

HOMEWORK 1

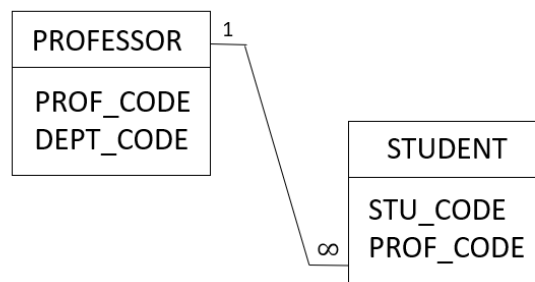
Question 1 (5 points)

Refer to the database containing the following two tables.

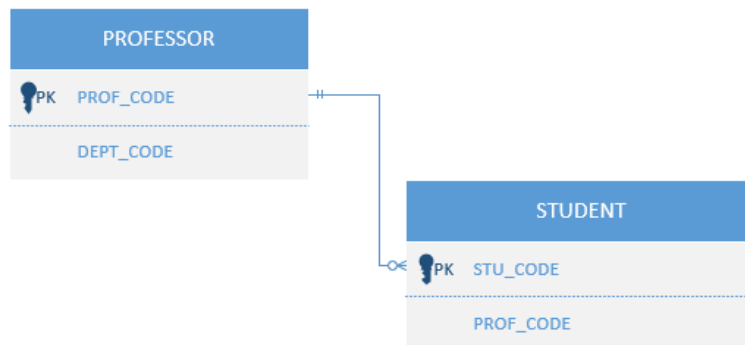
PROF_CODE	DEPT_CODE
1	2
2	6
3	6
4	4

STU_CODE	PROF_CODE
100278	NULL
128569	2
512272	4
531235	2
531268	NULL
553427	1

- a. (2 point) Create a relational database diagram.



- b. (3 points) Create a Crow's Foot ERD. **Hint:** Pay attention to NULLs and consider NULLs while showing the appropriate relationships on the diagram.



Question 2 (21 points)

Refer to the database tables below to answer the questions.

TRUCK table

TRUCK_NUM	BASE_CODE	TYPE_CODE	TRUCK_MILES	TRUCK_SERIAL_NUM
1001	501	1	32123.5	AA-322-12212-W11
1002	502	1	76984.3	AC-342-22134-Q23
1003	501	2	12346.6	AC-445-78656-Z99
1004	NULL	1	2894.3	WQ-112-23144-T34
1005	503	2	45673.1	FR-998-32245-W12
1006	501	2	193246	AD-456-00845-R45
1007	502	3	32012.3	AA-341-96573-Z84
1008	502	3	44213.6	DR-559-22189-D33
1009	503	2	10932.9	DE-887-98456-E94

TYPE table

TYPE_CODE	TYPE_DESCRIPTION
1	Single box, double-axle
2	Single box, single-axle
3	Tandem trailer, single-axle

BASE table

BASE_CODE	BASE_CITY	BASE_STATE	BASE_AREA_CODE	BASE_PHONE	BASE_MANAGER
501	Murfreesboro	TN	615	123-4567	Andrea D. Gallagher
502	Lexington	KY	568	234-5678	George H. Delarosa
503	Cape Girardeau	MO	456	345-6789	Maria J. Talindo
504	Dalton	GA	901	456-7890	Peter F. McAvee

- a. (5 points) For each table, identify the primary key and the foreign key(s). If a table does not have a foreign key, write *None*.

Table	Primary Key	Foreign Key(s)
TRUCK	TRUCK_NUM	BASE_CODE, TYPE_CODE
TYPE	TYPE_CODE	None
BASE	BASE_CODE	None

- b. (5 points) Do the tables exhibit entity integrity?

Table	Entity Integrity (Yes/No)	Reason
TRUCK	Yes	Each TRUCK_NUM value is unique and there are no nulls
TYPE	Yes	Each TYPE_CODE value is unique and there are no nulls
BASE	Yes	Each BASE_CODE value is unique and there are no nulls

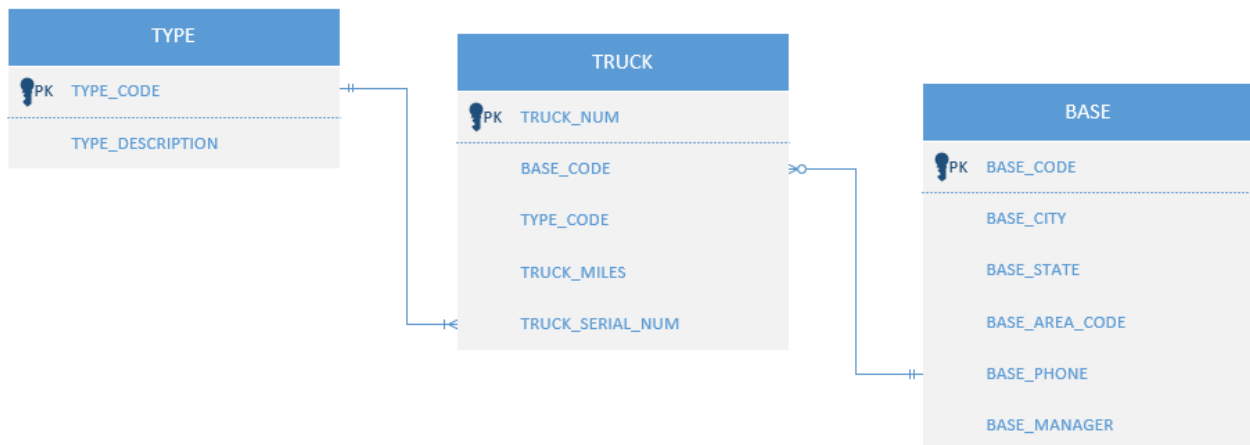
c. (5 points) Do the tables exhibit referential integrity?

Table	Referential Integrity (Yes/No)	Reason
TRUCK	Yes	Each TYPE_CODE in TRUCK points to an existing TYPE_CODE in TYPE and each BASE_CODE in TRUCK points to an existing BASE_CODE in BASE
TYPE	NA	
BASE	NA	

d. (1 point) Identify the TRUCK table's candidate key.

TRUCK_SERIAL_NUM

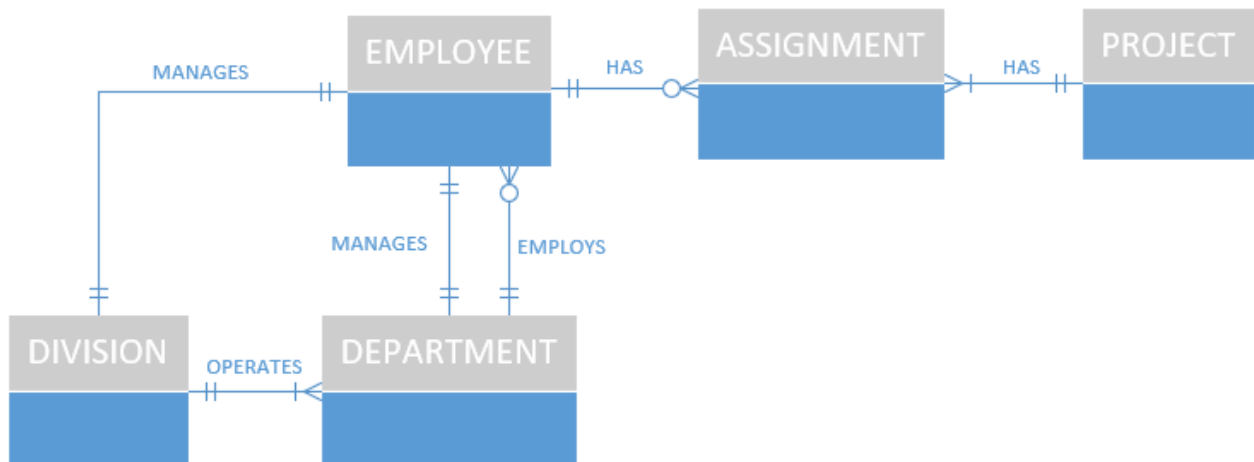
e. (5 points) Create a Crow's Foot ERD for the database.



Question 3 (20 points)

Use the following business rules to create a single Crow's Foot ERD. Write all appropriate connectivities. Assume all relationship strengths to be weak; i.e. show all connections using dashed lines.

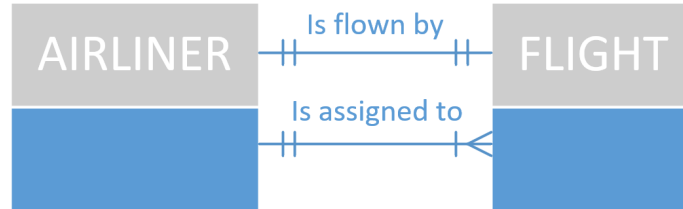
1. A department employs many employees, but each employee is employed by only one department.
2. Some employees, known as "rovers," are not assigned to any department.
3. A division operates many departments, but each department is operated by only one division.
4. An employee may be assigned many projects, and a project may have many employees assigned to it.
5. A project must have at least one employee assigned to it.
6. One of the employees manages each department, and each department is managed by only one employee.
7. One of the employees runs each division, and each division is run by only one employee.



Question 4 (24 points)

Create a Crow's Foot ERD for each of the following descriptions.

- a. **(8 points)** An airliner can be assigned to fly many flights, but each flight is flown by only one airliner.



- b. **(8 points)** The StrongBond Corporation operates many factories. Each factory is located in a region, and each region can be "home" to many of StrongBond's factories. Each factory has many employees, but each employee is employed by only one factory.



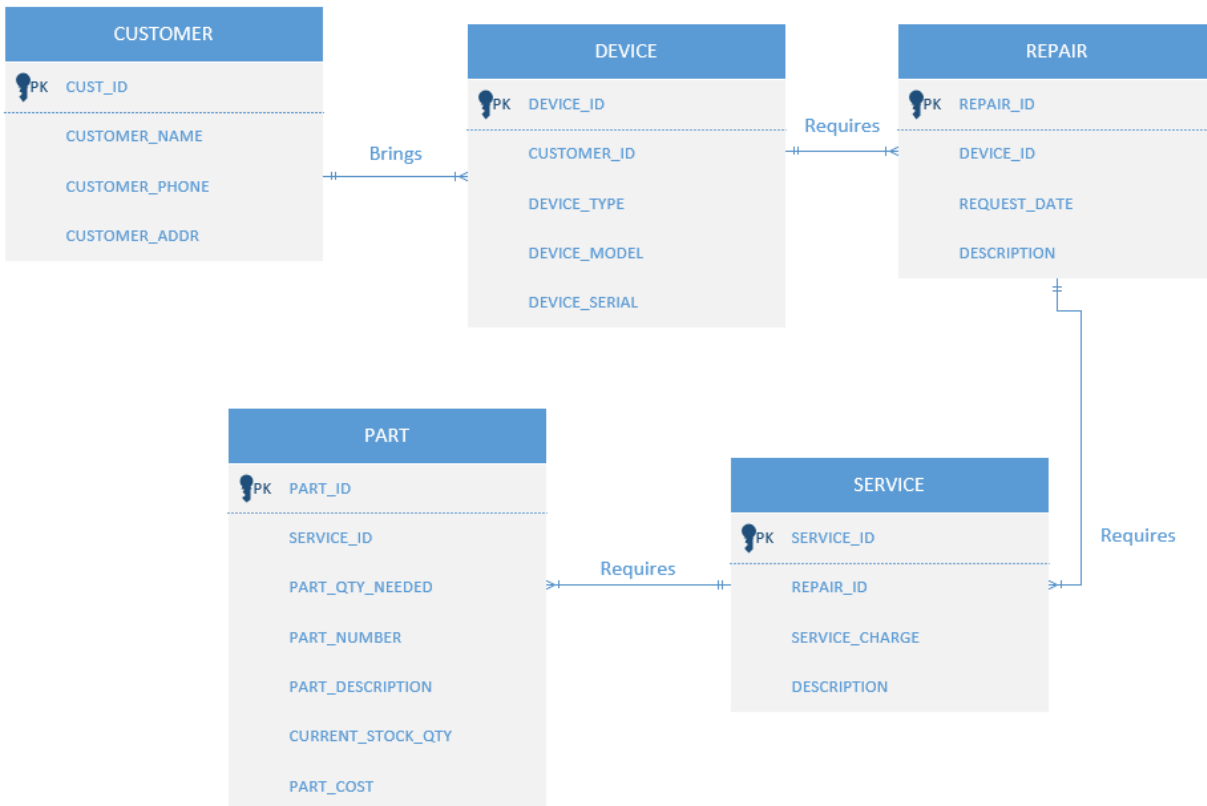
- c. **(8 points)** An employee may have earned many degrees, and each degree may have been earned by many employees.



Question 5 (40 points)

Create a Crow's Foot ERD to support the following business operations:

1. A friend of yours has opened Professional Electronics and Repairs (PEAR) to repair smartphones, laptops, tablets, and MP3 players. She wants you to create a database to help her run her business.
2. When a customer brings a device to PEAR for repair, data must be recorded about the customer, the device, and the repair. The customer's name, address, and a contact phone number must be recorded (if the customer has used the shop before, the information already in the system for the customer is verified as being current). For the device to be repaired, the type of device, model, and serial number are recorded (or verified if the device is already in the system). Only customers who have brought devices into PEAR for repair will be included in this system.
3. Since a customer might sell an older device to someone else who then brings the device to PEAR for repair, it is possible for a device to be brought in for repair by more than one customer. However, each repair is associated with only one customer. When a customer brings in a device to be fixed, it is referred to as a repair request, or just "repair," for short. Each repair request is given a reference number, which is recorded in the system along with the date of the request, and a description of the problem(s) that the customer wants fixed. It is possible for a device to be brought to the shop for repair many different times, and only devices that are brought in for repair are recorded in the system. Each repair request is for the repair of one and only one device. If a customer needs multiple devices fixed, then each device will require its own repair request.
4. There are a limited number of repair services that PEAR can perform. For each repair service, there is a service ID number, description, and charge. "Charge" is how much the customer is charged for the shop to perform the service, including any parts used. The actual repair of a device is the performance of the services necessary to address the problems described by the customer. Completing a repair request may require the performance of many services. Each service can be performed many different times during the repair of different devices, but each service will be performed only once during a given repair request.
5. All repairs eventually require the performance of at least one service, but which services will be required may not be known at the time the repair request is made. It is possible for services to be available at PEAR but that have never been required in performing any repair.
6. Some services involve only labor activities and no parts are required, but most services require the replacement of one or more parts. The quantity of each part required in the performance of each service should also be recorded. For each part, the part number, part description, quantity in stock, and cost is recorded in the system. The cost indicated is the amount that PEAR pays for the part. Some parts may be used in more than one service, but each part is required for at least one service.



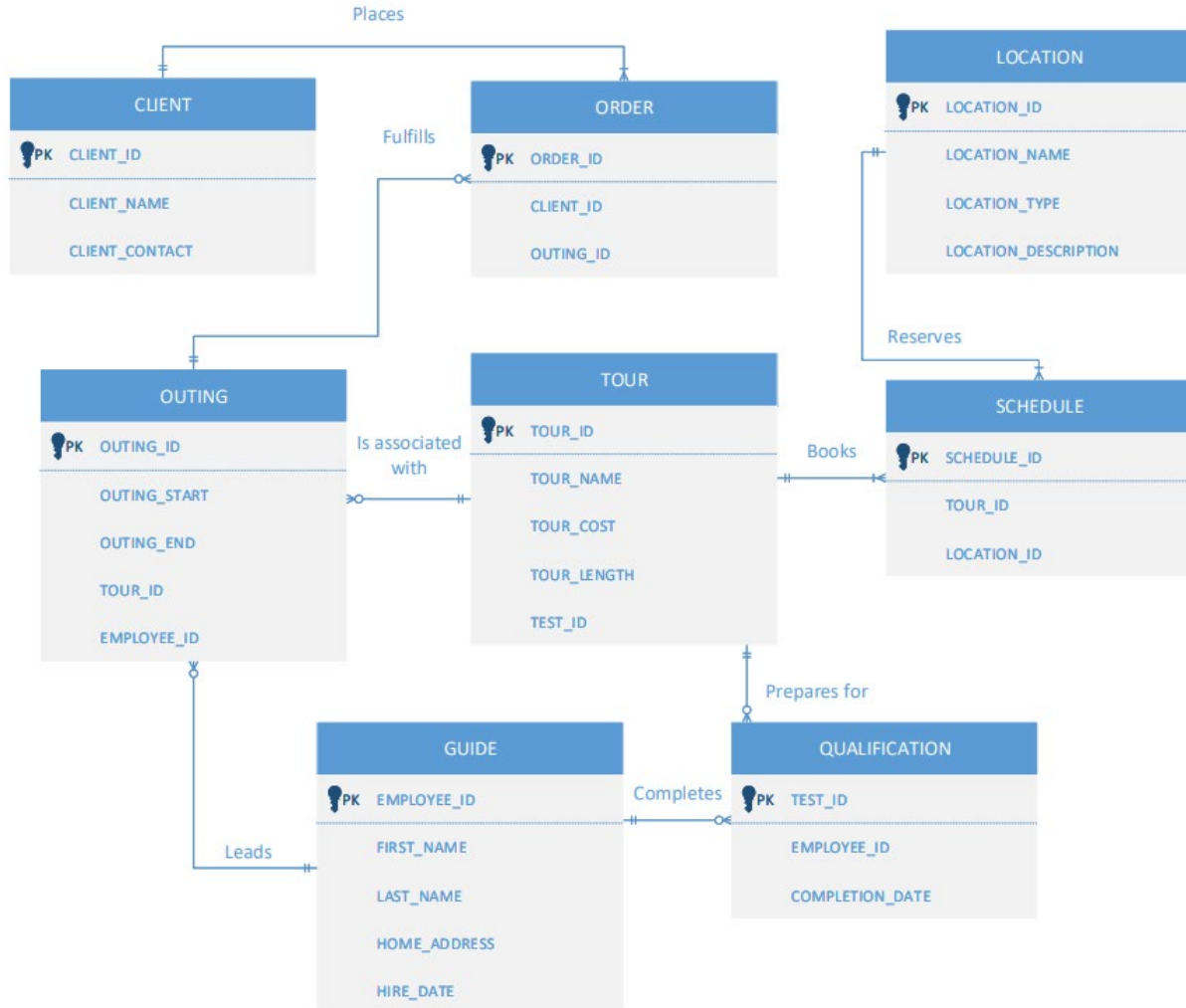
Question 6 (40 points)

Luxury Scenic Tours (LST) provides guided tours to groups of visitors to the Washington, D.C. area. In recent years, LST has grown quickly and is having difficulty keeping up with all of the various information needs of the company. The company's operations are as follows:

1. LST offers many different tours. For each tour, the tour name, approximate length (in hours), and fee charged is needed. Guides are identified by an employee ID, but the system should also record a guide's name, home address, and date of hire. Guides take a test to be qualified to lead specific tours. It is important to know which guides are qualified to lead which tours and the date that they completed the qualification test for each tour. A guide may be qualified to lead many different tours. A tour can have many different qualified guides. New guides may or may not be qualified to lead any tours, just as a new tour may or may not have any qualified guides.

2. Every tour must be designed to visit at least three locations. For each location, a name, type, and official description are kept. Some locations (such as the White House) are visited by more than one tour, while others (such as Arlington Cemetery) are visited by a single tour. All locations are visited by at least one tour. The order in which the tour visits each location should be tracked as well.
3. When a tour is actually given, that is referred to as an “outing.” LST schedules outings well in advance so they can be advertised and so employees can understand their upcoming work schedules. A tour can have many scheduled outings, although newly designed tours may not have any outings scheduled. Each outing is for a single tour and is scheduled for a particular date and time. All outings must be associated with a tour. All tours at LST are guided tours, so a guide must be assigned to each outing. Each outing has one and only one guide. Guides are occasionally asked to lead an outing of a tour even if they are not officially qualified to lead that tour. Newly hired guides may not have ever been scheduled to lead any outings. Tourists, called “clients” by LST, pay to join a scheduled outing. For each client, the name and telephone number are recorded. Clients may sign up to join many different outings, and each outing can have many clients. Information is kept only on clients who have signed up for at least one outing, although newly scheduled outings may not have any clients signed up yet.

- a. (30 points) Create a Crow’s Foot ERD to support LST operations.



- b. (10 points) The operations provided state that it is possible for a guide to lead an outing of a tour even if the guide is not officially qualified to lead outings of that tour. Imagine that the business rules instead specified that a guide is never, under any circumstance, allowed to lead an outing unless he or she is qualified to lead outings of that tour. How could the ERD change in Part a. be modified to enforce this new condition? Draw the new ERD. *Hint: you can reuse the diagram from part a above and make the changes. The changes are very minor but I wanted to see if you can identify these changes.*

