

**CMPT354 - Assignment 2**

1. Express the following queries in Relational Algebra. Both the correctness and the simplicity count

- 1) List items available in both “red” and “blue”.

$$\pi_{items}(\sigma_{color='red'}(Types) \cap \sigma_{color='blue'}(Types))$$

- $\pi_{items}(\sigma_{color='red'}(Types) \cap \sigma_{color='blue'}(Types))$

- 2) List the name of the employees making at least as much as “Jane”. If there are several employees named “Jane”, which Jane’s salary is used in this comparison in your answer?

$$jSalary = \pi_{salary}(\sigma_{name='Jane'}(Employee))$$

$$\pi_{name}(\sigma_{salary > jSalary}(Employee))$$

- $jSalary = \pi_{salary}(\sigma_{name='Jane'}(Employee)) \setminus \pi_{name}(\sigma_{salary > jSalary}(Employee))$

- 3) Find the largest salary paid to any employees.

$$sal1 = \pi_{salary}(\rho_{1 \rightarrow sal1}(Employees))$$

$$sal2 = \pi_{salary}(\rho_{1 \rightarrow sal2}(Employees))$$

$$cross = sal1 \times sal2$$

$$allExceptMax = \pi_{salary}(\sigma_{sal1 < sal2}(cross))$$

$$maxSalary = salary1 - allExceptMax$$

- $sal1 = \pi_{salary}(\rho_{1 \rightarrow sal1}(Employees)) \setminus$   
 $sal2 = \pi_{salary}(\rho_{1 \rightarrow sal2}(Employees)) \setminus$   
 $cross = sal1 \times sal2 \setminus$   
 $allExceptMax = \pi_{salary}(\sigma_{sal1 < sal2}(cross)) \setminus$   
 $maxSalary = salary1 - allExceptMax$

- 4) What departments sell every item with a red color.

$$red = \pi_{item}(\sigma_{color='red'}(Types))$$

$$sales/red$$

- $red = \pi_{item}(\sigma_{color='red'}(Types)) \setminus sales/red$

- 5) What departments sell only items with **only** red color, in other words, what departments do not sell any item with a non-red color.

$$notRed = \pi_{dept}(\sigma_{color \neq red}(Sales \bowtie Types))$$

$$\pi_{dept}Sales - notRed$$

- $notRed = \pi_{dept}(\sigma_{color \neq red}(Sales \bowtie Types)) \setminus \pi_{dept}Sales - notRed$

2. Express the queries in Question 1 in SQL.

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1) List items available in both "red" and "blue".

```
SELECT T.item
FROM Types T
WHERE T.color = "red"
INTERSECT
SELECT T.item
FROM Types T
WHERE T.color = "blue"
```

---

2) List the name of the employees making at least as much as "Jane". If there are several employees named "Jane", which Jane's salary is used in this comparison in your answer?

```
SELECT E2.name
FROM Employees E, Employees E2
WHERE E.name = 'Jane' AND E2.salary >= E.Salary
```

- If there are multiple Jane's, it will compare against the salary of the first "Jane" it encounters in the result set

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3) Find the largest salary paid to any employees.

```
SELECT E.salary
FROM Employees E
EXCEPT
SELECT E2.salary
FROM Employees E2
WHERE E2.salary < (SELECT MAX(E3.salary) FROM Employees E3);
```

---

4) What departments sell every item with a red color.

```
SELECT DISTINCT S.dept
FROM Sales S
WHERE NOT EXISTS ( ( SELECT T.item
                     FROM Types T
                     WHERE T.color='red')
                  EXCEPT
                  (SELECT S2.item
                   FROM Sales S2,
                   WHERE S2.dept = S.dept)
                  )
```

---

5) What departments sell only items with **only** red color, in other words, what departments do not sell any item with a non-red color.

```
SELECT DISTINCT S.dept
FROM Sales S
EXCEPT
SELECT S2.dept
FROM Sales S2
WHERE S2.item IN (
    SELECT T.item
    FROM Types T
    WHERE T.color != 'red'
)
```

3. This question refers to the queries in Question 1.

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a) **Express query 1 in SQL without using INTERSECT: List items available in both “red” and “blue”**

```
SELECT T.Items
FROM Types T
WHERE T.item='red' AND T.item='blue'
```

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b) **Express query 2 in SQL using nested query: List the name of the employees making at least as much as “Jane”.**

```
SELECT E.name
FROM Employees E
WHERE E.salary >= (SELECT J.salary
                   FROM Employees J
                   WHERE J.name='Jane')
```

---

c) **Express query 3 without using EXCEPT: Find the largest salary paid to any employees.**

```
SELECT MAX(E.Salary)
FROM Employees E
```

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d) **Express query 5 without using EXCEPT: What departments sell only items with **only** red color, in other words, what departments do not sell any item with a non-red color.**

```
SELECT DISTINCT S.dept
FROM Sales S,
WHERE S.dept NOT IN (SELECT S2.dept
                    FROM Sales S2, Types T
                    WHERE S2.item = T.item AND T.color != 'red' )
```