

Assignment1

CSCB20

UTSC

Due Date*: 9th February @ 11:59pm on MarkUs

You must work in groups of exactly 2 (including yourself) for this assignment. Working alone is not an option. There are two parts to this assignment. In **PartA** you will write relational algebra only. In **PartB** you will write actual SQL queries. Note: In PartB we are also asking you to recreate the data that was provided in lecture worksheet1, as a SQL database. On this SQL database you will test your SQL queries for correctness. We will learn in lecture on 29th January on how to recreate this data **manually** and later by writing a **script**.

PartA: Relational Algebra

1. (40 points) This question introduces you to WorldWar II capital ships. It involves the following relations:

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

Ships are built in “classes” from the same design, and the class is usually named for the first ship of that class. The relation **Classes** records the name of the class, the type (‘bb’ for battleship or ‘bc’ for battle cruiser), the country that built the ship, the number of main guns, the bore (diameter of the gun barrel, in inches) of the main guns, and the displacement (weight, in tons). Relation **Ships** records the name of the ship, the name of its class, and the year in which the ship was launched. Relation **Battles** gives the name and date of battles involving these ships, and relation **Outcomes** gives the result (‘sunk’, ‘damaged’, ‘ok’) for each ship in each battle. We provide sample data for these four relations. See (??). Note that, there are some “dangling tuples” in this data for example, ships mentioned in **Outcomes** that are not mentioned in **Ships**. For every relational algebra query that you write, you must **also** show us the final result (i.e. the actual data produced from your query). However, your relational algebra query should work for any arbitrary data, not just the data shown in this assignment.

- (a) Give the class names and countries of the classes that carried guns of at least 16 inch bore
- (b) Find the ships launched prior to 1921
- (c) Find the ships sunk in the battle of the Denmark Strait
- (d) The “Treaty of Washington” in 1921 prohibited capital ships heavier than 35,000 tons. List the ships that violated the treaty of Washington.
- (e) List the name, displacement, and number of guns of the ships engaged in the battle of Guadalcanal.
- (f) List all the capital ships mentioned in the database. (Remember that all these ships may not appear in the **Ship** relation).

*See the submission instructions on this handout for more details

- (g) Find the classes that had only one ship as a member of that class
- (h) Find those countries that had both battleships and battle cruisers
- (i) Find those ships that “lived to fight another day”; they were damaged in one battle, but later fought in another.

<i>class</i>	<i>type</i>	<i>country</i>	<i>numGuns</i>	<i>bore</i>	<i>displacement</i>
Bismarck	bb	Germany	8	15	42000
Iowa	bb	USA	9	16	46000
Kongo	bc	Japan	8	14	32000
North Carolina	bb	USA	9	16	37000
Renown	bc	Gt. Britain	6	15	32000
Revenge	bb	Gt. Britain	8	15	29000
Tennessee	bb	USA	12	14	32000
Yamato	bb	Japan	9	18	65000

Figure 1: The relation **Classes**

<i>name</i>	<i>date</i>
Denmark Strait	5/24-27/41
Guadalcanal	11/15/42
North Cape	12/26/43
Surigao Strait	10/25/44

Figure 2: The relation **Battles**

<i>ship</i>	<i>battle</i>	<i>result</i>
Arizona	Pearl Harbor	sunk
Bismarck	Denmark Strait	sunk
California	Surigao Strait	ok
Duke of York	North Cape	ok
Fuso	Surigao Strait	sunk
Hood	Denmark Strait	sunk
King George V	Denmark Strait	ok
Kirishima	Guadalcanal	sunk
Prince of Wales	Denmark Strait	damaged
Rodney	Denmark Strait	ok
Scharnhorst	North Cape	sunk
South Dakota	Guadalcanal	damaged
Tennessee	Surigao Strait	ok
Washington	Guadalcanal	ok
West Virginia	Surigao Strait	ok
Yamashiro	Surigao Strait	sunk

Figure 3: The relation **Outcomes**

<i>name</i>	<i>class</i>	<i>launched</i>
California	Tennessee	1921
Haruna	Kongo	1915
Hiei	Kongo	1914
Iowa	Iowa	1943
Kirishima	Kongo	1915
Kongo	Kongo	1913
Missouri	Iowa	1944
Musashi	Yamato	1942
New Jersey	Iowa	1943
North Carolina	North Carolina	1941
Ramillies	Revenge	1917
Renown	Renown	1916
Repulse	Renown	1916
Resolution	Revenge	1916
Revenge	Revenge	1916
Royal Oak	Revenge	1916
Royal Sovereign	Revenge	1916
Tennessee	Tennessee	1920
Washington	North Carolina	1941
Wisconsin	Iowa	1944
Yamato	Yamato	1941

Figure 4: The relation **Ships**

Part B: SQL queries

You can only begin with question 2) if you have the required software installed on your computer. Please refer to Blackboard, under “software installation”.

2. (40 points) Write the following queries (**in SQL only**), 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) Give the manufacturer and speed of laptops with a hard disk of at least thirty gigabytes
 - (b) Find the model number and price of all products (of any type) made by manufacturer B
 - (c) Find those manufacturers that sell Laptops, but not PC's.
 - (d) Find those hard-disk sizes that occur in two or more PC's
 - (e) Find those pairs of PC models that have both the same speed and RAM. A pair should be listed only once; e.g. list (i,j) but not (j,i)
 - (f) Find those manufacturers of at least two different computers (PC's or laptops) with speeds of at least 3.0
 - (g) Find the makers of PC's with a speed of atleast 3.0
 - (h) Find the printers with the highest price
 - (i) Find the laptops whose speed is slower than that of any PC
 - (j) Find the model number of the item (PC, laptop or printer) with the highest price.
 - (k) Find the maker of the color printer with the lowest price
 - (l) Find the maker(s) of the PC(s) with the fastest processor among all those PC's that have the smallest amount of RAM.
 - (m) Write a query that will produce information about all products (PC, laptops, and printers) including their manufacturer if available, and whatever information about that product is relevant (i.e., found in the relation for that type of product).
3. (20 points) A general form of relational-algebra query is:

$$\pi_L(\sigma_C(R_1 \times R_2 \times \dots \times R_n))$$

Here, L is an arbitrary list of attributes, and C is an arbitrary condition. The list of relations R_1, R_2, \dots, R_n may include the same relation repeated several times, in which case appropriate renaming may be assumed applied to the R'_i s. Show how to express any query of this form in SQL.

Submission

Here are the instructions on how you will submit your Assignment1 on MarkUs `markus.utsc.utoronto.ca/cscb20w18`. All due dates are firm. There is no exception to this. If you submit your assignment late, we will not mark your assignment. Please make sure that you submit your assignment on time.

- You must create a tar file i.e. **assignment1.tar** (Please pay careful attention to the naming here. This is not .zip but .tar). If you are not familiar with tar files, a simple google search will show you how to create one.
- Inside this tar file, you will have a directory called **a1**. Now inside **a1** you will have the following items:
 - honorCode.txt**: You must enter the following blurb in your honor code signed (by entering your and your partner first name, last name and student #). If this file is absent, we will not mark your assignment, and you will receive zero on the entire assignment.

Honor Code: We pledge that this program represents my own program code and that We have coded on my own. We received help from no one in designing and debugging my program. We have also read the plagiarism section in the course info sheet of CSC B20 and understand the consequences.

a1PartA.pdf: This file must be clearly typed out either using Word or preferably L^AT_EX your entire partA solution. Make sure that this file contains the relational algebra AND the actual output produced for each of this queries.

a1PartB.pdf: This file must be clearly typed out either using Word or preferably L^AT_EX your entire partB solution. Make sure that this file contains the SQL queries AND the actual output produced for each of this queries. This file must also contain your solution to question 3) neatly typed out.

a1PartB.txt: This file is a text file that only contains all your SQL queries. We require this file so that we can test out your SQL queries for correctness. You can simply generate this file directly from a1PartB.pdf (i.e. simply copy the SQL portion into here).

THIS IS OPTIONAL, **a1Bonus.pdf**: This is optional. You only create this file if you like to attempt the bonus section. You can get +5 points if **all** the questions are correct here. For bonus, we are asking you to take partA of this assignment, and manually recreate the data in SQL, and then for all the relational algebra queries that you produced in partA, also now produce the SQL queries. Note, you will only receive the +5, if all the SQL queries are correct.

THIS IS OPTIONAL, **a1Bonus.txt**: This is optional. You will only have this file if you attempt the bonus and also have the file **a1Bonus.pdf**. The details of this file are similar to **a1PartB.txt**.