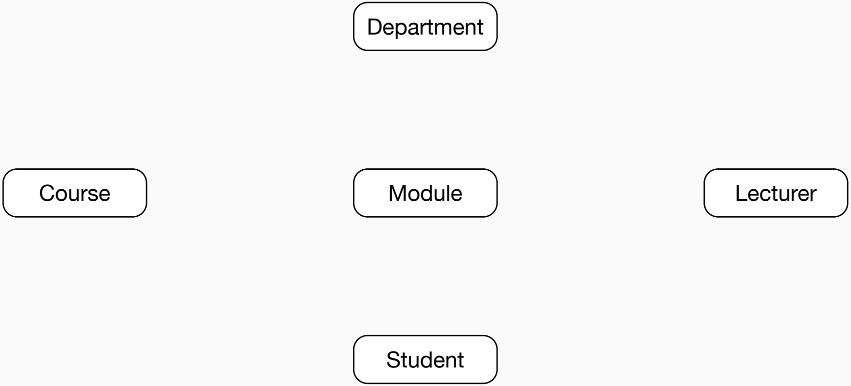
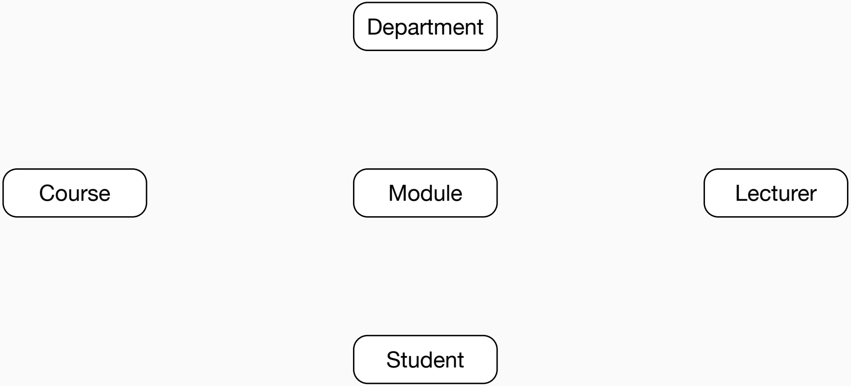
Draw Entities

Entities: Department, Course, Module, Student, Lecturer.



Add Relationships

A department offers several courses.



Department

Course

Module

Lecturer

Student

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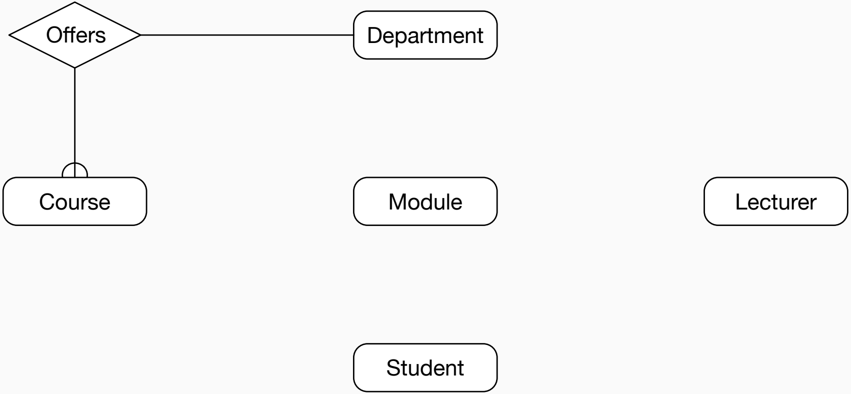

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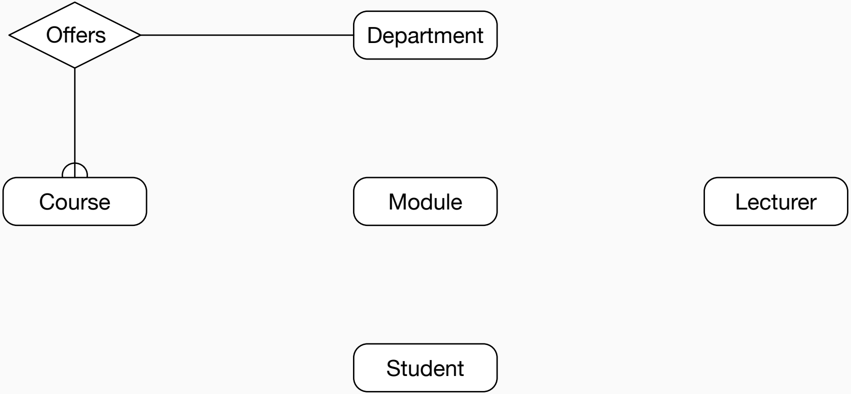
A number of modules make up each course. Each module can be included in multiple courses.



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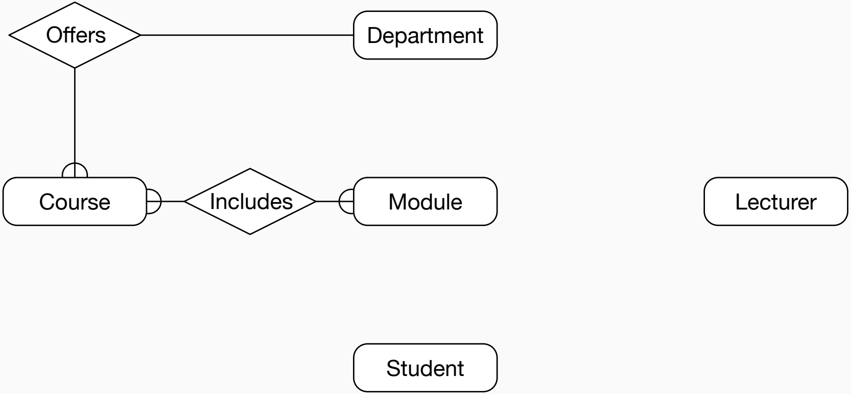
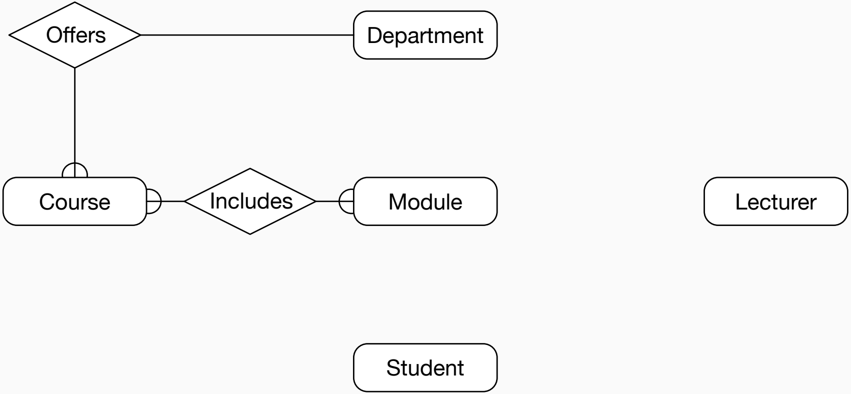


Add Relationships

Students enrol in a particular course.



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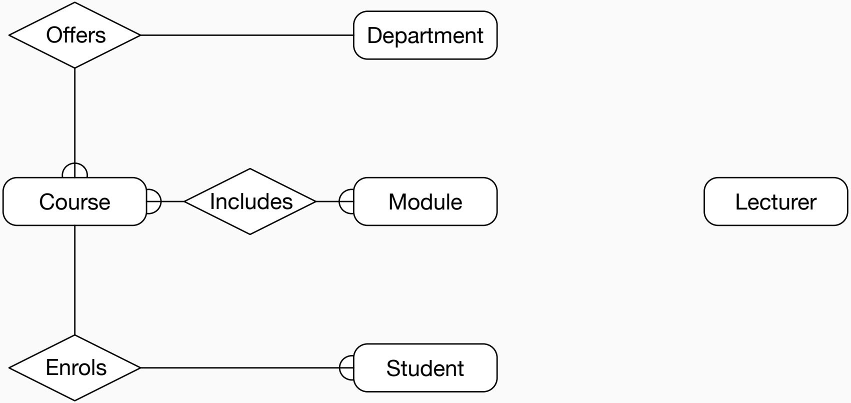
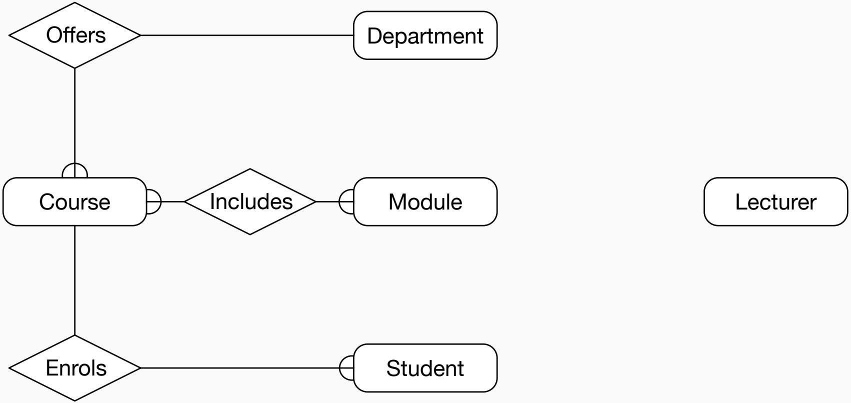


Add Relationships

Students take modules.



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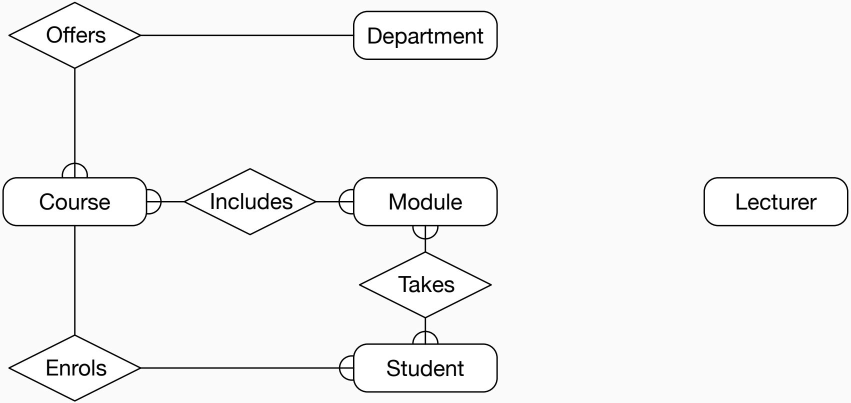
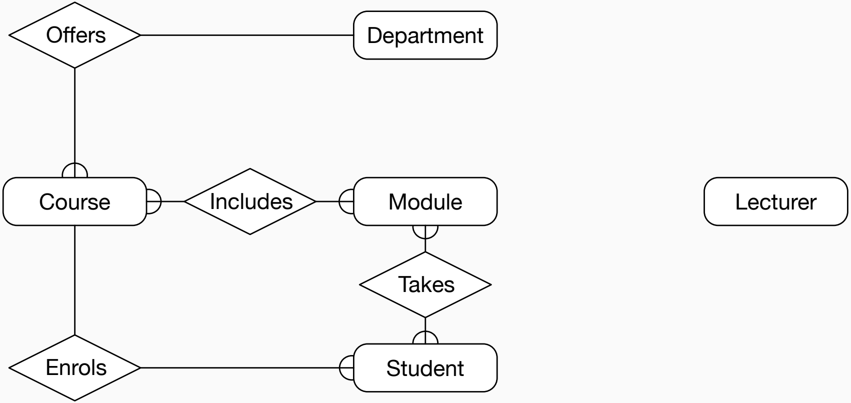


Add Relationships

Each module is taught by a lecturer.



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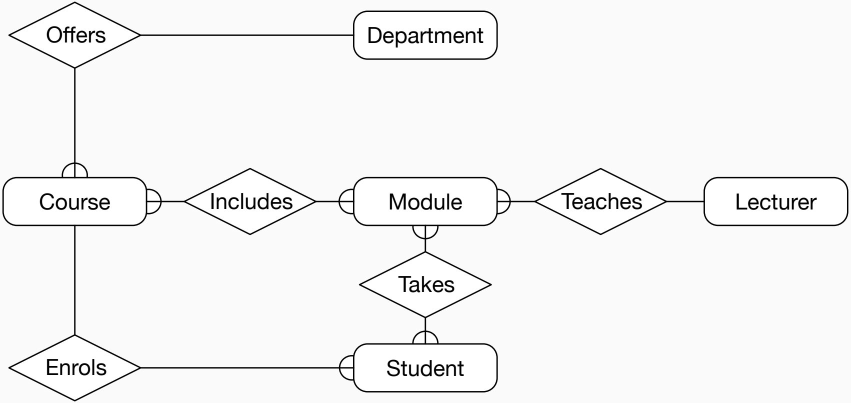
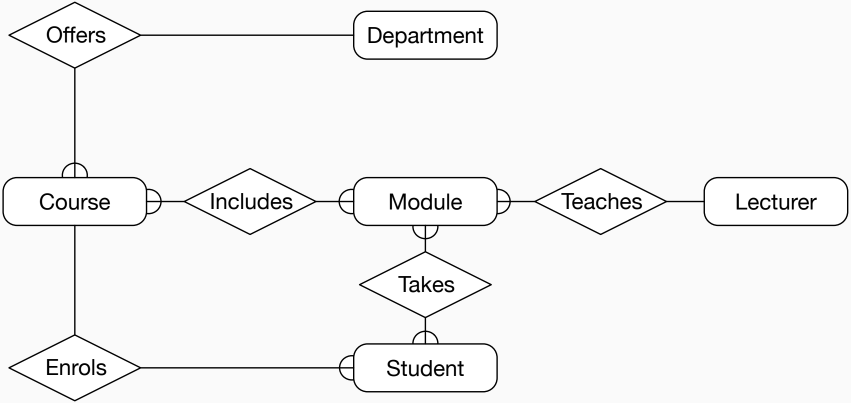


Add Relationships

Several lecturers work in the same department.



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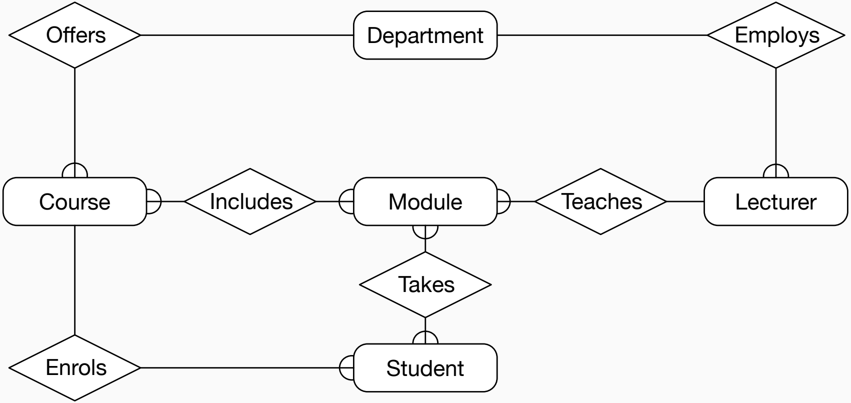
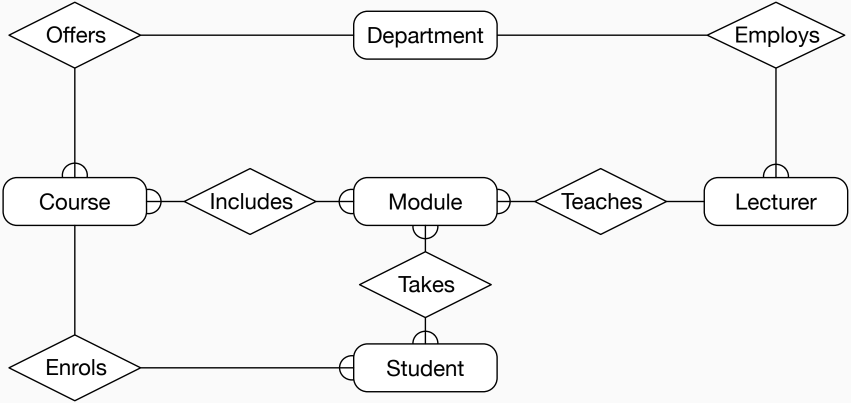


Add Relationships

Each lecturer tutors a number of students. Each student has only one tutor.



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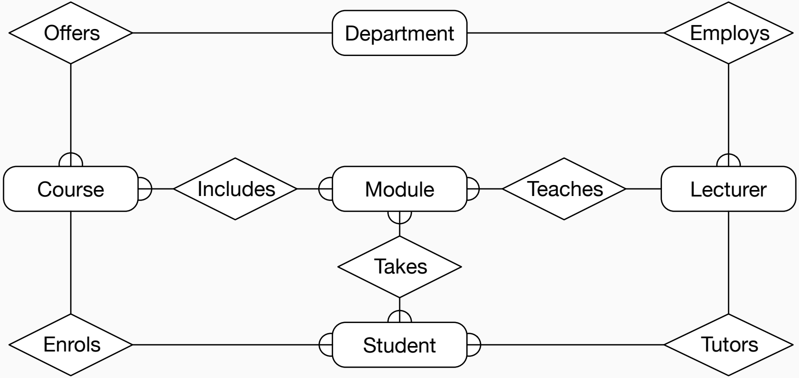

What else?

Add Attributes

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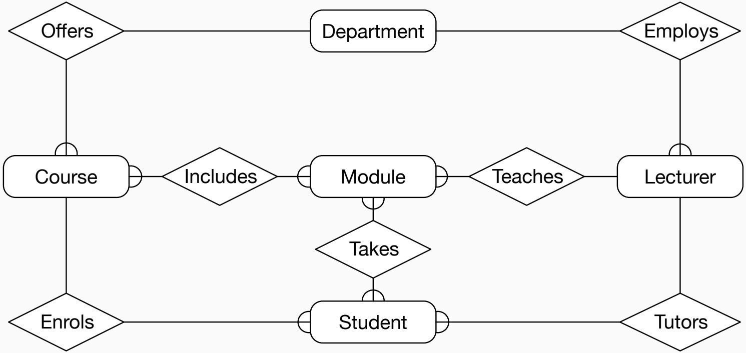

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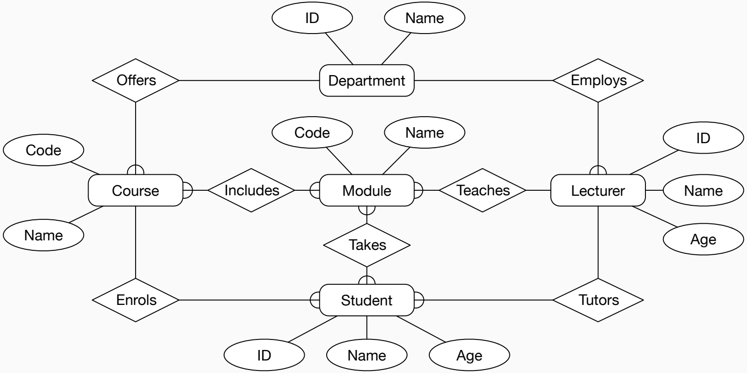


M:M Relationships

- M:M Relationships are very difficult to represent in a database.
- How to represent M:M Relationship between Students and Modules?

Student		
sID	sName	Age

Module	
mCode	mName

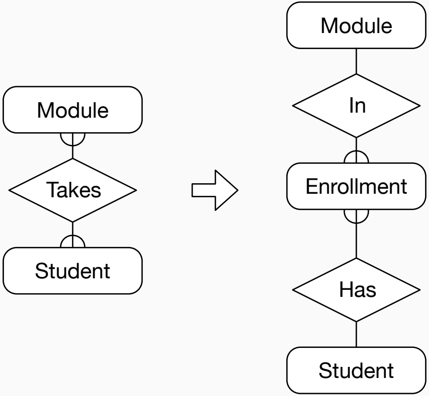
M:M Relationships

Student			
sID	sName	Age	mCodes
1001	Jack Smith	20	DBI, PRG, IAI
1002	Anne Jones	19	PRG, IAI, VIS

Modules		
mCode	sName	sIDs
DBI	Database and Interfaces	20
PRG	Programming	19, 20
IAI	Introduction to AI	19, 20
VIS	Computer Vision	19

Removing M:M Relationships

- M:M Relationships are difficult to represent in a database.
- We can split a M:M relationship into two 1:M Relationships.
- An additional entity is required.



Removing M:M Relationships

Student		
sID	sName	Age
1001	Jack Smith	20
1002	Anne Jones	19

Modules	
mCode	mName
DBI	Database and Interfaces
PRG	Programming
IAI	Introduction to AI
VIS	Computer Vision

Enrolment		
ID	sID	mCode
1	1001	DBI
2	1001	PRG
3	1001	IAI
4	1002	PRG
5	1002	IAI
6	1002	VIS

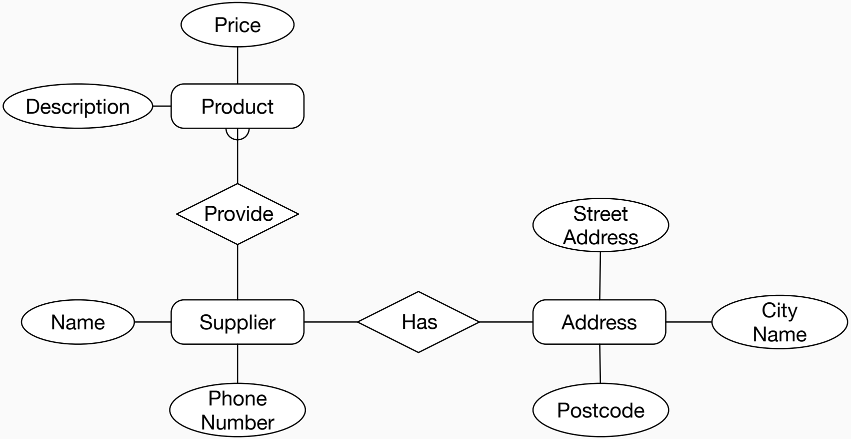
Example: Products

“We want to represent information about products in a database. Each product has a description, a price and a supplier. Suppliers have addresses, phone numbers, and names. Each address is made up of a street address, a city name, and a postcode. Each supplier can provide multiple products. Each type of product can only be supplied by its corresponding supplier. Each address corresponds to one particular supplier and each supplier can only have one address.”

Example: Products

- Entities:
    - Product
    - Supplier
    - Address
- Attributes:
    - Description
    - Price
    - Name
    - Phone Number
    - Street Address
    - City Name
    - Postcode
- Relationships:
    - Supplier and Product: 1 to Many
    - Supplier and Address: 1 to 1

ER Diagram: Product

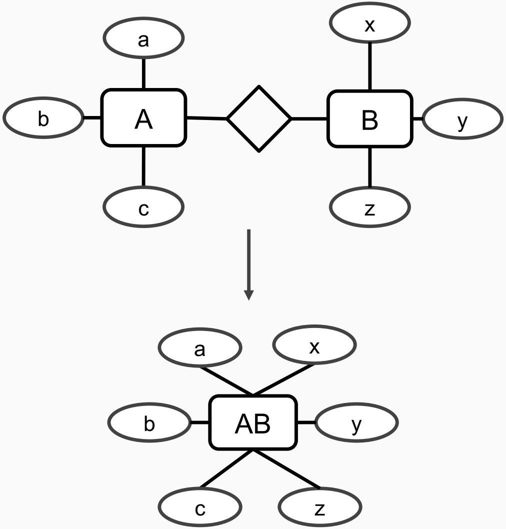


One to One Relationships

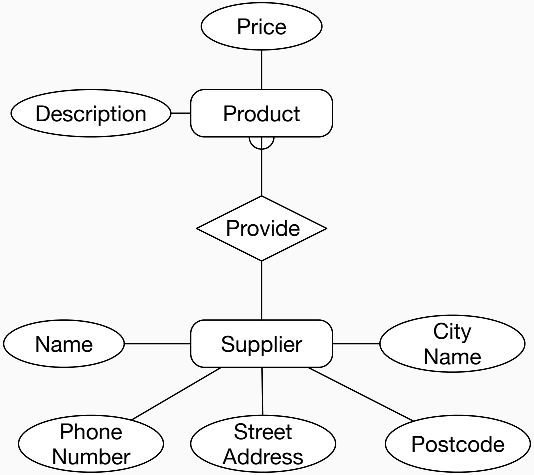
- Some relationship between entities, A and B, might be redundant if
  - It is a 1:1 relationship.
  - Every A is related to a B and every B is related to an A.
- Example:
  - The relationship between the supplier and address.
  - Every supplier has an address.
  - We don't need addresses that are not related to a supplier.

Removing One to One Relationships

- We can merge the two entities that take part in a redundant relationship together
  - They become a single entity.
  - The new entity has all the attributes of the old ones.

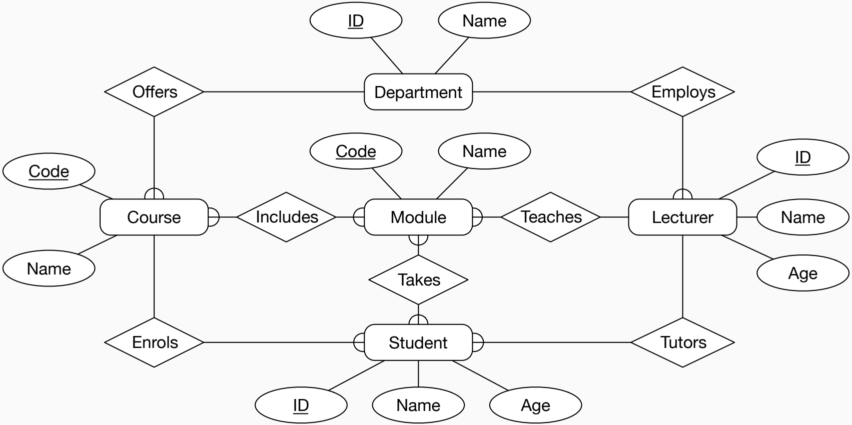


Removing One to One Relationships



Primary Key

- We often find that we need to specify which attributes will serve as Primary Keys in our ER diagram.
- We do this by underlining the attribute in relation.



Exams and Coursework

- Identify the entities, attributes, relationships, and cardinality ratios from the description.
- Draw an entity-relationship diagram showing the items you identified.
- Many to many relationships are hard to represent in database. Explain the nature of these problems, and describe how they may be solved.

Hints

Draw an ER Diagram is not an easy task...

- Be Organised.
    - If we can't read it, how can we mark it?
- Summarise the rules.
    - E.g., Entities can have attributes but attributes have no smaller parts.
- This is a skill that needs practice.
- Rarely will you get it right first time.