CS 143 Homework 2

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Problem 1

$$Employee(\underline{\text{person-name}}, \text{age, street, city})$$

$$Work(\underline{\text{person-name}}, \underline{\text{company-name}}, \text{salary})$$

$$Company(\underline{\text{company-name}}, \text{city})$$

$$Manage(\underline{\text{person-name}}, \text{manager-name})$$

a) Write a query in SQL to find the names of all companies such that all of their employees have salaries higher than \$150,000.

```
SELECT company-name
FROM Company
WHERE company-name NOT IN (SELECT company-name
                          FROM Work
                          WHERE salary < 150000);
```

b) Write the same query in Relational Algebra.

$$\Pi_{\text{company-name}}(Company) - \Pi_{\text{company-name}}(\sigma_{\text{salary} < 150000}(Work))$$

c) Compare the results of (a) and (b). Are they the same? Why?

Yes, these results are the same. We would say they're logically equivalent, since they return the same results, regardless of the input tables they're given. The subquery in **a)** is an exact translation to SQL from the relational algebra expression $\Pi_{\text{company-name}}(\sigma_{\text{salary} < 150000}(Work))$. Likewise, the main query is responsible for modelling $\Pi_{\text{company-name}}(Company)$ from **b)**.

Problem 2

Using the same database as in Problem 1, write the following queries in SQL. Each answer should utilize at least 1 subquery.

a) Find the name(s) of the employee(s) whose total salary is higher than those of all employees living in Los Angeles.

```
SELECT E.person-name
FROM Employee E, Work W
WHERE E.person-name = W.person-name
    AND salary > (SELECT MAX(salary)
                  FROM Employee E, Work W
                  WHERE E.person-name = W.person-name
                      AND city = "Los Angeles");
```

b) Find the name(s) of the manager(s) whose total salary is higher than that of at least one employee that they manage.

```
SELECT DISTINCT manager-name
FROM Manage M1, Work W1
WHERE M1.manager-name = W1.person-name
    AND EXISTS(SELECT *
               FROM Manage M2, Work W2
               WHERE M1.manager-name = M2.manager-name
                   AND M2.person-name = W2.person-name
                   AND W1.salary > W2.salary);
```

Problem 3

$$MovieStar(\underline{name}, address, gender)$$

$$MovieExec(\underline{name}, address, company, netWorth)$$

a) Find the names and addresses of all female movie stars who are also movie executives with a net worth over $1,000,000.

i) Write the query using the *INTERSECT* operator.

```
(SELECT name, address
 FROM MovieStar
 WHERE gender = 'F')
INTERSECT
(SELECT name, address
 FROM MovieExec
 WHERE netWorth > 1000000);
```

ii) Write the query without using the *INTERSECT* operator.

```
SELECT name, address
FROM MovieStar S, MovieExec E
WHERE S.name = E.name AND gender = 'F' AND netWorth > 1000000;
```

b) Find the names of movie stars who are not movie executives.

i) Write the query using the *EXCEPT* operator.

```
(SELECT name
 FROM MovieStar)
EXCEPT
(SELECT name
 FROM MovieExec);
```

ii) Write the query without using the *EXCEPT* operator.

```
SELECT name
FROM MovieStar
WHERE name NOT IN (SELECT name
                   FROM MovieExec);
```

Problem 4

$$ComputerProduct(\text{manufacturer}, \underline{\text{model}}, \text{price})$$
$$Desktop(\underline{\text{model}}, \text{speed}, \text{ram}, \text{hdd})$$
$$Laptop(\underline{\text{model}}, \text{speed}, \text{ram}, \text{hdd}, \text{weight})$$

a) Find the average speed of all desktop computers.

```
SELECT AVG(speed)
FROM Desktop;
```

b) Find the average price of PCs and laptops made by Dell.

```
SELECT AVG(price)
FROM ComputerProduct
WHERE manufacturer = 'Dell';
```

c) Find the average price of all laptops with a weight above 3kg.

```
SELECT AVG(price)
FROM Laptop
WHERE weight > 3;
```

d) For each different CPU speed, find the average price of a laptop.

```
SELECT speed, AVG(price)
FROM Laptop
GROUP BY speed;
```

e) Find the manufacturers that make at least three different computer models.

```
SELECT manufacturer
FROM ComputerProduct
GROUP BY manufacturer
HAVING COUNT(*) >= 3;
```

Problem 5

Using the same database as in Problem 4, make the following database modifications.

a) Using two *INSERT* statements, insert a desktop computer manufactured by HP, with model number 1100, price $1000, speed 1.2 GHz, 256MB RAM, and a 40GB hard drive.

```
INSERT INTO ComputerProduct VALUES ('HP', 1100, 1000);
INSERT INTO Desktop VALUES (1100, 1.2, 256, 40);
```

b) Using two *DELETE* statements, delete all desktops manufactured by IBM with price below $1000.

```
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;
```

c) For each laptop made by Gateway, subtract 1GB from the HDD.

```
UPDATE Laptop
SET hdd = hdd - 1
WHERE model IN (SELECT model
                FROM ComputerProduct
                WHERE manufacturer = 'Gateway');
```