**Vitamin 2 Solutions**

Q1: Names of sailors for whom all pink boats have been reserved by no other sailor.

The clause below the WHERE NOT EXISTS, returns all the reserved pink boat ids that were reserved by at least two sailors (since it does an equality check on S.sid and R.sid and if it finds another R.sid that does not equal the S.sid it’s checking, the innermost AND EXISTS clause will return true). In the outermost clause, we’re selecting sailor names that make the clause under WHERE NOT EXISTS return true. In order for that to return true, a sailor’s reserved pink boat must not have been reserved by anyone else!

Q2: Names of sailors who have reserved as many distinct boats as the number of all pink boats.

If you take a look at the HAVING clause, you’ll notice that a sailor name included in the output will have to have reserved as many distinct boats as the number of all pink boats in the table.

Q3: Names of sailors who have reserved all pink boats.

Notice the clause starting with the 4th SELECT from the beginning of the query. We’re taking every sid in Reserves and doing a cross join with all the pink boats. This means that every possible combination of sid to pink boat id will be produced. However, from that output, we are excluding every row that is in the Reserves table due to the EXCEPT clause (SELECT sid, bid FROM Reserves just returns all the rows in Reserves). Which R.sids are left? The ones that have reserved either none or some pink boats! We then select the sids from that output in the outer SELECT. Then from that step, we take all the sids in Reserves and exclude the sids of sailors that have reserved either none or some pink boats, leaving us with sids of sailors that have reserved all pink boats!

Q4: What is the number of cache hits if we use an LRU replacement policy?

8

Q5: What is the number of cache hits if we use an MRU replacement policy?

5

Q6: What is the number of cache hits if we use a CLOCK replacement policy?

8

Q7: What is the number of set reference bits at the end of Q6?

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