CSC343 Worksheet 3 Solution

June 16, 2020

1. **Exercise 6.1.1**:

   If there is a comma between A and B (i.e, *SELECT A, B*), we can conclude A and B are two different attributes.

   If there are no commas between A and B, we can conclude B is an alias of A.

2. **Exercise 6.1.2**:

   a) SELECT address FROM Studio WHERE name = 'MGM';

   b) SELECT birthdate FROM MovieStar WHERE name = 'Sandra Bullock';

   c) SELECT starName FROM StarsIn WHERE movieYear = 1980, movieTitle LIKE '%Love%';

   Correct Solution:

   SELECT starName FROM StarsIn WHERE movieYear = 1980 AND movieTitle LIKE '%Love%';

   d) SELECT name FROM MovieExec WHERE netWorth >= 10000000;

   e) SELECT name FROM MovieStar WHERE gender='male' OR address LIKE '%Malibu%';

3. **Exercise 6.1.3**:

   a) SELECT model, speed, hd FROM PC WHERE price < 1000;

   b) SELECT model, speed AS gigahertz, hd AS gigabytes FROM PC WHERE price < 1000;

   c) SELECT maker FROM Product WHERE type='printer';

   d) SELECT model, ram, screen FROM Laptops WHERE price > 1500;

   e) SELECT * FROM Printer WHERE color=TRUE;

f) SELECT model, hd FROM PC WHERE speed = 3.20 AND price < 2000;

4. **Exercise 6.1.4**:

a) SELECT class, country FROM Classes where numGuns >= 10;

b) SELECT name AS shipName FROM Ships WHERE launched < 1918;

c) SELECT ship, battle FROM Outcomes WHERE result='sunk';

d) SELECT name FROM Ships WHERE name = class;

e) SELECT name FROM Ships WHERE name LIKE 'R%';

f) SELECT name FROM ships WHERE name LIKE '% % %';

5. **Exercise 6.1.5**:

a) Given $a = 10$, the sets of tuples that satisfy the condition is

$(10, -MAX\_INT), (10, -MAX\_INT + 1), \cdots (10, 0), \cdots, (10, MAX\_INT - 1),$
$(10, MAX\_INT), (10, NULL)$

Given $b = 20$, the sets of tuples that satisfy the condition is

$(-MAX\_INT, 20), (-MAX\_INT + 1, 20), \cdots (0, 20), \cdots, (MAX\_INT - 1, 20),$
$(MAX\_INT, 20), (NULL, 20)$

Given $a = 10$ and $b = 20$, the set of tuple that satisfy the condition is $(10, 20)$

b) Given $a = 10$ AND $b = 20$, the only set of (a, b) tuple that satisfy the condition is $(10, 20)$.

c) There are three cases to consider

i. $a < 10$

In this case, the set of (a, b) tuples that satisfy the condition is:

$(9, -MAX\_INT), (9, -MAX\_INT + 1), \cdots (9, 0), \cdots, (9, MAX\_INT - 1),$
$(9, MAX\_INT), (9, NULL)$

$(8, -MAX\_INT), (8, -MAX\_INT + 1), \cdots (8, 0), \cdots, (8, MAX\_INT - 1),$
$(8, MAX\_INT), (8, NULL)$

$\cdots$

$(-MAX\_INT + 1, -MAX\_INT), (-MAX\_INT + 1, -MAX\_INT + 1),$
$\cdots (-MAX\_INT + 1, 0), \cdots, (-MAX\_INT + 1, MAX\_INT - 1),$
$(-MAX\_INT + 1, MAX\_INT), (-MAX\_INT + 1, NULL)$

$(-MAX\_INT + 1, -MAX\_INT), (-MAX\_INT + 1, -MAX\_INT + 1),$
$\cdots (-MAX\_INT + 1, 0), \cdots, (-MAX\_INT + 1, MAX\_INT - 1),$
$(-MAX\_INT + 1, MAX\_INT), (-MAX\_INT + 1, NULL)$

ii. $a >= 10$

In this case, the set of (a, b) tuples that satisfy the condition is:

$(10, -MAX\_INT), (10, -MAX\_INT + 1), \cdots (10, 0), \cdots, (10, MAX\_INT - 1),$
$(10, MAX\_INT), (10, NULL)$

$(11, -MAX\_INT), (11, -MAX\_INT + 1), \cdots (11, 0), \cdots, (11, MAX\_INT - 1),$
$(11, MAX\_INT), (11, NULL)$

$\cdots$

$(MAX\_INT - 1, -MAX\_INT), (MAX\_INT - 1, -MAX\_INT + 1),$
$\cdots (MAX\_INT - 1, 0), \cdots, (MAX\_INT - 1, MAX\_INT - 1),$
$(MAX\_INT - 1, MAX\_INT), (MAX\_INT - 1, NULL)$

$(MAX\_INT, -MAX\_INT), (MAX\_INT, -MAX\_INT + 1),$
$\cdots (MAX\_INT, 0), \cdots, (MAX\_INT, MAX\_INT - 1),$
$(MAX\_INT, MAX\_INT), (MAX\_INT, NULL)$

iii. $a < 10$ AND $a >= 10$

This case is not considered. No (a, b) tuples match this condition.

d) In this case the set of (a, b) tuples that satisfy this condition is

$(-MAX\_INT, -MAX\_INT), (-MAX\_INT + 1, -MAX\_INT + 1),$
$\cdots (0, 0), \cdots, (MAX\_INT - 1, MAX\_INT - 1),$
(MAX_INT, MAX_INT)

Here, the case $a = NULL$ and $b = NULL$ is not considered, since $NULL \neq NULL$.

Notes:

- NULL = NULL is NULL.

e) In this case, the set of (a, b) tuples that satisfy this condition is

$(-MAX\_INT, -MAX\_INT), (-MAX\_INT, -MAX\_INT + 1),$
$\cdots, (-MAX\_INT, MAX\_INT - 1),$
$(-MAX\_INT, MAX\_INT),$

$(-MAX\_INT + 1, -MAX\_INT + 1), (-MAX\_INT + 1, -MAX\_INT + 2),$
$\cdots, (-MAX\_INT + 1, MAX\_INT - 1),$
$(-MAX\_INT + 1, MAX\_INT),$

$\cdots$

$(MAX\_INT - 1, MAX\_INT - 1), (MAX\_INT - 1, MAX\_INT)$,

(MAX_INT, MAX_INT)

Here, the case $a = NULL$ OR $b = NULL$ is not considered, since $a \not\leq b$.

6. SELECT * FROM Movies WHERE length;

7. (a) SELECT StarsIn.starName FROM StarsIn, MovieStar WHERE StarsIn.starName = MovieStar.name AND MovieStar.gender = 'male';
   (b) SELECT StarsIn.starName FROM Movies, StarsIn WHERE StarsIn.movieTitle = Movies.title AND Movies.studioName = 'MGM';
   (c) SELECT MovieExec.name FROM MovieExec, Studio WHERE MovieExec cert# = studio.presC# AND Studio.name = 'MGM';
   (d) SELECT M2.title FROM Movies AS M1, Movies AS M2 WHERE M1.title = "Gone With the Wind" AND M2.length > M1.length;
   (e) SELECT Mx2.name FROM MovieExec AS Mx1, MovieExec AS Mx2 WHERE Mx1.name = 'Merg Griffin' AND Mx2.netWorth > Mx1.netWorth;

8. a) SELECT Product.maker, Laptop.speed FROM Product, Laptops WHERE Product.type = 'laptop' AND Laptop.hd >= 30;
   b) (SELECT model, price FROM PC INNER JOIN Product ON PC.model = Product.model WHERE maker = 'B')

      UNION

      (SELECT model, price FROM Printer INNER JOIN Product ON Printer.model = Product.model WHERE maker = 'B')

      UNION

      (SELECT model, price FROM Laptop INNER JOIN Product ON Laptop.model = Product.model WHERE maker = 'B')

   c) (SELECT maker FROM Product WHERE type='laptop') - (SELECT maker FROM Product WHERE type='pc')
   d) SELECT pc1.hd FROM PC AS pc1, PC AS pc2 WHERE pc1.model ! = pc2.model AND pc1.hd = pc2.hd;
   e) SELECT pc1.model FROM PC AS pc1, PC AS pc2 WHERE pc2.model ! = pc1.model AND pc2.model >= pc1.model AND pc2.ram = pc1.ram AND pc2.speed = pc1.speed;

9. The second part of problem (i.e. Writing each query in different ways) will be done during review :).

a)
```
SELECT maker FROM Product WHERE model IN (
    SELECT model FROM PC WHERE product.model = PC.model AND
    PC.speed >= 3.0
);
```

b)
```
SELECT p1.model FROM Printer AS p1 WHERE
p1.price >= ALL (
    SELECT p2.price FROM Printer AS p2
)
```

c)
```
SELECT l1.model FROM Laptop AS l1 WHERE
speed >= ALL (
    SELECT l2.speed FROM Laptop AS l2
)
```

Correct Solution:
```
 SELECT l1.model FROM Laptop AS l1 WHERE
 speed <= ALL (                          //correction: >=
changed to <=
     SELECT l2.speed FROM Laptop AS l2
 )
```

d)
```
SELECT model FROM (
    (SELECT model, price FROM PC)
    UNION
    (SELECT model, price FROM Laptop)
    UNION
    (SELECT model, price FROM Printer)
) AS ModelPrice WHERE price >= ANY (
    SELECT price FROM ModelPrice
)
```

e)
```
SELECT model FROM (
    (SELECT model, price FROM PC)
    UNION
    (SELECT model, price FROM Laptop)
    UNION
    (SELECT model, price FROM Printer)
) AS ModelPrice WHERE price >= ANY (
    SELECT price FROM ModelPrice
)
```

f)
```
SELECT maker FROM Product, Printer WHERE
Product.model = Printer.model AND
Printer.color = TRUE AND
Printer.price <= ANY (
    SELECT price FROM Printer
);
```

Notes:

- EXISTS
  - EXISTS R is a condition that is true if and only if relation R is not empty

```
SELECT SupplierName
FROM Suppliers
WHERE EXISTS (SELECT ProductName FROM Products WHERE
Products.SupplierID = Suppliers.supplierID AND Price = 22);
```

- s IN R
  - is true if and only if s is equal to one of the values in R.
  - s NOT IN R true if and only if s has no value in R.

```
SELECT name
FROM MovieExec
WHERE cert# IN
    (SELECT producerC#
    FROM Movies
    WHERE (title, year) IN
        (SELECT movieTitle movieYear
        FROM StarsIn
        WHERE starName = 'Harrison Ford'
        )
    );
```

- $s >$ ANY R
  - is true if and only if s is greater than at least one value in unary relation R.
- $s >$ ALL R
  - is true if and only if s is greater than at least one value in unary relation R.

10. a)
```
SELECT country FROM Classes WHERE
numGuns >= ANY (
    SELECT numGuns FROM Classes
);
```

b)
```
SELECT name FROM Ships WHERE EXISTS (
    SELECT * FROM Outcome WHERE
    Ships.name = Outcomes.ship AND
    Outcome.result = 'sunk'
);
```

c)
```
SELECT name FROM Ships WHERE EXISTS (
    SELECT name FROM Ships, Classes WHERE
        Ships.class = Classes.class AND
        Classes.bore = 16
);
```

d)
```
SELECT battle FROM Outcomes WHERE EXISTS (
    WHERE EXISTS (
        SELECT * FROm Ships WHERE
        Outcomes.ship = Ships.name AND
        Ships.class = 'Kongo'
    )
);
```

11.

12.

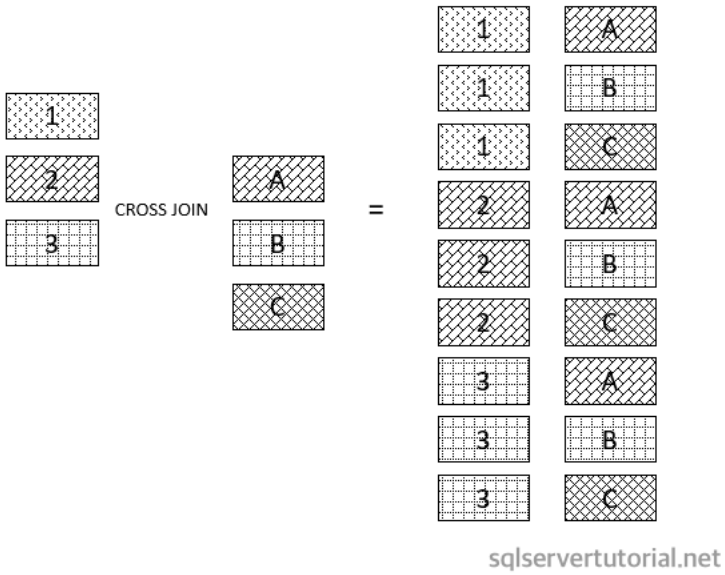
13. a) Cross join would result in the following attributes

(Studio.name, Studio.address, Studio.pressC#, MovieExec.name, MovieExec.address, MovieExec.cert#, MovieExec.networth)

With its tuples containing all possible combinations of values

Notes:

- **Cross Join:**
  - Is equivalent form of $R \times S$
  - Creates all possible combinations of values while keeping all all columns.



b) In this case, the resulting operation would have the following attributes

(StarsIn.movieTitle, StarsIn.moveYear, StarsIn.starName,
MovieStar.name, MovieStar.addresss, MovieStar.gender,
MovieStar.birthDate)

with atrribute values of MovieStar returning null when StarsIn values are present, and vice versa

Notes:

- **Outerjoins:**
  - Is equivalent form of Natural Join but with missing values in rows (i.e. dangling tuples) returning null
  - **Syntax:** *Relation 1* NATURAL FULL OUTER JOIN *Relation 2*
  - FULL OUTER JOIN VS NATURAL FULL OUTER JOIN
    - FULL OUTER JOIN
      - Allows to explicitly define the keys for the join condition
    - NATURAL FULL OUTER JOIN
      - Database engine chooses the keys based on common names

Customer

CustomerID	CustomerName	ContactName	Address	City	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico

+

Order

OrderID	CustomerID	EmployeeID	OrderDate	ShipperID
10308	2	7	1996-09-18	3
10309	37	3	1996-09-19	1
10310	77	8	1996-09-20	2

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Customer FULL OUTER JOIN Orders ON
Customer.customerID = Order.customerID

CustomerName	OrderID
Alfreds Futterkiste	*Null*
Ana Trujillo Emparedados y helados	10308
Antonio Moreno Taquería	10365

value in dangling tuple

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