CS143: Database Systems
Homework #2

1. Assume the following tables for this problem:

```
Employee(person-name, age, street, city)
Work(person-name, company-name, salary)
Company(company-name, city)
Manage(person-name, manager-name)
```

A person may work for more than one company. A company may be located in more than one city. Each person's name is unique.

Write the following queries in SQL. You should use at least one subquery in each of your answers and write each query in two significantly different ways (e.g., using different sets of the operators `EXIST`, `IN`, and `SOME`)

(a) Find the names of the employees whose salaries are higher than those of all employees living in Los Angeles.

ANSWER:

```
SELECT person-name FROM Work
GROUP BY person-name
HAVING SUM(salary)>ALL
(SELECT sum(salary) FROM Work, Employee
WHERE Work.person-name=Employee.person-name AND city=’Los Angeles’
GROUP BY Work.person-name)

SELECT person-name FROM Employee E
WHERE NOT EXISTS
(SELECT Work.person-name FROM Work, Employee
WHERE Work.person-name=Employee.person-name AND city=’Los Angeles’
GROUP BY Work.person-name
HAVING SUM(salary)>
(SELECT SUM(salary) FROM Work
WHERE person-name=E.person-name))
```

(b) Find the names of the managers whose salaries are higher than that of at least one employee that they manage.

ANSWER:

```
SELECT DISTINCT manager-name FROM Manager M1
WHERE
(SELECT SUM(salary) FROM Work
WHERE Work.person-name=M1.manager-name
GROUP BY Work.person-name) > SOME
(SELECT SUM(salary) FROM Work, Manager M2
WHERE Work.person-name=M2.person-name AND M2.manager-name=M1.manager-name
GROUP BY Work.person-name))
```

```
SELECT DISTINCT manager-name FROM Manager M1
WHERE EXISTS
(SELECT person-name FROM Manager M2
WHERE M1.manager-name=M2.manager-name AND
(SELECT SUM(salary) FROM Work
WHERE Work.person-name=M2.person-name
GROUP BY Work.person-name) <
(SELECT SUM(salary) FROM Work
WHERE Work.person-name=M2.manager-name
GROUP BY Work.person-name))
```

2. Assume the database of the previous problem, answer the following questions.

   (a) Write a query in SQL to find the names of such companies that all of their employees have salaries higher than $100000.
   ANSWER:
   ```
   SELECT company-name FROM Work W1 WHERE ALL (SELECT salary FROM Work W2 WHERE W1.company-name
   = W2.company-name) > 100000
   ```

   (b) Write the same query in Relational Algebra.
   ANSWER:
   $\Pi_{company-name}(Work) - \Pi_{company-name}(\sigma_{salary<=100000}(Work))$

   (c) Compare the results of (a) and (b), are they the same? Why?
   ANSWER:
   No, because there might be duplicates in the result of the SQL query.

3. Assume the following tables for this problem:

```
MovieStar(name, address, gender)
MovieExec(name, address, company, netWorth)
```

   (a) We want to find the names and addresses of all female movie stars (`gender = 'F'` in the `MovieStar` relation) who are also movie executives with a net worth over $1,000,000 (`netWorth > 1000000` in the `MovieExec` relation).

      i. Write the query using `INTERSECT` operator.
      ANSWER:
      ```
      SELECT name, address FROM MovieStar WHERE gender='F' INTERSECT SELECT name, address
      FROM MovieExec WHERE netWorth>1000000
      ```

ii. Write the query without using `INTERSECT` operator.
ANSWER:
`SELECT name, address FROM MovieStar WHERE gender='F' AND (name, address) in (SELECT name, address FROM MovieExec WHERE netWorth>1000000)`

(b) We want to find the movie stars who are not movie executives.

i. Write the query using `EXCEPT` operator.
ANSWER:
`SELECT name FROM MovieStar EXCEPT SELECT name FROM MovieExec`

ii. Write the query without using `EXCEPT` operator.
ANSWER:
`SELECT name FROM MovieStar WHERE name not in (SELECT name FROM MovieExec)`

4. Assume the following tables for this problem:

```
ComputerProduct(manufacturer, model, price)
Desktop(model, speed, ram, hdd)
Laptop(model, speed, ram, hdd, weight)
```

A computer product is either a desktop or a laptop.

(a) Find the average speed of all desktop computers.
ANSWER:
`SELECT AVG(speed) FROM Desktop`

(b) Find the average price of all laptops with weight below 2kg.
ANSWER:
`SELECT AVG(price) FROM ComputerProduct CP, Laptop L WHERE CP.model=L.model AND weight<=2`

(c) Find the average price of PC's and laptops made by "Dell."
ANSWER:
`SELECT AVG(price) FROM ComputerProduct WHERE manufacturer='DELL'`

(d) For each different CPU speed, find the average price of a laptop.
ANSWER:
`SELECT AVG(price) FROM Laptop GROUP BY speed`

(e) Find the manufacturers that make at least three different computer models.
ANSWER:
`SELECT manufacturer FROM ComputerProduct GROUP BY manufacturer HAVING COUNT(model)>=3`

5. Assume the computer-product database of the previous problem, and write the following database modifications.

(a) Using two `INSERT` statements, insert a desktop computer manufactured by HP, with model number 1200, price $1000, speed 1.2Ghz, 256MB RAM, and an 80GB hard drive.
ANSWER:

```
INSERT INTO ComputerProduct VALUES (‘HP’, 1200, 1000)

INSERT INTO Desktop VALUES (1200, ‘1.2GHz’, ‘256MB’, ‘80GB’)
```

(b) Using two `DELETE` statements, delete all desktops manufactured by IBM with price below $1000. (*Comments: Be careful with the order of your two* `DELETE` *statements.*)
ANSWER:

```
DELETE FROM Desktop
WHERE model IN
(SELECT model FROM ComputerProduct
WHERE manufacturer = ‘IBM’ AND price < 1000)

DELETE FROM ComputerProduct
WHERE manufacturer=‘IBM’ AND price<1000 AND model NOT IN
(SELECT model FROM Laptops)
```

(c) For each laptop made by Gateway, add one kilogram to the weight. (*Hint: The* `WHERE` *clause in a* `UPDATE` *statement may contain complex conditions, including subqueries.*)
ANSWER:

```
UPDATE Laptop
SET weight=weight+1
WHERE model IN
(SELECT model
FROM ComputerProduct
WHERE manufacturer=‘Gateway’)
```