DB Assignment 7

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Flights (flightNumber, originalCity, destinationCity, distance, departTime, arrivalTime)

Aircraft (aircraftId, aircraftName, cruisingRange)

Certified (pilotId, aircraftId)

Pilots (pilotId, pilotName, salary)

(1) List the pilot IDs of those pilots who are certified to fly Boeing aircraft.

Solution: $\pi_{pilotId}(\sigma_{aircraftName='Boeing'}(Aircraft \bowtie Certified))$

(2) List the pilotNames of those pilots who are certified by to fly Boeing aircraft.

$\pi_{pilotName}(\sigma_{aircraftName='Boeing'}(Aircraft \bowtie Certified \bowtie Pilots))$

Solution:

(3) List the IDs of those pilots who can operate aircrafts with a range greater than 2000 miles but are not certified to fly any Boeing aircraft.

Solution: $\pi_{pilotId}(\sigma_{cruisingRange>2000}(Aircraft \bowtie Certified) - \pi_{pilotId}(\sigma_{aircraftName='Boeing'}(Aircraft \bowtie Certified))$

(4) List the aircraft IDs that can be used on non-stop flights from Detroit (DTW) to Beijing (PEK)

Hint: to fly from DTW to PEK non-stop, the aircraft cruising range has to be able to cover the distance from DTW to PEK.

Solution:

$$\pi_{aircraftId}\left(\sigma_{cruisingRange > distance}\left(Aircraft \times \sigma_{originalCity = 'DTW' \wedge destinationCity = 'PEK'}(Flights)\right)\right)$$

(5) find the IDs of those pilots who make the highest salary.

Solution

$$P(P_1, Pilots) \quad P(P_2, Pilots)$$

$$\pi_{pilotId}(Pilots) - \pi_{pilotId}\left(\sigma_{P_1.salary > P_2.salary}(P_1 \times P_2)\right)$$

(5.1) For the question in 5, write an equivalent RA expression which accomplish the same

Solution:

$$\pi_{pilotId}(Pilots) - \pi_{pilotId}\left(P_1 \underset{P_1.salary > P_2.salary}{\bowtie} P_2\right)$$

⑥ Imagine Pilots relation has another field called managerId, which is a foreign key pointing to the pilot who is the manager of this current pilot:

Pilots (pilotId, pilotName, salary, managerId)

Note: This imaginary managerId is only added for this question, not applicable to all other questions.

Now, list the Ids of those pilots who are making more money than their managers.

Solution:

$P(P_1, \text{Pilots})$

$P(P_2, \text{Pilots})$

$$\Pi_{\text{pilotId}}\left(\sigma_{P_1.\text{salary} > P_2.\text{salary}}\left(P_1 \otimes_{P_1.\text{managerId} = P_2.\text{PilotId}} P_2\right)\right)$$

⑦ List the Ids of those pilots who are certified for all aircrafts.

Solution:

Numerator : $\Pi_{\text{pilotId, aircraftId}}(\text{Pilots} \otimes \text{Certified})$

Denominator : $\Pi_{\text{aircraftId}}(\text{Aircraft})$

$$\Pi_{\text{pilotId, aircraftId}}(\text{Pilots} \otimes \text{Certified}) \Big/ \Pi_{\text{aircraftId}}(\text{Aircraft})$$

(8) List the Ids of those aircrafts that can be piloted by all the pilots whose salary is more than 100k.

Solution: Numerator : $\Pi_{aircraftId, PilotId}$ (Pilots ⊗ Certified)

Denominator : $\Pi_{PilotId}(\sigma^{Pilots}_{salary > 100000})$

$$\Pi_{aircraftId, PilotId}(Pilots \otimes Certified) \Big/ \Pi_{PilotId}(\sigma^{Pilots}_{salary > 100000})$$