CS 353 Spring 2020
Homework 3 Solutions
Due: 13 March, Wednesday till 17:00

Q.1 [60 pts] (Each part, except (e), (g), and (h) are 5 points; (e), (g), and (h) are 10 points.)
Consider the computer product database schema below.

Product(maker, model, type)
PC(model, speed, ram, hd, price)
Laptop(model, speed, ram, hd, screen, price)
Printer(model, color, type, price)

Maker of a product is the manufacturer firm. models are numbers for PCs, Laptops, and Printers. Type of a product is "pc", "laptop", or "printer." Color for printer is true for color printers, false for black and white printers. Printer type is "laser" or "inkjet". PC models are four-digit numbers 1XXX. Laptop models are four-digit numbers 2XXX. Printer models are four-digit numbers 3XXX.

Write the following queries in SQL:

a) Find the model number and price for all color laser printers.
b) Find the manufacturers that produce PC's or Laptops, but not printers.
c) Find the manufacturers that produce laptops who have a hard disk higher than 120 GB and a memory (RAM) of at least 1024 MB and a screen size of at least 17.0 inch, together with the laptop models and prices of the models.
d) Find the manufacturer pairs that produce the same PC models with the speeds of at least 2.5 MHz. Report the pairs only once.
e) Find the Laptop models that are produced by at least three different manufacturers. Do this i) without aggregate operators, ii) with aggregate operators.
f) Find the manufacturers that produce all PCs and laptops whose speed is at least 2.50.
g) Find the manufacturers who produce exactly one PC, one Laptop, and one Printer model. Do this i) without aggregate operators, ii) with aggregate operators.
h) Find the manufacturer(s) who produce Laptops with the highest speed. Do this i) without aggregate operators, ii) with aggregate operators.
i) Find the pairs of laptops (model) with the same speed, RAM, and screen size. Report the pairs only once.

Q.2 [20 pts, 5 pts each]
World War II capital ships schema. 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 battlecruiser), the country that built the ship, the number of 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", or "ok") for each in each battle.

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

a) What does the following query mean (express the meaning in one English sentence)?
SELECT O.ship, O.battle, O.result, C.country

FROM OUTCOMES O, SHIPS S, CLASSES C
WHERE O.ship = S.name AND S.class = C.class AND O.result IN (“damaged”, “sunk”)

b) Write an equivalent query **without** using IN (set membersip) operator and the set construct.
c) What does the following query mean (express the meaning in one English sentence)?
$\Pi_{name,\ country,\ type}$ (($\Pi_{ship,\ battle}$ (Outcomes) / Π_{battle} (Outcomes)) $\bowtie_{ship\ =\ name}$ Ships $\bowtie$ Classes)
d) Write the equivalent SQL query.

Q.3 [20 pts, 5 pts each]

Consider the schema provided in Question 1. Write the following queries in SQL:

a) Delete all laptops whose ram are less than 1024 MB.
b) Delete all printers that are produced by a manufactures that doesn’t produce PC’s and Laptops.
c) For each PC manufactured by manufacturer IBM, subtract 100 $ from the price and double amount of hard disk and ram.
d) Delete all ships from the Ships table that had sunk in a Battle.