Sample midterm exam CMPT 321 Fall 2017

The following narrative describes a simplified version of the organization of Olympic facilities.

> The Olympic facilities are divided into sports complexes. Sports complexes are divided into one-sport and multisport types. Multisport complexes have areas of the complex designated for each sport with a location indicator (e.g., center, NE corner, and so on). A complex has a location, chief organizing individual, total occupied area, and so on. Each complex holds a series of events (e.g., many different races). For each event there is a planned date, duration, number of participants, number of officials, and so on. A roster of all officials will be maintained together with the list of events each official will be involved in. Different equipment is needed for the events (e.g., goal posts, poles, parallel bars). The two types of facilities (one-sport and multisport) will have different types of information.

Question 1 [7 points]

Draw an E/R diagram that shows the entity sets, attributes (including keys), and relationships for this application.

Question 2 [5 points]

Translate the E/R design for your previous exercise into a relational schema using the Object-oriented approach.

Question 3 [5 points]

Consider this schema:

One (this, something)
Two (before, after)
Two[before] ⊆ One [this][1)]

[1)]This means that the values in *Two.before* are a subset of values in *One.this*, that is each value of *Two.before* must exist in column *One.this*.

One has 10 tuples. *Two* has 200 tuples.
What do we know about the minimum and maximum number of tuples in the results of the following queries?

a. One X Two

b. Two $\bowtie_{\text{before=this}}$ One

c. $\sigma_{this='b'}(One)$

d. $\sigma_{this='a'}$ (Two $\bowtie_{before = this}$ One)

Question 4 [15 points]

Consider the Supplier-Parts-Catalog schema presented below.
Suppliers (<u>sid</u>, sname, address)
Parts (<u>pid</u>, pname, color)
Catalog (<u>sid</u>, <u>pid</u>, cost)
The Catalog relation lists the prices charged for parts by Suppliers.

State what the following queries compute:

1. $\pi_{sname}(\pi_{sid} ((\sigma_{color='red'}Parts) \bowtie \sigma_{cost<100}Catalog)) \bowtie Suppliers)$

2. $\pi_{sname}(\pi_{sid} ((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers))$

3. $(\pi_{sname}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)) \cap$
   $(\pi_{sname}((\sigma_{color='green'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers))$

4. $(\pi_{sid}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)) \cap$
   $(\pi_{sid}((\sigma_{color='green'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers))$

5. $\pi_{sname}((\pi_{sid,sname}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog)) \bowtie Suppliers) \cap (\pi_{sid,sname}((\sigma_{color='green'}Parts) \bowtie (\sigma_{cost<100}Catalog)) \bowtie Suppliers)))$

6. $\pi_{sname}((\sigma_{color='green'}Parts) \bowtie Suppliers) - \pi_{sname}((\sigma_{color!='green'}Parts) \bowtie Suppliers)$

7. $P1 = \rho_{name1,cost1}(\pi_{pname,cost}(\sigma_{color='green'}Parts) \bowtie Catalog)$
   $P2 = \rho_{name2,cost2}(\pi_{pname,cost}(\sigma_{color='green'}Parts) \bowtie Catalog)$
   $R = \pi_{name1}(\sigma_{cost1<cost2}(P1 \times P2))$
   $S = \pi_{pname}(Parts) - R$

8. $A = \pi_{pname}(Parts)$
   $B = \pi_{color}(Parts)$
   $Y = A \times B$
   $Z = Y - \pi_{pname,color}(Parts)$
   $S = \pi_{pname}(Parts) - \pi_{pname}(Z)$

Question 5

Write the following SQL queries for the above database.

1. For every supplier, print the name of the supplier and the total number of parts that she supplies.

2. For every supplier that supplies at least five parts, print the name and price of the most expensive part that she supplies.