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Class/Discussion Section: CS143/1A

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

SOLUTION:

a)
```
SELECT person-name
FROM Work
GROUP BY person-name
HAVING SUM(salary) > ALL
    -- Compute salary of each employee residing in Los Angeles
    (SELECT SUM(salary)
    FROM Work W, Employee E
    WHERE W.person-name = E.person-name AND E.city = 'Los Angeles'
    GROUP BY W.person-name)
```

```
SELECT person-name
FROM Employee E
WHERE NOT EXISTS
    -- Check if employee's salary less than salary of an employee residing in Los Angeles
    (SELECT Work.person-name
    FROM Work, Employee
    WHERE Work.person-name = Employee.person-name AND Employee.city = 'Los Angeles'
    GROUP BY Work.person-name
    HAVING SUM(Work.salary) >
        -- Find employee's salary
        (SELECT SUM(salary)
        FROM Work
```

```
            WHERE person-name = E.person-name))
```

b)
```
SELECT DISTINCT(manager-name)
FROM Manage M
WHERE
    -- Compute M manager's salary
    (SELECT SUM(Work.salary)
    FROM Work
    WHERE Work.person-name = M.manager-name
    GROUP BY Work.person-name)
  > SOME
    -- Compute M manager's employees' salaries
    (SELECT SUM(Work.salary)
    FROM Work, Manage
    WHERE Work.person-name = Manage.person-name AND Manage.manager-name =
M.manager-name
    GROUP BY Work.person-name)
```

PROBLEM 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.
b) Write the same query in Relational Algebra.
c) Compare the results of (a) and (b), are they the same? Why?

SOLUTION:

a)
```
SELECT company-name
FROM Work W
WHERE 100000 < ALL
    (SELECT salary
    FROM Work
    WHERE Work.company-name = W.company-name)
```

b) $\pi_{company-name}(Work) - \pi_{company-name}\left(\sigma_{salary \leq 100000}(Work)\right)$

c) Results of (a) and (b) are not the same, since the SQL query might contain duplicates.

PROBLEM 3: Assume the following tables for this problem:

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

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.
   ii. Write the query without using INTERSECT operator.
b) We want to find the movie stars who are not movie executives.
   i. Write the query using EXCEPT operator.
   ii. Write the query without using EXCEPT operator.

SOLUTION:

a)

i.
```
-- Find all female movie stars
(SELECT name, address
FROM MovieStar
WHERE gender = 'F')
INTERSECT
  -- Find all executives with a net worth over $1,000,000
  (SELECT name, address
  FROM MovieExec
  WHERE netWorth > 1000000)
```

ii.
```
SELECT MS.name, MS.address
FROM MovieStar MS, MovieExec ME
WHERE MS.name = ME.name AND MS.gender = 'F' AND ME.netWorth > 1000000
```

b)

i.
```
-- Get names of all movie stars
SELECT name
FROM MovieStar
EXCEPT
  -- Get names of all executives
  (SELECT name
  FROM MovieExec)
```

ii.
```
SELECT name
FROM MovieStar
WHERE name NOT IN (SELECT name FROM MovieExec)
```

PROBLEM 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.
b) Find the average price of all laptops with weight below $2kg$.
c) Find the average price of desktops and laptops made by “Dell."
d) For each different CPU speed, find the average price of a laptop.
e) Find the manufacturers that make at least three different computer models.

SOLUTION:

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

b)
```
SELECT AVG(CP.price)
FROM Laptop L, ComputerProduct CP
WHERE L.model = CP.model AND L.weight < 2
```

c)
```
SELECT AVG(price)
FROM ComputerProduct CP
WHERE manufacturer = ‘DELL’
```

d)
```
SELECT AVG(CP.price)
FROM Laptop L, ComputerProduct CP
WHERE L.model = CP.model
GROUP BY L.speed
```

e)
```
SELECT manufacturer
FROM ComputerProduct
GROUP BY manufacturer
HAVING COUNT(model) > 3
```

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PROBLEM 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.
b) Using two $DELETE$ statements, delete all desktops manufactured by IBM with price below $1000.
c) For each laptop made by Gateway, add one kilogram to the weight.

SOLUTION:

a)
```
INSERT INTO ComputerProduct
VALUES ('HP', 1200, 1000)

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

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