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CS425 - HW2
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Question I (3 Points)

Write a relational algebra expression that returns the racer's name along with the car horsepower driven in each race.

$$\Pi_{Name,\, Horse\_power,\, R\_ID}\,(Racer \bowtie Result \bowtie Car)$$

Question II (2 Points)

Write a relational algebra expression that returns the racer's name associated with different location they raced in.

$$\Pi_{Name,\, Location}\,(Racer \bowtie Result \bowtie Race)$$

Question III (4 Points)

Write a relational algebra expression that returns the sponsor, the race, and the racer name they have sponsored.

$$\Pi_{Sponsor,\, R\_ID,\, Name}\,(Racer \bowtie Result \bowtie Sponsor)$$

Question IV (5 Points)

Write a relational algebra expression that returns the female racer 's name, born before 1982 with the highest race time.

$$E1 \leftarrow Racer \bowtie_{Gender='F' \,\wedge\, Birth\_year<1982}\,(Result)$$

$$\Pi_{Name}\,(E1) \;-\; \Pi_{E1.Name}\,(\sigma_{E1.Time < d.Time}\,(E1 \bowtie Car)$$

Question V (5 Points)

Write a relational algebra expression that returns the racer's name and associated race sponsor that drove a 'Mercedes' car during at least one of their races.

$$\Pi_{Name,\, Sponsor}(Racer \bowtie Result \bowtie Sponsor \bowtie \sigma_{Manufacturer\,=\,'Mercedes'}(Car))$$

Question VI (4 Points)

Write a relational algebra expression that return the winner name in each race. The winner is the racer that finishes the race in least time.

$$\Pi_{Name}(Racer \bowtie \sigma_{Time\,=\,min\_Time}\,(Result \bowtie {}_{R\_ID}\gamma_{min(Time)\ as\ min\_Time}\,(Racer \bowtie Result)))$$

Question VII (4 Points)

Write a relational algebra expression that returns the horsepower per cylinder, assuming that the horsepower is equally proportional to the number of cylinders.

$$\Pi_{(Horse\_power/Num\_Cylinders)\ as\ horsepower\_per\_cylinder}(Car)$$

Question VIII (4 points)

Write a relational algebra that returns the racer's name that only drives Ferrari.

$$E1 \leftarrow Racer \bowtie Result \bowtie Race$$

$$\Pi_{Name}(E1) \ - \ \Pi_{Name}(\sigma_{Manufacturer \neq 'Ferrari'}(E1))$$

Question IX- (3 points)

Write a relational algebra name that never participated in a 'rallycross' racer.

$$E1 \leftarrow Racer \bowtie Result \bowtie Race$$

$$\Pi_{Name}(E1) \ - \ \Pi_{Name}(\sigma_{Type='RallyCross'}(E1))$$

Question X. (4 points)

Write a relational algebra expression for the cars that finished the race in a time smaller than all races average time.

$$E1 \leftarrow \gamma_{avg(Time)\ as\ avg\_Time}(Result)$$

$$E2 \leftarrow \sigma_{Time<avg\_Time}(Result \times E1)$$

$$Car \bowtie \Pi_{C\_ID}(E2)$$

Question XI- (3 points)

Write a relational algebra name that participated in each race.

$$r \leftarrow \Pi_{Name,\ R\_ID}(Racer \bowtie Result)$$

$$s \leftarrow \Pi_{R\_ID}(Race)$$

$$r \div s$$

Question XII (5 points)

Write a relational algebra expression that returns the manufacturer name whose cars won the greatest number of races.

$$E1 \leftarrow {}_{R\_ID}\gamma_{min(Time)}\,(Result)$$

$$E2 \leftarrow \sigma_{Time=min(Time)}\,(E1 \bowtie Result)$$

$$E3 \leftarrow E2 \bowtie Sponsor$$

$$E4 \leftarrow {}_{Sponsor}\gamma_{count(R\_ID)}(E3)$$

$$\rho_{(Sponsor,\, numofSponsorWins)}(E4)$$

$$E5 \leftarrow \gamma_{max(numofSponsorWins)}(E4)$$

$$\Pi_{Sponsor}(\sigma_{numofSponsorWins = max(numofSponsorWins)}(E5 \times E4)$$

Question XIII. (4 points)

Write a relational algebra expression manufacturer for cars with low horsepower, meaning that all its manufactured cars are less than 800 horsepower.

$$\Pi_{Manufacturer}(\sigma_{maxHP<800}\,(\Pi_{maxHP,\, Manufacturer}(Car \bowtie {}_{Manufacturer}\gamma_{max(Horse\_power)\ as\ maxHP}(Car))))$$