Exercise 4.5 Solutions

Question 1

$$\pi_{eid}(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified))$$

Question 2

$$\pi_{ename}(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified \bowtie Employees))$$

Question 3

$$\rho(BonnToMadrid, \sigma_{from='Bonn'\wedge to='Madrid'}(Flights))$$
$$\pi_{aid}(\sigma_{cruisingrange>distance}(Aircraft \times BonnToMadrid))$$

Question 4

$$\pi_{flno}(\sigma_{distance<cruisingrange \wedge salary>100,000}(Flights \bowtie Aircraft \bowtie$$
$$Certified \bowtie Employees)))$$

Question 5

$$\rho(R1, \pi_{eid}(\sigma_{cruisingrange>3000}(Aircraft \bowtie Certified)))$$
$$\pi_{ename}(Employees \bowtie (R1 - \pi_{eid}(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified))))$$

Question 6

The approach to take is first find all the employees who do not have the highest salary. Subtract these from the original list of employees and what is left is the highest paid employees.

$$\rho(E1, Employees)$$
$$\rho(E2, Employees)$$
$$\rho(E3, \pi_{E2.eid}(E1 \bowtie_{E1.salary>E2.salary} E2)$$
$$(\pi_{eid}E1) - E3$$

Question 7

The approach taken is similar to the solution for the previous exercise. First find all the employees who do not have the highest salary. Remove these from the original list of employees and what is left is the highest paid employees. Remove the highest paid employees from the original list. What is left is the second highest paid employees together with the rest of the employees. Then find the highest paid employees of this new list. This is the list of the second highest paid employees.

$\rho(E1, Employees)$
$\rho(E2, Employees)$
$\rho(E3, \pi_{E2.eid}(E1 \bowtie_{E1.salary > E2.salary} E2)$
$\rho(E4, E2 \bowtie E3)$
$\rho(E5, E2 \bowtie E3)$
$\rho(E6, \pi_{E5.eid}(E4 \bowtie_{E1.salary > E5.salary} E5)$
$(\pi_{eid} E3) - E6$

Question 8

$$\rho(R1, {}_{eid}\gamma_{COUNT(aid) \rightarrow certCount} Certified)$$
$$\rho(MaxCount, \gamma_{MAX(certCount)} R1)$$
$$\pi_{eid} \sigma_{certCount = MaxCount} R1$$

Question 9

The approach behind this query is to first find the employees who are certified for at least three aircraft (they appear at least three times in the Certified relation). Then find the employees who are certified for at least four aircraft. Subtract the second from the first and what is left is the employees who are certified for exactly three aircraft.

$\rho(R1, Certified)$
$\rho(R2, Certified)$
$\rho(R3, Certified)$
$\rho(R4, Certified)$
$\rho(R5, \pi_{eid}(\sigma_{(R1.eid=R2.eid=R3.eid) \wedge (R1.aid \neq R2.aid \neq R3.aid)}(R1 \times R2 \times R3)))$
$\rho(R6, \pi_{eid}(\sigma_{(R1.eid=R2.eid=R3.eid=R4.eid) \wedge (R1.aid \neq R2.aid \neq R3.aid \neq R4.aid)}$

$(R1 \times R2 \times R3 \times R4)))$
$R5 - R6$

Question 10

$$\gamma_{SUM(salary)} Employees$$