

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) π_{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) $R \bowtie_L S$
 - k) $R \bowtie_R S$
 - l) $R \bowtie S$
 - m) $R \bowtie_{R.B < S.B} S$
2. **Exercise 6.4.1:** Write each of the queries 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 queries, based on the database schema

```

1  Product(maker, model, type)
2  PC(model, speed, ram, hd, price)
3  Laptop(model, speed, ram, hd, screen, price)
4  Printer(model, color, type, price)
5

```

- a) Find the average 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 queries, 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

```

- 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

```

1  Product(maker, model, type)
2  PC(model, speed, ram, hd, price)
3  Laptop(model, speed, ram, hd, screen, price)
4  Printer(model, color, type, price)
5

```

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 speed 3.2, RAM 1024, hard disk 180, and sells for \$2499
- b) Insert 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 manufacturer 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 tons. 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 facts 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