CSC343 Worksheet 4

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)]

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

   Compute the following

   a) $\pi_{A+B,A^2,B^2}(R)$
   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 γ operation. Write it in SQL.

7. **Exercise 6.4.9:** The γ 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?

8. **Exercise 6.5.1:** Write the following database modifications, 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)
```

of Exercise 2.4.1. Describe the effect of the modifications on the data of that exercise

a) Using two INSERT statements, store in the database the fact that PC model 1100 is made by manufacturer C, has spped 3.2, RAM 1024, hard disk 180, and sells for $2499

b) Intert the facts that for every PC there is a laptop with the same manufacturer, speed, RAM, and hard disk, a 17-inch screen, a model number 110 greater, and a price $500 more.

c) Delete all PC's with less than 100 gigabytes of hard disk

d) Delete all laptops made by a manufacturer that doesn't make printers

e) Manufacturer A buys manufacturer B. Change all products made by B so they are now made by A.

f) For each PC, double the amount of RAM and add 60 gigabytes to the amount of hard disk (Remember that several attributes can be changed by one UPDATE statement)

g) For each laptop made by manufactuerer B, add one inch to the screen size and subtract $100 from the price.

9. **Exercise 6.5.2:** Write the following database modifications, based on the database schema.

```
1    Classes(class, type, country, numGuns, bore, displacement)
2    Ships(name, class, launched)
3    Battles(name, date)
4    Outcomes(ship, battle, result)
5
```

of Exercise 2.4.3. Describe the effect of the modifications on the data of that exercise.

a) The two British battleships of the Nelson class - Nelson and Rodney - were both launched in 1927, had 16-inch guns, and a displacement of 34,000 tones. Insert these facts into the database

b) Two of the three battleships of the Italian Vittorio Veneto class Vittorio Veneto and Italia - were launched in 1940; the third ship of that class, Roma, was launched in 1942. Each had nine 15-inch guns and a displacement of 41,000 tons. Insert these facdts into the database.

c) Delete from **Ships** all ships sunk in battle

d) Modify the **Classes** relation so that gun bores are measured in centimeters (one inch = 2.5 centimeters) and displacements are measured in metric tons (one metric ton = 1.1 tons).

e) Delete all classes with fewer than three ships