# CSC343 Worksheet 4 Solution

June 17, 2020

1. **Exercise 5.2.1**: Here are two relations

   $R(A, B)$: [(0,1),(2,3),(0,1,),(2,4),(3,4)]

   $S(A, B)$: [(0,1), (2,4), (2,5), (3,4), (0,2), (3,4)]

   Compute the following

   a) $\pi_{A+B,A^2,B^2}$
   b) $\pi_{B+1,C-1}(S)$
   c) $\tau_{B,A}(R)$
   d) $\tau_{B,C}(S)$
   e) $\delta(S)$
   f) $\gamma_{A,SUM(B)}(R)$
   g) $\gamma_{B,AVG(C)}(S)$
   h) $\gamma_{A}(R)$
   i) $\gamma_{A,MAX(C)}(R \bowtie S)$
   j) $R \overset{\circ}{\bowtie}_{L} S$
   k) $R \overset{\circ}{\bowtie}_{R} S$
   l) $R \overset{\circ}{\bowtie} S$
   m) $R \overset{\circ}{\bowtie}_{R.B<S.B} S$

2. **Exercise 6.4.1:** Write each of the quires in Exercise 2.4.1 in SQL, making sure that duplicates are eliminated

3. **Exercise 6.4.2:** Write each of the queries in Exercise 2.4.3 in SQL, making sure duplicates are eliminated

4. **Exercise 6.4.6:** Write the following queires, based on the database schema

```
Product(maker, model, type)
PC(model, speed, ram, hd, price)
Laptop(model, speed, ram, hd, screen, price)
Printer(model, color, type, price)
```

]

a) Find the avergage speed of PC's

b) Find the average speed of laptops costing over $1000

c) Find the average price of PC's made by manufacturer "A"

d) Find the average price of PC's and laptops made by manufacturer "D"

e) Find, for each different speed, the average price of a PC

f) Find for each manufacturer, the average screen size of its laptop

g) Find the manufacturers that make at least three different models of PC

h) Find for each manufacturer who sells PC's the maximum price of a PC

i) Find, for each speed of PC above 2.0, the average price.

5. Write the following queires, based on the database schema

```
Classes(class, type, country, numGuns, bore, displacement)
Ships(name, class, launched)
Battles(name, date)
Outcomes(ship, battle, result)
```

a) Find the number of battleship classes

b) Find the average number of guns of battleship classes

c) Find the average number of guns of battleships. Note the difference between b) and c); do we weight a class by the number of ships of that class or not?

d) Find for each class the year in which the first ship of that class was launched

e) Find for each class the number of ships of that class sunk in battle

6. **Exercise 6.4.8:** In Example 5.10, we gave an example of the query: "find, for each star who has appeared in at least three movies, the earliest year in they appeared." We wrote this query as a $\gamma$ operation. Write it in SQL.

7. **Exercise 6.4.9:** The $\gamma$ operator of extended relational algebra does not have a feature that corresponds to the **HAVING** clause of SQL. Is it possible to mimic a SQL query with a **HAVING** clause in relational algebra?