

CS3431 Homework 4 (Fall 2012 B term)

Homework Due: Monday, Dec. 3rd, 2012 at 3pm in class

Homework Maximum Points: 50 pts

Problem 1. Query Languages and Semantics. [10 pts]

- Two relational query languages have been developed, namely, SQL and relational algebra. Explain what the primary purpose(s) and uses of these two languages are. Compare and contrast them.
- Explain why relational algebra has been defined both for set-semantics and also for bag-semantics.
- $\text{SELECT}_{C \text{ or } D}(\text{Relation } R) = \text{SELECT}_C(\text{Relation } R) \cup \text{SELECT}_D(\text{Relation } R)$. Here C and D are two arbitrary conditions on R. Does the above equivalence hold for bag semantics? Explain why you think it holds, or give a counterexample to show that it does not hold.
- $\text{SELECT}_{C \text{ and } D}(\text{Relation } R) = \text{SELECT}_C(\text{Relation } R) \cap \text{SELECT}_D(\text{Relation } R)$. Here C and D are two arbitrary conditions on R. Does the above equivalence hold for bag semantics? Explain why you think it holds, or give a counterexample to show that it does not hold.
- Assume you do not have a *natural full outer join* operator available to express your queries, then please give a relational algebra expression utilizing only basic algebra operators such as natural join, select, extended projection, and so on to express this same query. Explain your answer briefly.

Problem 2. Relational Algebra. [20 pts]

All the questions are based on the database application of battle ships for World Wide War (WWW) listed below. Specify **relational algebraic expressions** for each query given below. If a query cannot be expressed in relational algebra, then indicate this and justify your answer.

ShipModels(mname, type, country, numGuns, gunSize)

Ships(sname, hasModel, launchYear)

Battles(bname, year)

Outcomes(ship, battle, result)

The primary keys are underlined.

The foreign key constraints are:

Ships (hasModel) REFERENCES ShipModels (mname)

Outcomes (ship) REFERENCES Ships (sname)

Outcomes (battle) REFERENCES Battles (bname)

The relation *ShipModels* records the name of each model, its type, country that builds ships of this model (only one country makes ships of a given model), number of guns, and size of the guns on that ship (diameter of gun barrel, in inches). Relation *Ships* records the ship name, model name, and the year in which the ship was first launched. Relation *Battles* gives the name and year of each battle. Relation *Outcomes* gives the result (sunk, damaged, or ok) for each ship in each battle.

1. For each country, find the year when it launched its first ship.
2. Find the the ship (s) that participated in the largest number of battles, and return their *sname* and the name of the country that manufactured this ship.
3. For each country that launched at least 3 ships, find the number of ships it has launched altogether.
4. Find the *snames* of ships that got damaged in a battle, yet successfully fought in *later* battles without ever getting any further damaged or being sunk.
5. For each model and battle, find the number of ships of that model that sunk in the battle.
6. Find the *snames* of ships that got damaged in at least two different battles, yet that never were sunk (neither before nor after).
7. For each battle that had involved at least one ship from IRAQ and one ship from USA, determine the total number of ships sunk in that battle independent of country.

Problem 3. SQL Queries. [20 pts]

This question is again based on the database application of ships for the World Wide War (WWW) application belowd.

- Formulate **SQL** statements for the queries listed in problem 2 above.
- Also, we will be providing you a sample data set on the MYWPI course site. Test the SQL queries on the data set we will provide to you on oracle. Do submit your queries and results for running your queries on our sample data setd in hardcopy to us..
- Also submit your work via MYWPI. For that, please put all your SQL statements into one file (say, hw4-queries.sql) and the output of running the queries (such as, using command spool in sqlplus) into another file (say hw4-results.txt), illustrating the results you got on our test data.

Below find some sample data for these four relations to give you a better sense about p the application.

mname	type	country	numGuns	gunSize
Jetty	bb	Japan	8	15
Iowa	bb	USA	26	16
Warrier	bc	USA	30	16
Drone	bc	IRAQ	100	10

Sample data for ShipModels Relation

sname	hasModel	launchYear
Speedy	Jetty	1940
MayFlower	Warrier	1915
SunDance	Warrier	1944
Drone1	Drone	1940
Drone2	Drone	2012

Sample data for Ships

bname	year
NorthAtlantic	1941
NorthCape	1944
BigBay	2012

Sample data for Battles

sname	bname	result
MayFlower	NorthCape	ok
Speedy	NorthAtlantic	damaged
Speedy	NorthCape	sunk
Drone1	NorthCape	ok
Drone2	BigBay	sunk

Sample data for Outcomes