CSE 111 – DATABASE SYSTEMS

Midterm (200 points)

Consider the following relational schema and corresponding sample data:

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

class	*type*	*country*	*numGuns*	*bore*	*displacement*
Bismarck	bb	Germany	8	15	42,000
Iowa	bb	USA	9	16	46,000
Kongo	bc	Japan	8	14	32,000
North Carolina	bb	USA	9	16	37,000
Renown	bc	Britain	6	15	32,000
Revenge	bb	Britain	8	15	29,000
Tennessee	bb	USA	12	14	32,000
Yamato	bb	Japan	9	18	65,000

name	*class*	*launched*
California	Tennessee	1915
Haruna	Kongo	1915
Hiei	Kongo	1915
Iowa	Iowa	1933
Kirishima	Kongo	1915
Kongo	Kongo	1913
Missouri	Iowa	1935
Musashi	Yamato	1942
New Jersey	Iowa	1936
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	1915
Washington	North Carolina	1941
Wisconsin	Iowa	1940
Yamato	Yamato	1941

name	*date*
Denmark Strait	1941-05-24
Guadalcanal	1942-11-15
North Cape	1943-12-26
Surigao Strait	1944-10-25

ship	*battle*	*result*
California	Surigao Strait	ok
Kirishima	Guadalcanal	sunk
Resolution	Denmark Strait	ok
Wisconsin	Guadalcanal	damaged
Tennessee	Surigao Strait	ok
Washington	Guadalcanal	ok
New Jersey	Surigao Strait	ok
Yamato	Surigao Strait	sunk
Wisconsin	Surigao Strait	damaged

Write `SQL` statements for the following tasks in the file `midterm.sql` provided to you:

1. Create the tables in the schema. Use the exact given names for the tables and their attributes (**10 points**)
2. Populate every table with the corresponding sample data. Use the exact given values for all the attributes and pay close attention to how you handle the dates in order to support valid comparisons. (**40 points**)

3. For every country that launched ships between 1930 and 1940, inclusive, find the number of ships it launched. Print the country name and the number of ships it launched. (**5 points SQL + 5 points execution tree**)
4. Add the following data to the database: All the ships launched in 1920 or earlier participate in the `Denmark Strait` battle and are `damaged`. If such a ship already participated in the `Denmark Strait` battle, do not include it anymore. (**10 points**)
5. For every country, find the number of `damaged` ships it has in battles. (**5 points SQL + 5 points execution tree**)
6. Find the country(ies) with the smallest number of `damaged` ships in battles. (**5 points SQL + 5 points execution tree**)
7. Delete from the `Outcomes` table all the ships from `Japan` that participate in the `Denmark Strait` battle. (**10 points**)
8. Find the ships that survived a battle in which they were `damaged` and then fought in another battle. (**5 points SQL + 5 points execution tree**)
9. Find the countries that have both `bb` and `bc` ships—not classes. Print the country name, the number of `bb` ships and the number of `bc` ships. (**5 points SQL + 5 points execution tree**)
10. Double `numGuns` for the classes that have ships `launched` in 1940 or later. (**10 points**)
11. Find the classes that have exactly two ships in the class. (**5 points SQL + 5 points execution tree**)
12. Find the classes that still have exactly two ships in the class after considering all the battles. A `sunk` ship does not exist anymore. (**5 points SQL + 5 points execution tree**)
13. Delete from `Ships` all the ships that were `sunk` in a battle. (**10 points**)
14. Find the total `numGuns` across all the ships for every country. (**5 points SQL + 5 points execution tree**)
15. Whenever a ship is `damaged` in a battle, it looses one of its guns. Find the total `numGuns` across all the ships for every country under this assumption. Do not forget to include in your result the countries that do not have `damaged` ships. (**5 points SQL + 5 points execution tree**)
16. Insert a ship into `Ships` for every `class` for which there does not exist a ship having the class name in `Ships`. The name of the ship is the same as the class name. `launched` is set to the minimum value of `launched` for the ships in the class, if any such ship exists. Otherwise, set `launched` to the minimum value in `Ships`. (**10 points**)
17. Find the number of ships `launched` by every country in every decade between 1910 and 1950: 1911–1920, 1921–1930, 1931-1940, and 1941–1950. The output consists of a column for the country and columns for every decade, 4 in total, named 1911–1920, 1921–1930, 1931-1940, and 1941–1950. There is a tuple for every `country` in `Classes` with the corresponding count. If no ships are launched in a decade, a 0 has to appear in the result. (**5 points SQL + 5 points execution tree**)

You can test your code by executing the command `./test.sh` in the terminal. This generates the output for all the query statements. It is important to notice that modification statements change the content of the database, thus, the result of subsequent queries.

You have to turn in two files. The first file is `midterm.sql` with your SQL statements and tested with `./test.sh`. The second file contains the optimized relational algebra query execution trees for the queries. For this, draw/write your answers in a doc file or presentation slides and convert to pdf. Upload both `midterm.sql` and the pdf file to CatCourses.