Exercise. Consider the following self-describing schema with the underlined **primary keys** and the **corresponding foreign keys**. The database records products stored in warehouses.

```
warehouse(wid, address, city)
stock(wid, pid, qty)                % This is a composite key
product(pid, name, category )
```

In addition to the primary and foreign key constraints, the following column constraint holds.

```
CHECK(qty>0);
```

Question. Which of the following operations may violate a constraint on the `warehouse` table?

None:
Insert a record in the `product` table.
Delete a record from the `product` table.
Delete a record from the `stock` table.

Question. Which of the following operations may violate a constraint on the `stock` table?

All :
Modify the quantity in one record of the `stock` table.
Delete a record from the `product` table.
Update a record in the `warehouse` table.

Question. Which of the following operations may violate constraints on more than one table?

Update a record in the `product` table. It can violate both a foreign key by removing a referenced pid and a primary key constraint by duplicating an existing pid

Exercise. Consider the following self-describing schema with the underlined **primary keys** and the **corresponding foreign keys**. The database records products stored in warehouses.

```
warehouse(wid, address, city)
stock(wid, pid, qty)                % This is a composite key
product(pid, name, category )

The following column constraint holds.

CHECK(qty>0);
```

Products not in stock in a warehouse do not appear with quantity 0 but rather have no corresponding entry in the stock table.

Translate the following queries into SQL. Use your knowledge of integrity constraints to simplify the queries. Do not use SQL JOIN and its variants. Do not use nested queries in the SELECT and FROM clause. Prefer simpler queries to nested queries, to aggregates, to algebraic queries and other complicated answers, if possible and unless otherwise indicated.

Question. Find the categories of product in stock in warehouses of the city of Johor Baru.

```
SELECT (optional : DISTINCT, not preferred GROUP BY p.category) p.category
FROM warehouse w, stock s, product p
WHERE w.wid=s.wid AND p.pid=s.pid AND w.city='Johor baru";
```

Question. Find the **different** cities in which there are **two or more** warehouses. Use a simple query.

```
SELECT DISTINCT w1.city
FROM warehouse w1, warehouse w2
WHERE w1.city=w2.city AND w1.wid<>w2.wid;
```

Question. For each city and product, print the city, the product name and the total quantity of the product in stock in the warehouses of the city if the total quantity is 1000 or more.

```
SELECT w.city, p.name, SUM(s.qty)
FROM warehouse w, stock s, product p
WHERE w.wid=s.wid AND p.pid=s.pid
GROUP BY w.city, p.pid, p.name
HAVING SUM(s.qty) >= 1000
```

Question 7. Find the identifiers of the warehouses in which all products of the category 'monitor' are in stock in quantity of 100 units or more.

```
SELECT w.wid
FROM warehouse w
WHERE NOT EXISTS (SELECT *
FROM product p
WHERE p.category = 'monitor' AND NOT EXISTS (SELECT *
FROM stock s
WHERE w.wid=s.wid AND p.pid=s.pid AND s.qty>=100)
```

Exercise.

Your company, Apasaja Pte Ltd, has been commissioned to design the human resource management system for an international company. Every employees work for exactly one of the several national branches of the company. They are given an identification number by the branch that they work for. The identification number is unique within the branch. However, two different branches may give the same identification number to two different employees. The system records the name of the employees (`ename`), their identification number (`eid`), the name (`bname`) and country (`country`) of the branches. There could be several branches in the same country but each branch has a unique name within the company. Projects are managed by zero or more branches. Employees are assigned to zero or more projects. Each project has a unique name (`pname`) within the company. The system also records a short description of the project (`pdesc`).

For instance, employee '`Smith`' with identification number '`123X`' works for the Raffles branch in Singapore. He has been assigned to two projects: the project with name '`Web design`' and description '`Design the company's Website`', and the project with name '`Database design`' and description '`Design the schema of the customer's database`'. The project '`Web design`' is managed by the '`Raffles`' branch and by the '`Suvarnabhumi`' branch. The project '`Database design`' is managed by the '`Raffles`' branch.

Question. Write the SQL DDL statements (complete with primary, foreign key and other relevant constraints) for the table associating employees with the projects that they are assigned to (let us call this table `assigned_to`). You can (and probably should) use your ER diagram above but this question is marked independently from the previous one.

In addition to the previous requirements enforce that an employee assigned to a project does so only for a project managed by the branch she works for.

```
CREATE TABLE assigned (
eid CHAR(9),
bname VARCHAR(62),
pname VARCHAR(62) REFERENCES project(pname) % optional
PRIMARY KEY (eid, bname, pname),
FOREIGN KEY (eid, bname) REFERENCES employee(eid, bname),
FOREIGN KEY (bname, pname) REFERENCES manage(bname, pname))
```