

Conceptual Design with ER Modeling

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Example

“A university consists of a number of departments. Each department offers several courses. A number of modules make up each course. 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, and each lecturer tutors a group of students”

Example - Entities

A university consists of a number of **departments**. Each department offers several **courses**. A number of **modules** make up each course. **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, and each lecturer tutors a group of students

Example - Relationships

- A university consists of a number of departments. Each department **offers** several courses. A number of modules **make up** each course. 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, and each lecturer **tutors** a group of students

Example - E/R Diagram

Entities: Department, Course, Module, Lecturer, Student

Department

Course

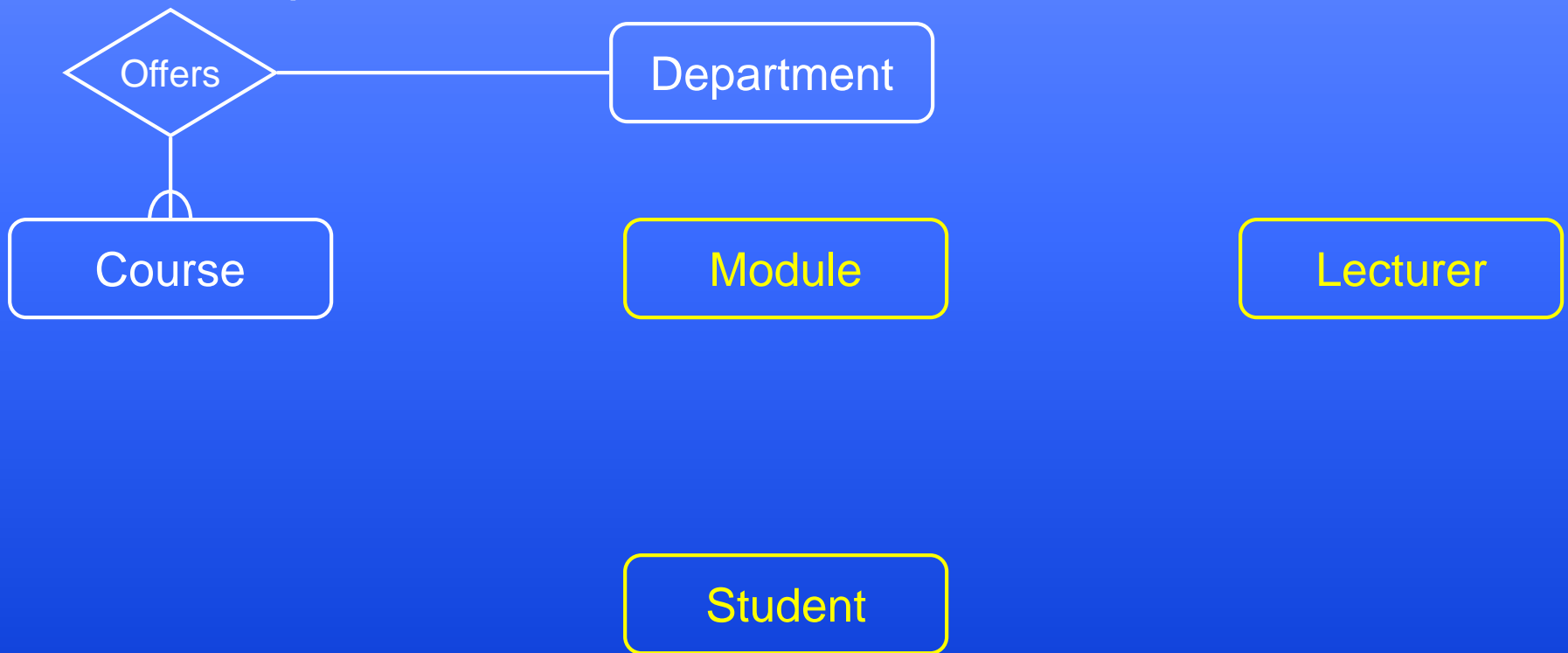
Module

Lecturer

Student

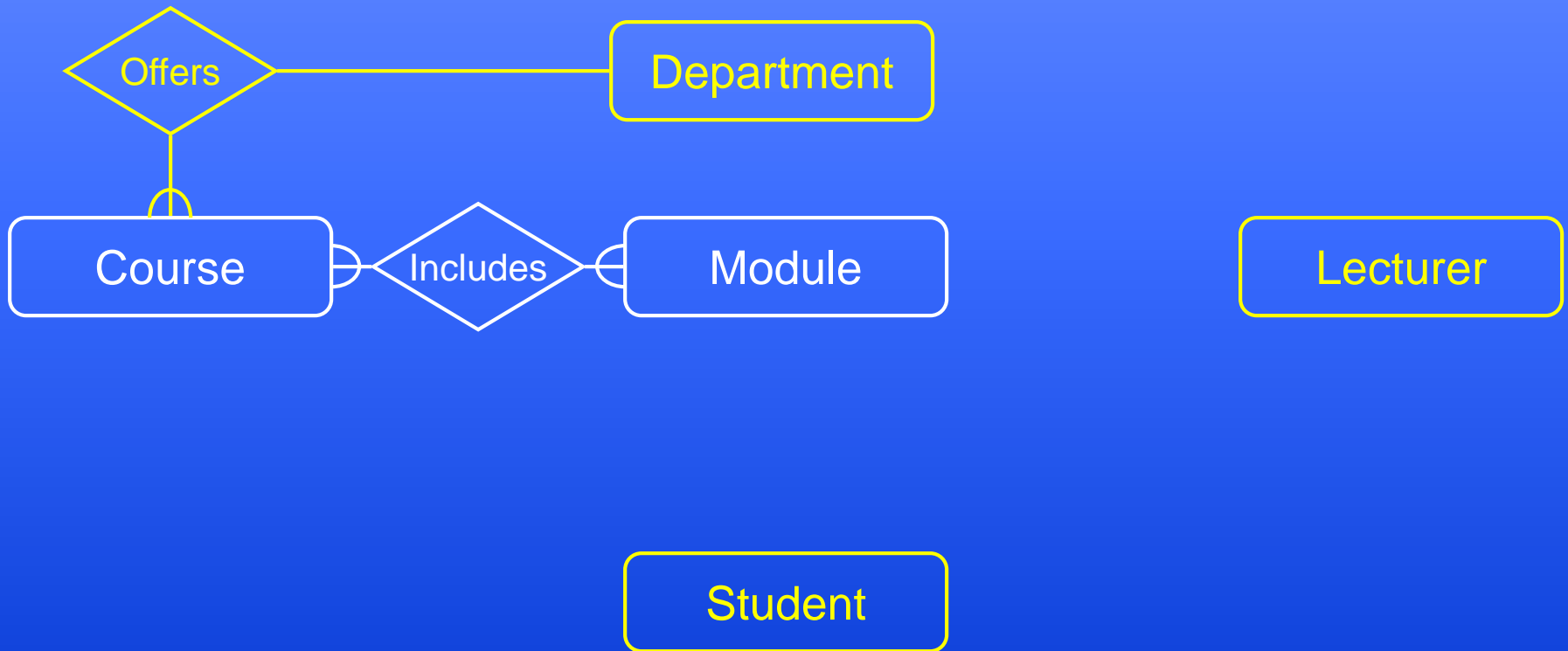
Example - E/R Diagram

Each department **offers** several courses



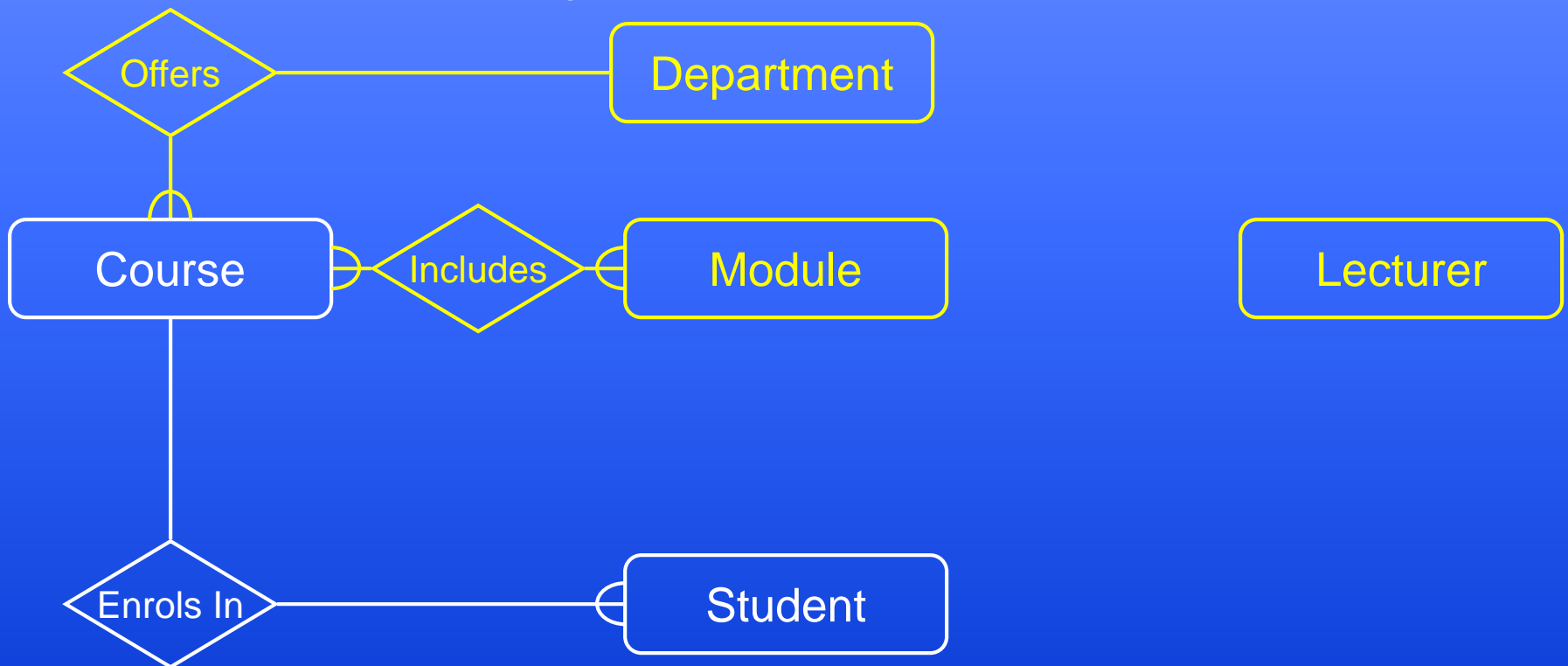
Example - E/R Diagram

A number of modules **make up** each courses



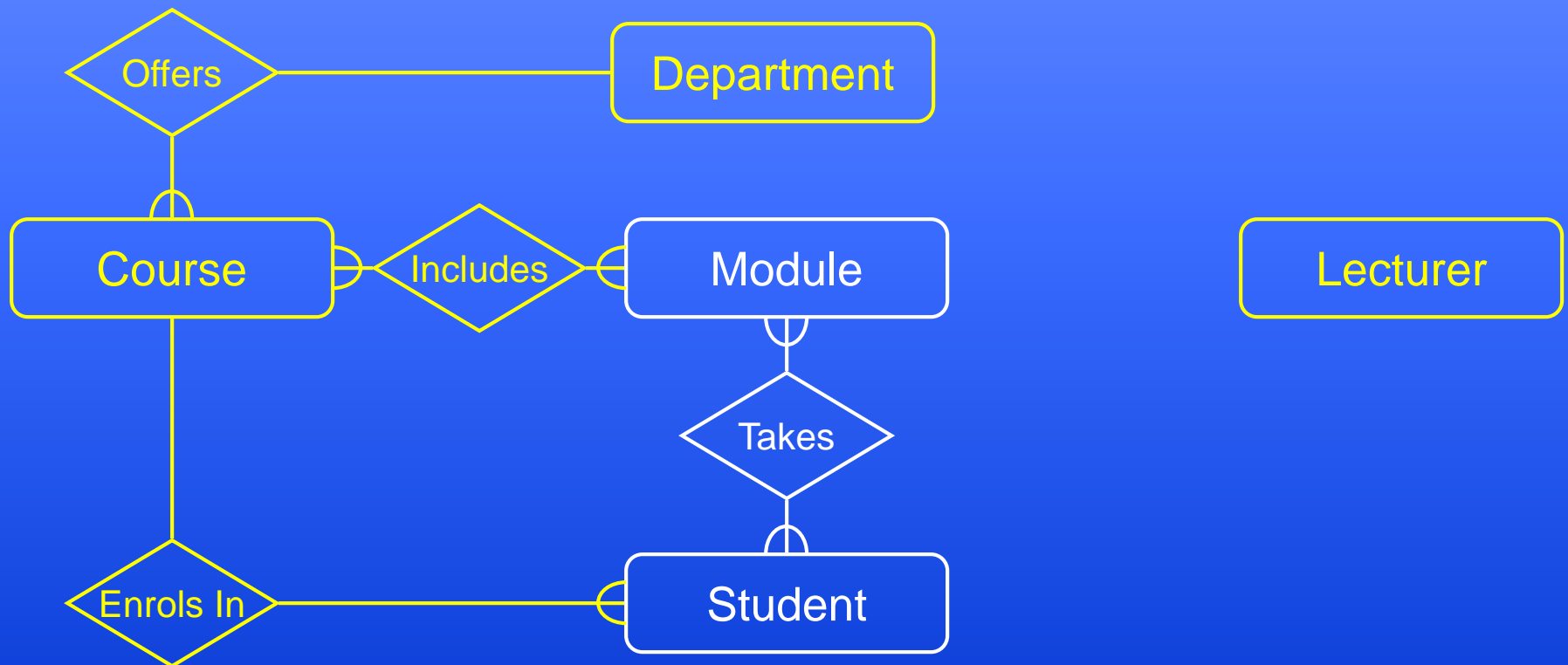
Example - E/R Diagram

Students **enrol in** a particular course



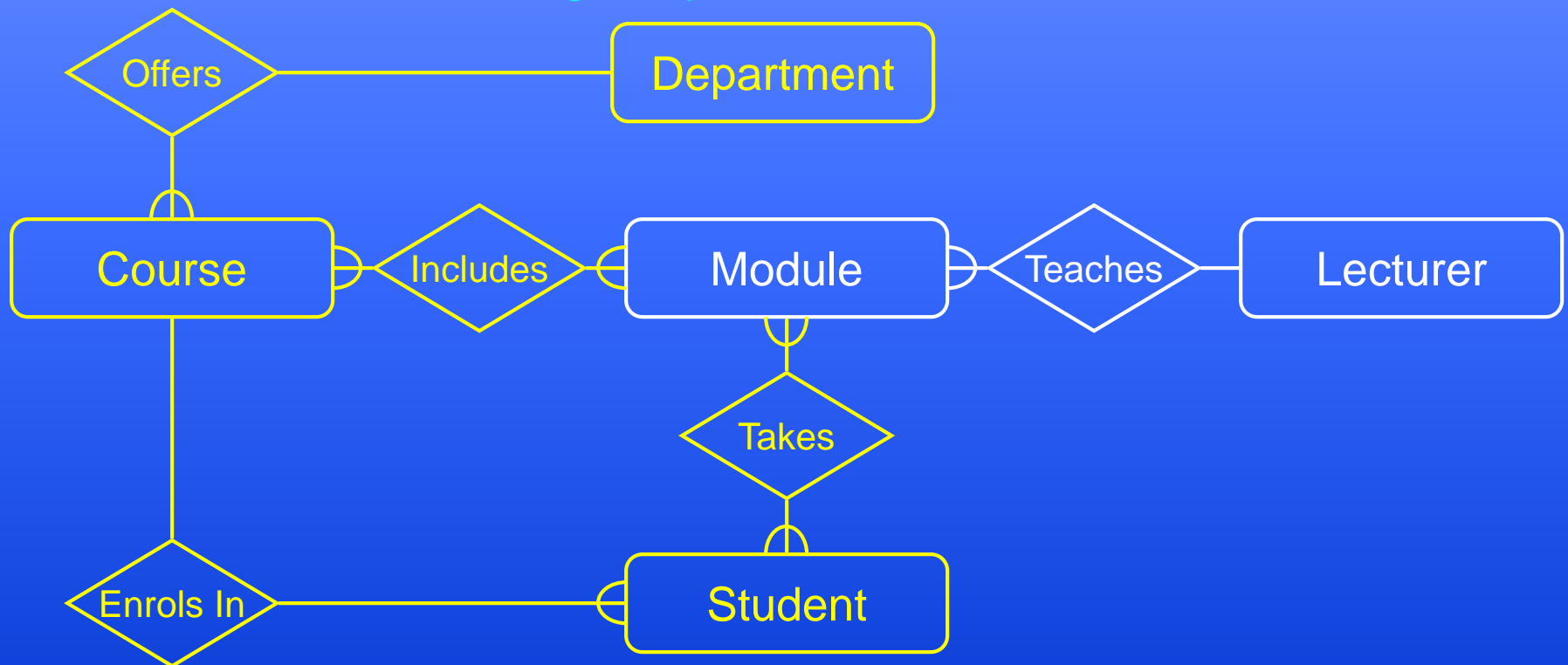
Example - E/R Diagram

Students ... **take** modules



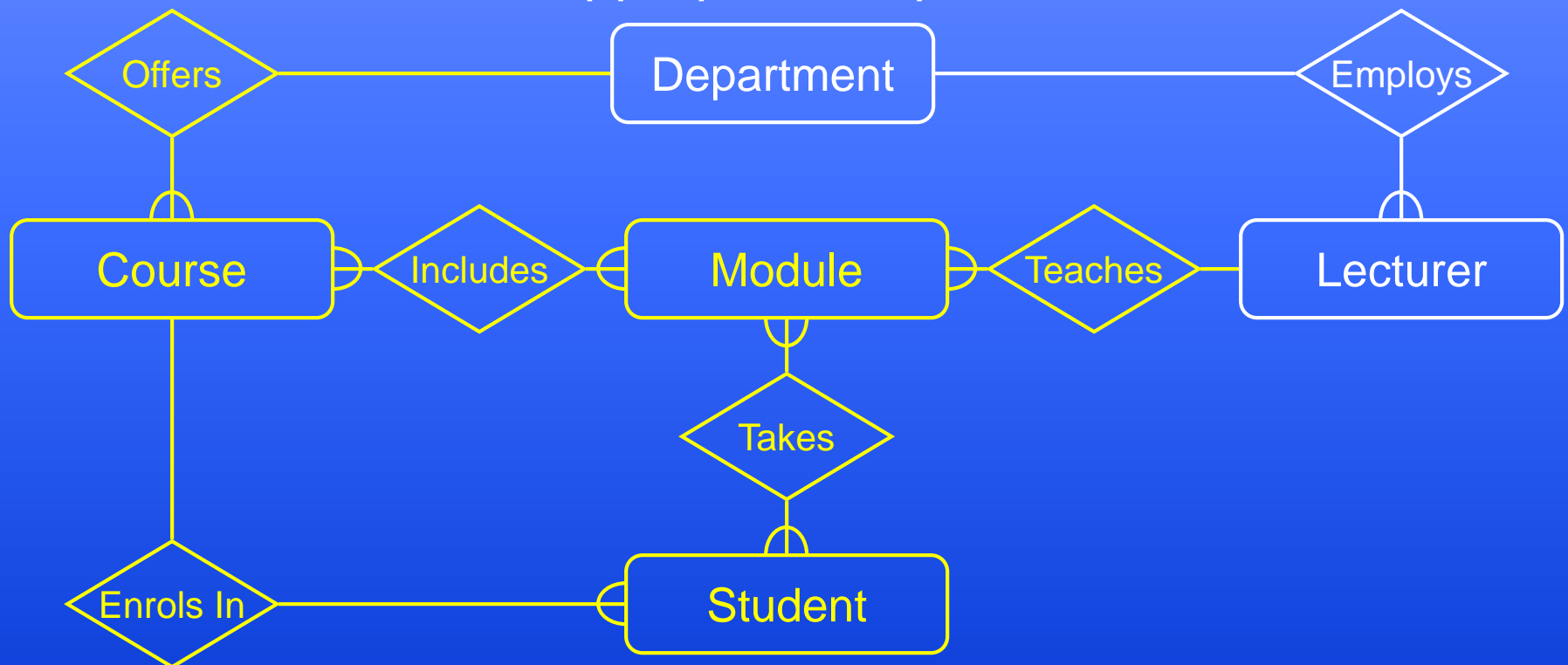
Example - E/R Diagram

Each module is taught by a lecturer



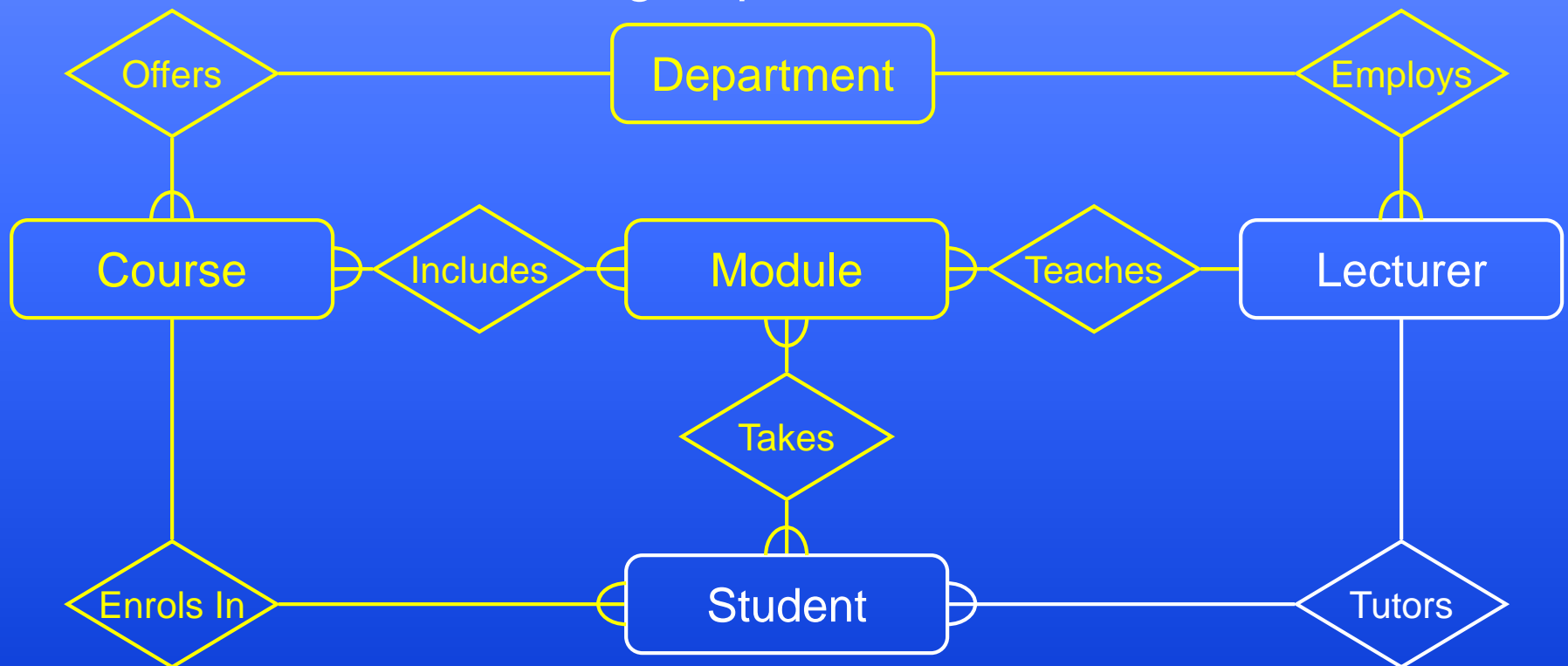
Example - E/R Diagram

a lecturer **from the** appropriate department

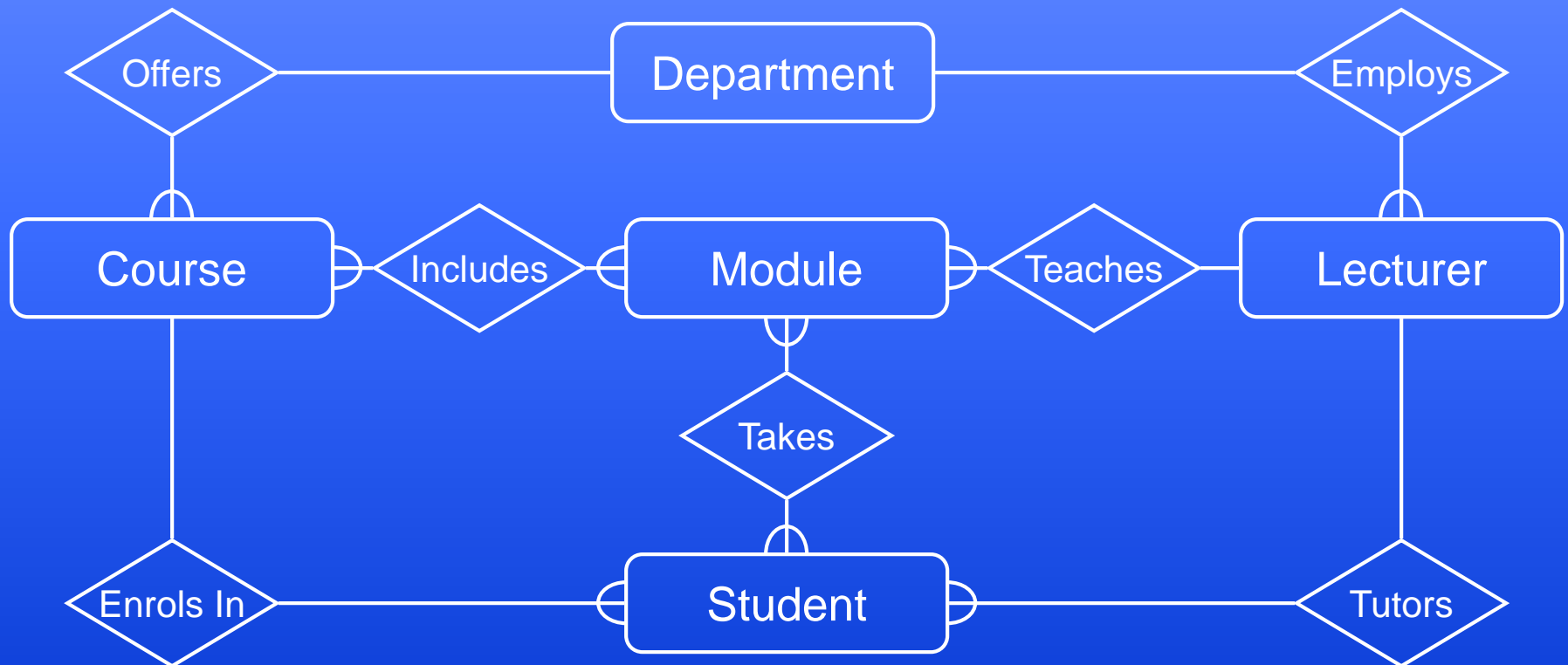


Example - E/R Diagram

each lecturer **tutors** a group of students



Example - E/R Diagram



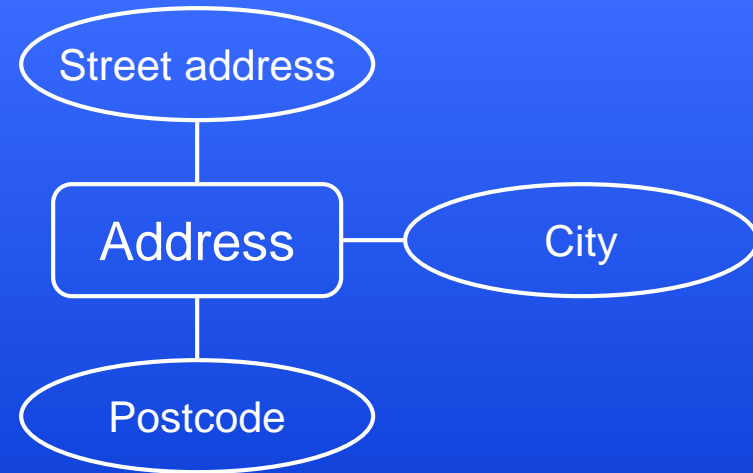
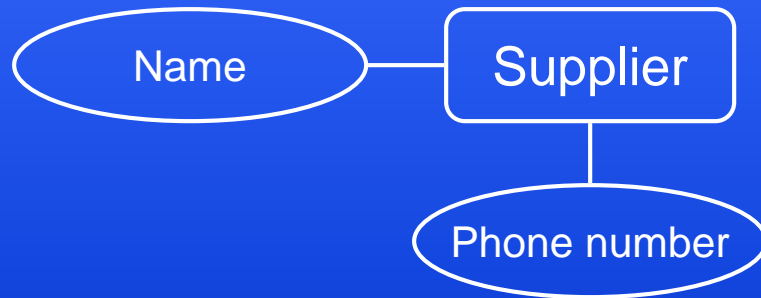
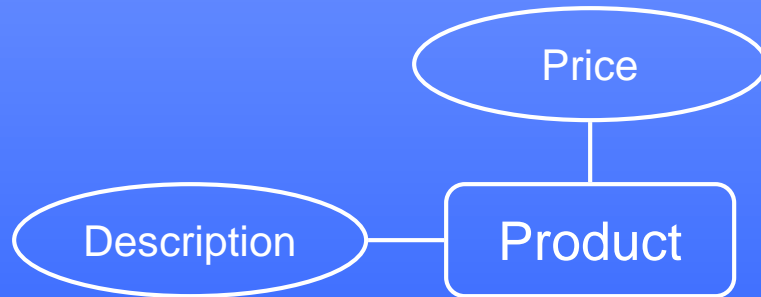
Example

“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, and a postcode.”

Example - Entities/Attributes

- Entities or attributes:
 - product
 - description
 - price
 - supplier
 - address
 - phone number
 - name
 - street address
 - city
 - postcode
- Products, suppliers, and addresses all have smaller parts so we can make them entities
- The others have no smaller parts and belong to a single entity

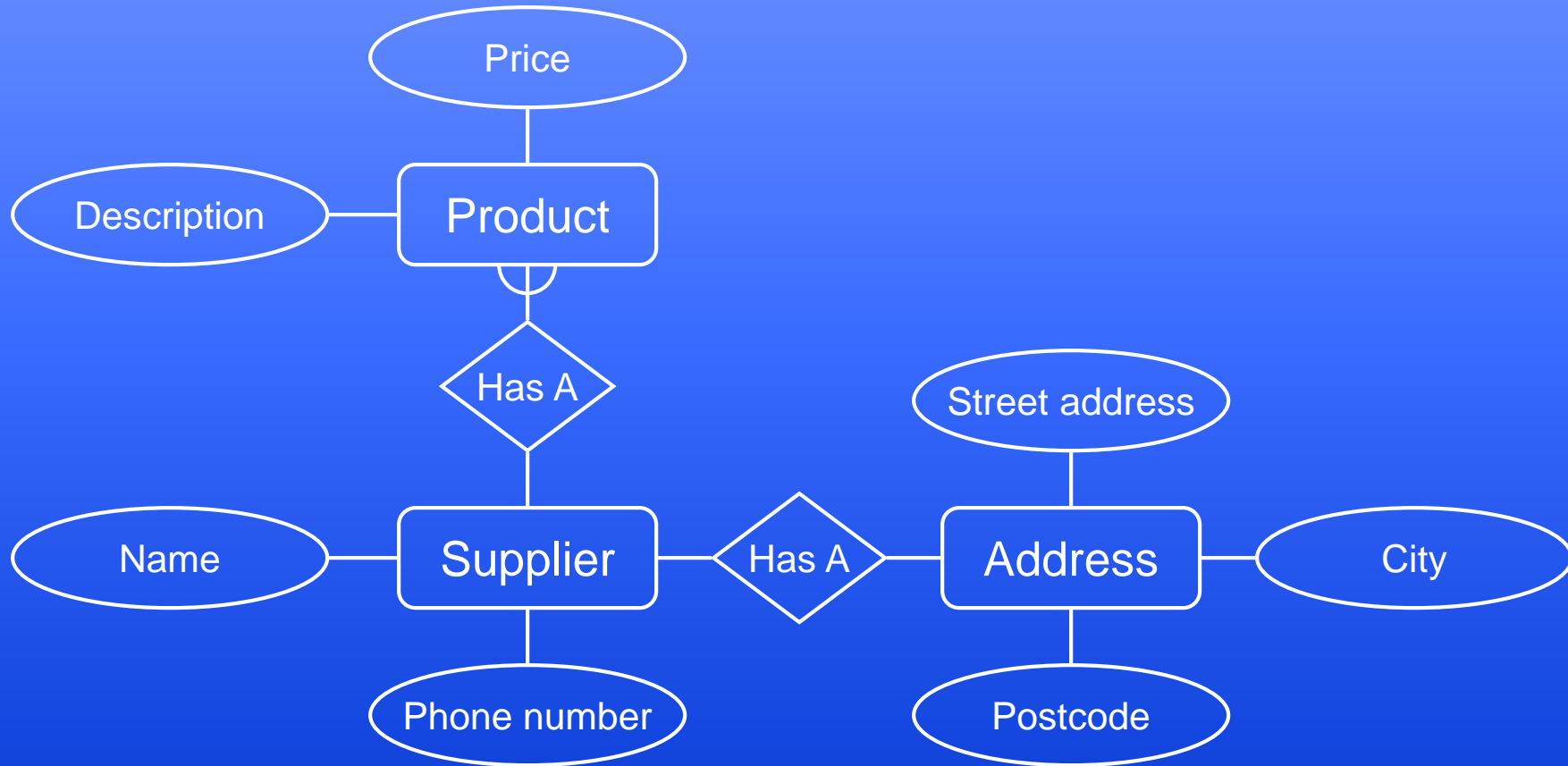
Example - E/R Diagram



Example - Relationships

- Each product has a supplier
 - Each product has a single supplier but there is nothing to stop a supplier supplying many products
 - A many to one relationship
- Each supplier has an address
 - A supplier has a single address
 - It does not seem sensible for two different suppliers to have the same address
 - A one to one relationship

Example - E/R Diagram

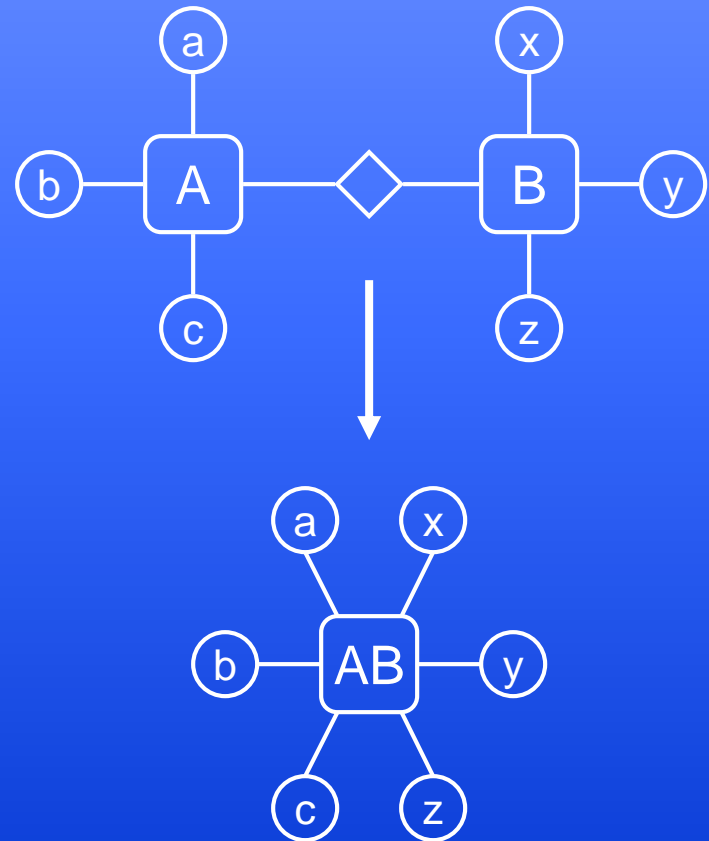


One to One Relationships

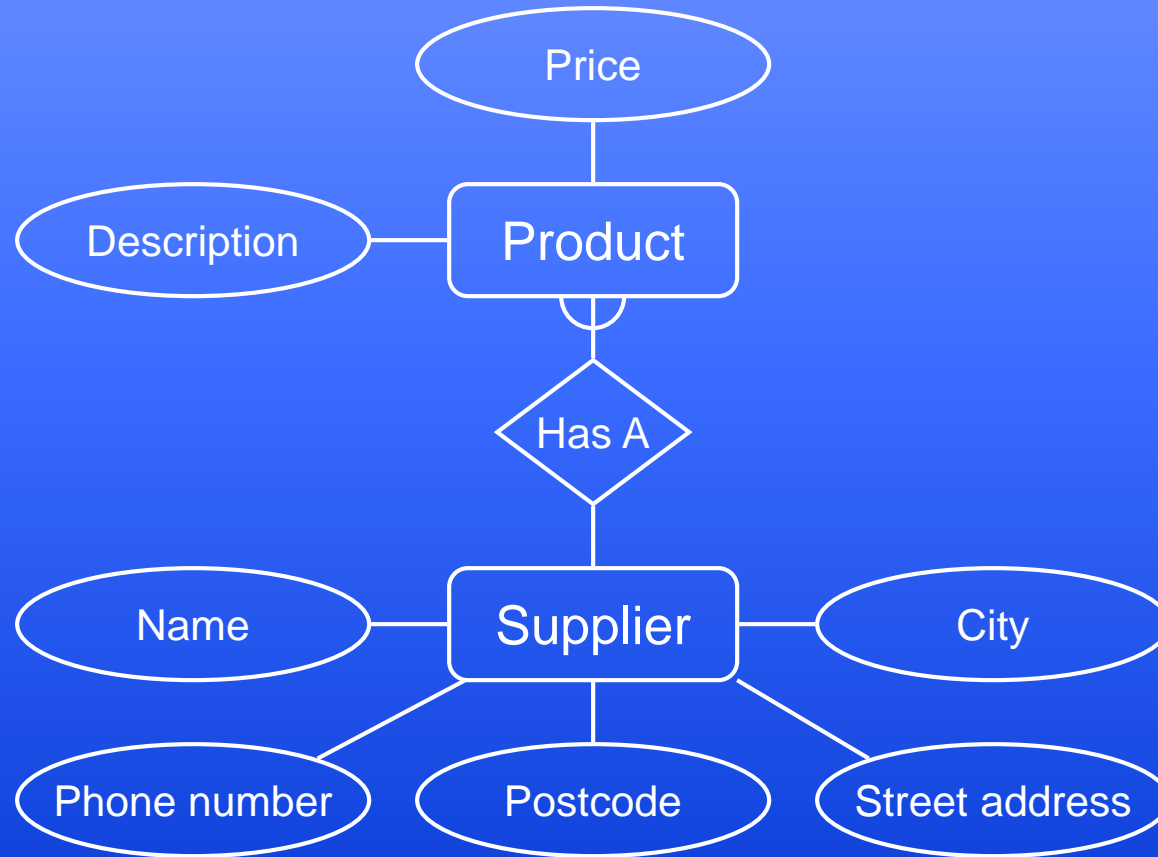
- **Some** relationships between entities, A and B, **might** be redundant if
 - It is a 1:1 relationship between A and B
 - Every A is related to a B and every B is related to an A
- Example - the supplier-address relationship
 - Is one to one
 - Every supplier has an address
 - We don't need addresses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

Redundant 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 one



Example - E/R Diagram



Class Activity – I

“Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents where and when it happened with person trace”.

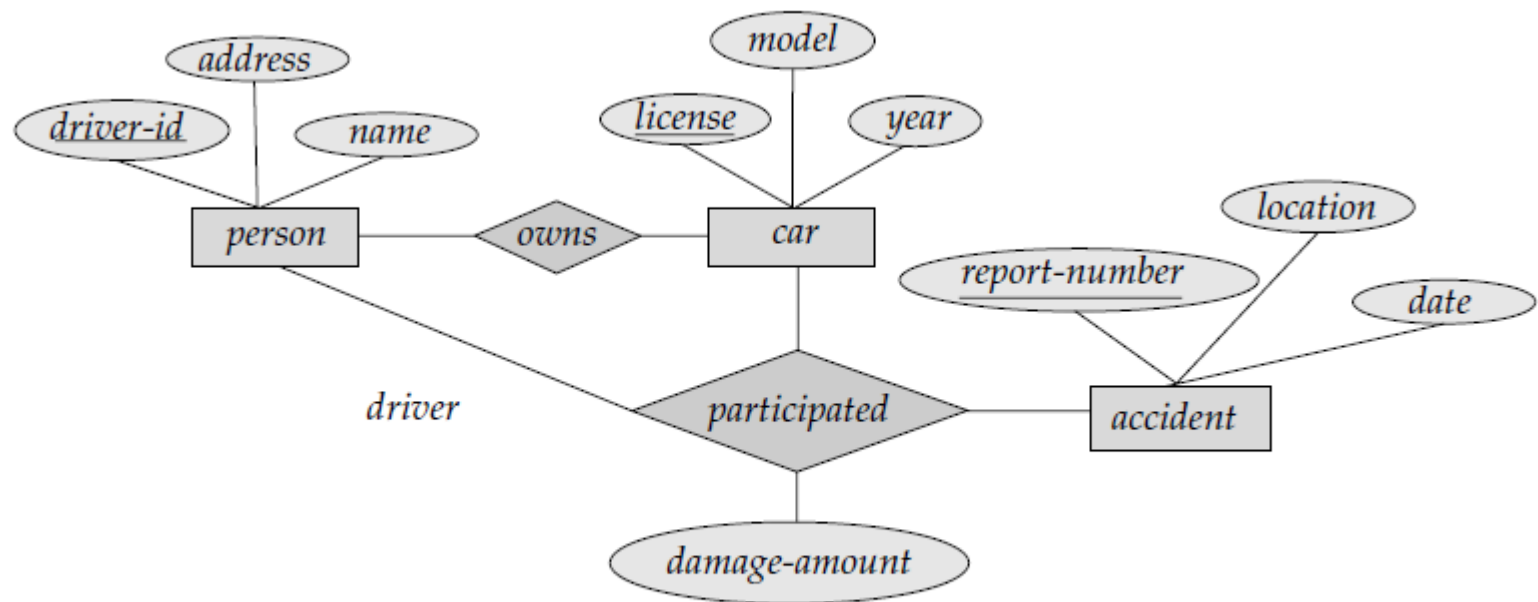


Figure 2.1 E-R diagram for a Car-insurance company.

Class Activity – II

Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.

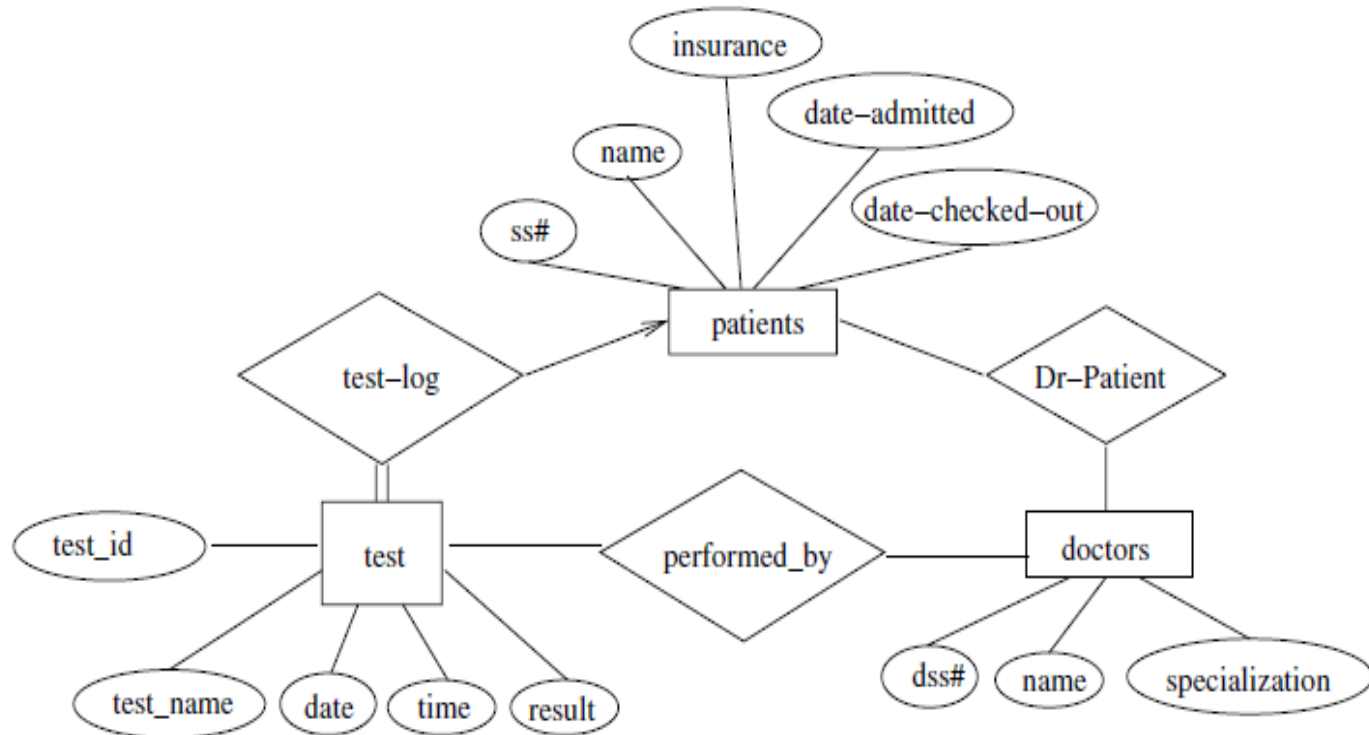


Figure 2.2 E-R diagram for a hospital.

Home Activity

Consider the following set of requirements for a UNIVERSITY database that is used to keep track of students' transcripts. This is similar but not identical to the database shown in Figure 1.2:

- a. The university keeps track of each student's name, student number, Social Security number, current address and phone number, permanent address and phone number, birth date, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and ZIP Code of the student's permanent address and to the student's last name. Both Social Security number and student number have unique values for each student.
- b. Each department is described by a name, department code, office number, office phone number, and college. Both name and code have unique values for each department.
- c. Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of the course number is unique for each course.
- d. Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.
- e. A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, or 4).

Design an ER schema for this application, and draw an ER diagram for the schema. Specify key attributes of each entity type, and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete.

Class Activity Continue ...

Composite and multivalued attributes can be nested to any number of levels. Suppose we want to design an attribute for a STUDENT entity type to keep track of previous college education. Such an attribute will have one entry for each college previously attended, and each such entry will be composed of college name, start and end dates, degree entries (degrees awarded at that college, if any), and transcript entries (courses completed at that college, if any). Each degree entry contains the degree name and the month and year the degree was awarded, and each transcript entry contains a course name, semester, year, and grade. Design an attribute to hold this information. Use the conventions in Figure 7.5..