

ID 2550814

Exam for Data Structures, Algorithms, and Databases

After inserting your student ID and the module name in the title, header and footer, write your answers between here and the statement of good academic conduct. Your ID and the module name will automatically appear on any subsequent pages.

QUESTION 1

(a)

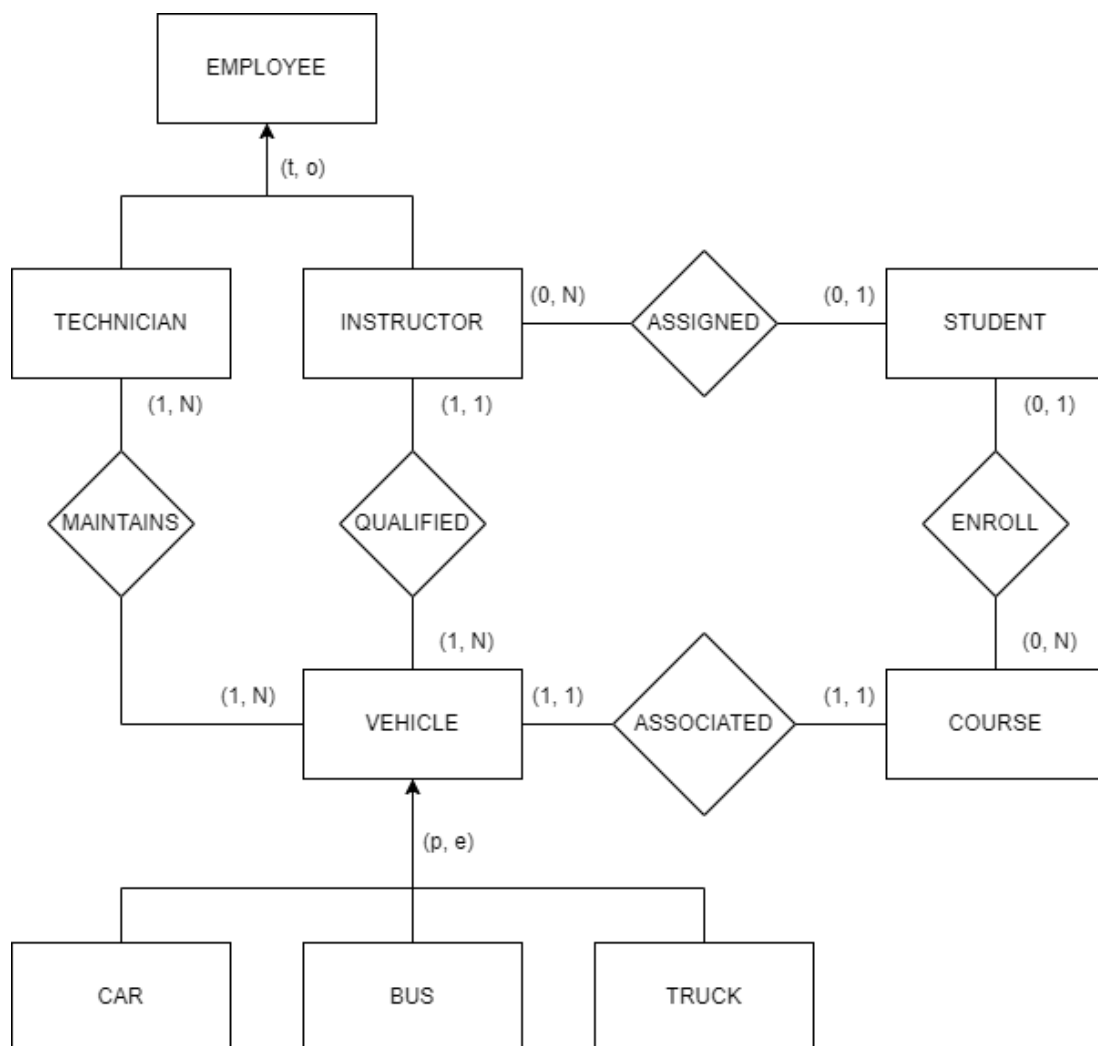


Figure 1: ER model for the application

Figure 1 shows the ER model for the application. It is assumed that all the employees are either instructors or technicians. A technician can maintain different types of vehicles, while an instructor can only teach about a particular vehicle type. An instructor could be teaching no students at a given time. A student can be enrolled in no courses or a maximum of one course, and therefore they can have 0 to 1 instructor. A course can have no students enrolled in it, and it can only be about one vehicle type. It is assumed that all the vehicles have only one course associated with them as well.

(b) The schemas for the ER model in Figure 1 are as below. The underlined attributes represent the primary key, and the attributes in *italics* could be null.

Employee(employee_id, name, address, phone)

Technician(employee_id, name, vehicle_type)

Instructor(employee_id, name, vehicle_type, *teaching_schedule*, student_history, success_rate)

Vehicle(vehicle_registration, vehicle_type, purchase_year, current_market_value)

Student(student_id, name, *course*, *instructor*, driving_hours, test_result, enrolment_status)

Course(course_id, vehicle_type, *number_of_students*)

(c)

```
create table vehicle (
  vehicle_registration varchar(10) primary key,
  vehicle_type varchar(20) not null,
  purchase_year date not null,
  current_market_value integer not null
```

```
)
```

```
create table course (
  course_id varchar(10) primary key,
  vehicle_type varchar(20) not null references vehicle(vehicle_type) on delete
  cascade,
  number_of_students integer
)
```

```
create table technician (
  employee_id varchar(10) primary key,
  name varchar(30) not null,
  vehicle_type varchar(20) not null references vehicle(vehicle_type) on delete
  cascade
)
```

QUESTION 2

(a) The table obtained after evaluating the given expression is as follows:

A	X	Y	B	D	W
b	x	7	f	p	1
b	x	7	f	r	4
a	y	5	h	p	3

(b) $courses \bowtie \pi_{cid} \left(\left(\sigma_{L1.year=2021} \left(\rho_{L1(cid,sid,L1.year)}(lecturing) \right) \right) \right)$
 $\bowtie \left(\sigma_{L2.year=2022} \left(\rho_{L2(cid,sid,L2.year)}(lecturing) \right) \right)$

Do not write below this line

Statement of good academic conduct

By submitting this assignment, I understand that I am agreeing to the following statement of good academic conduct:

- I confirm that this assignment is **my own work** and I have not worked with others in preparing this assignment.
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