Question 1 Solutions

a)

i) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars.

ii) This Relational Algebra statement does not return anything because of the sequence of projection operators. Once the sid is projected, it is the only field in the set. Therefore, projecting on sname will not return anything.

iii) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

iv) Find the Supplier ids of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

v) Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

b)

i) $\pi_{sname}(\pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog) \bowtie Suppliers)$

ii) $\pi_{sid}(\pi_{pid}(\sigma_{color='red' \vee color='green'}Parts) \bowtie Catalog)$

iii) $\rho(R1, \pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts)\ Catalog))$

$\rho(R2, \pi_{sid}\sigma_{address='1065\ Miliary\ Trail'}\ Suppliers)$

$R1 \cup R2$

iv) $\rho(R1, \pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog))$

$\rho(R2, \pi_{sid}((\pi_{pid}\sigma_{color='green'}Parts) \bowtie Catalog))$

$R1 \cap R2$

v) $(\pi_{sid,pid}Catalog)/(\pi_{pid}Parts)$

vi) $(\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red'}Parts)$

vii) $(\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red' \vee color='green'}Parts)$

viii) $\rho(R1,((\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red'}Parts)))$
$\rho(R2,((\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='green'}Parts)))$

$R1 \cup R2$

ix) $\rho(R1, Catalog)$

$\rho(R2, Catalog)$

$\pi_{R1.sid,R2.sid}(\sigma_{R1.pid=R2.pid \wedge R1.sid = R2.sid \wedge R1.cost>R2.cost}(R1 \times R2))$

x) $\rho(R1, Catalog)$

$\rho(R2, Catalog)$

$\pi_{R1.pid}\sigma_{R1.pid=R2.pid \wedge R1.sid!=R2.sid}(R1 \times R2)$

xi) $\rho(R1, \pi_{sid}\sigma_{sname='Canada\ Suppliers'}Suppliers)$

$\rho(R2, R1 \bowtie Catalog)$

$\rho(R3, R2)$

$\rho(R4(1 \rightarrow sid, 2 \rightarrow pid, 3 \rightarrow cost), \sigma_{R3.cost < R2.cost}(R3 \times R2))$

$\pi_{pid}(R2 - \pi_{sid,pid,cost}R4)$

xii) $\pi_{pid,sid}(\sigma_{cost<200}Catalog) / (\pi_{sid}\ Suppliers)$

Question 2 Solutions

a)

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

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

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

iv) $\pi_{flno}(\sigma_{distance < cruisingrange \wedge salary > 100000}(Flights \bowtie Aircraft \bowtie Certified \bowtie Employees)))$

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

vi) $\rho(E1, Employees)$

$\rho(E2, Employees)$

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

$(\pi_{eid}E1) - E3$

vii) $\rho(E1, Employees)$

$\rho(E2, Employees)$

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

$\rho(E4, E2 \bowtie E3)$

$\rho(E5, E2 \bowtie E3)$

$\rho(E6, \pi_{E5.eid}(E4 \bowtie_{E1.salary>E5.salary} E5)$

$(\pi eidE3) - E6$

vii) This cannot be expressed in relational algebra (or calculus) because there is no operator to count, and this query requires the ability to count up to a number that depends on the data.

ix) $\rho(R1, Certified)$

$\rho(R2, Certified)$

$\rho(R3, Certified)$

$\rho(R4, Certified)$

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

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

$(R1 \times R2 \times R3 \times R4)))$

$R5 - R6$

x) This cannot be expressed in relational algebra (or calculus) because there is no operator to sum values.

Question 3a Solutions

NOTE: These solutions are just one way of doing things. There are multiple solutions to these questions. Also, note that marks were not taken off if you used DISTINCT or not. We accepted both solutions!

Question 3a Solutions:

i) SQL: SELECT S.sname FROM Suppliers S, Parts P, Catalog C WHERE P.color='red' AND C.pid=P.pid AND C.sid=S.sid

	sname
1	Some Red Supplier
2	Some Red Some Green
3	Walmart
4	Walmart
5	Walmart
6	Red Supplier
7	Red Supplier
8	Red Supplier

ii) SQL: SELECT C.sid FROM Catalog C, Parts P WHERE (P.color = 'red' OR P.color = 'green') AND P.pid = C.pid

	sid
1	1
2	2
3	2
4	4
5	4
6	4
7	4
8	4
9	4
10	5
11	5
12	5

iii) **SQL:** SELECT S.sid FROM Suppliers S WHERE S.address = '1065 Military Trail' OR S.sid IN (SELECT C.sid
FROM Parts P, Catalog C WHERE P.color='red' AND P.pid = C.pid)

	sid
1	1
2	2
3	3
4	4
5	5

iv) **SQL:** SELECT C.sid FROM Parts P, Catalog C WHERE P.color = 'red' AND P.pid = C.pid AND EXISTS (SELECT P2.pid FROM Parts P2, Catalog C2 WHERE P2.color = 'green' AND C2.sid = C.sid AND P2.pid = C2.pid)

	sid
1	2
2	4
3	4
4	4

v) **SQL:** SELECT C.sid FROM Catalog C WHERE NOT EXISTS (SELECT P.pid FROM Parts P WHERE NOT EXISTS (SELECT C1.sid FROM Catalog C1 WHERE C1.sid = C.sid AND C1.pid = P.pid))

	sid
1	4
2	4
3	4
4	4
5	4
6	4
7	4

vi) **SQL:** SELECT C.sid FROM Catalog C WHERE NOT EXISTS (SELECT P.pid FROM Parts P WHERE P.color = 'red' AND (NOT EXISTS (SELECT C1.sid FROM Catalog C1 WHERE C1.sid = C.sid AND C1.pid = P.pid)))

	sid
1	4
2	4
3	4
4	4
5	4
6	4
7	4
8	5
9	5
10	5

vii) **SQL:** SELECT C.sid FROM Catalog C WHERE NOT EXISTS (SELECT P.pid FROM Parts P WHERE (P.color = 'red' OR P.color = 'green') AND (NOT EXISTS (SELECT C1.sid FROM Catalog C1 WHERE C1.sid = C.sid AND C1.pid = P.pid)))

	sid
1	4
2	4
3	4
4	4
5	4
6	4
7	4

viii) **SQL:** SELECT C.sid FROM Catalog C WHERE (NOT EXISTS (SELECT P.pid FROM Parts P WHERE P.color = 'red' AND (NOT EXISTS (SELECT C1.sid FROM Catalog C1 WHERE C1.sid = C.sid AND C1.pid = P.pid)))) OR (NOT EXISTS (SELECT P1.pid FROM Parts P1 WHERE P1.color = 'green' AND (NOT EXISTS (SELECT C2.sid FROM Catalog C2 WHERE C2.sid = C.sid AND C2.pid = P1.pid))))

	sid
1	4
2	4
3	4
4	4
5	4
6	4
7	4
8	4
9	5
10	5
11	5
12	5

ix) **SQL:** SELECT C1.sid, C2.sid FROM Catalog C1, Catalog C2 WHERE C1.pid = C2.pid AND C1.sid != C2.sid AND C1.cost > C2.cost;

	sid	sid
1	2	1
2	2	5
3	7	4
4	4	1
5	4	2
6	4	5
7	4	5
8	4	2
9	5	1
10	5	4

x) **SQL:** SELECT C.pid FROM Catalog C WHERE EXISTS (SELECT C1.sid FROM Catalog C1 WHERE C1.pid = C.pid AND C1.sid != C.sid)

	pid
1	1
2	8
3	1
4	4
5	8
6	8
7	1
8	2
9	3
10	4
11	7
12	8
13	1
14	2
15	3
16	8
17	8
18	7
19	8

xi) SQL: SELECT C.pid FROM Catalog C, Suppliers S WHERE S.sid = C.sid AND S.sname = 'Canada Suppliers' AND C.cost = (SELECT MAX(C1.cost) FROM Catalog C1, Suppliers S1 WHERE S1.sname = 'Canada Suppliers' AND C1.sid = S1.sid);

	pid
1	7

xii) **SQL:** SELECT pid FROM (SELECT DISTINCT C.pid FROM Catalog C EXCEPT SELECT DISTINCT C1.pid FROM Catalog C1 WHERE C1.cost >= 200) INTERSECT SELECT C2.pid FROM Catalog C2 GROUP BY pid HAVING COUNT(sid) = (SELECT COUNT(sid) FROM Suppliers);

	pid
1	8

CSCB20 Assignment 1:

Question 3b Solutions:

i) SQL: SELECT DISTINCT C.eid FROM Aircraft A, Certified C WHERE A.aid = C.aid AND A.aname = 'Boeing'

	eid
1	1
2	2
3	5

ii) SQL: SELECT DISTINCT E.ename FROM Aircraft A, Certified C, Employees E WHERE A.aid = C.aid AND A.aname = 'Boeing' AND E.eid= C.eid

	ename
1	Dharmik
2	Bob
3	Ryan

iii) **SQL:** SELECT DISTINCT A.aid FROM Aircraft A, Flights F WHERE F.'from' = 'Bonn' AND F.'to' = 'Madras' AND A.cruisingrange >= F.distance

	ename
1	Dharmik
2	Bob
3	Ryan

iv) **SQL:** SELECT F.flno FROM Aircraft A, Certified C, Employees E, Flights F WHERE A.aid = C.aid AND E.eid = C.eid AND distance <= cruisingrange AND salary > 100000

Everyone will get 2 points for this question regardless of your answer. There was a problem in the question.

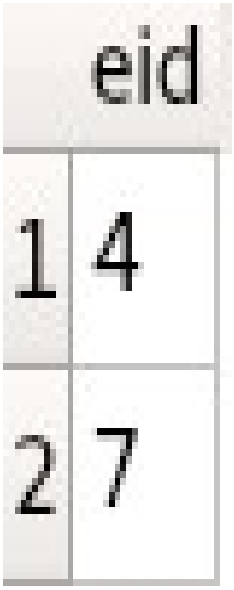
	flno
1	123
2	123

v) **SQL:** SELECT E.ename FROM Certified C, Employees E, Aircraft A WHERE A.aid = C.aid AND E.eid = C.eid AND A.cruisingrange >= 3000 AND E.eid NOT IN (SELECT C2.eid FROM Certified C2, Aircraft A2 WHERE C2.aid = A2.aid AND A2.aname = 'Boeing')

Everyone will get 2 points for this question regardless of your answer. The assignment sheet mispelled “Boeing” and as a result there were 2 different answers.

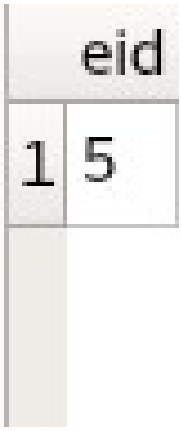
	ename
1	Alice
2	Jake

vi) **SQL:** SELECT E.eid FROM Employees E WHERE E.salary = (Select MAX (E2.salary) FROM Employees E2)



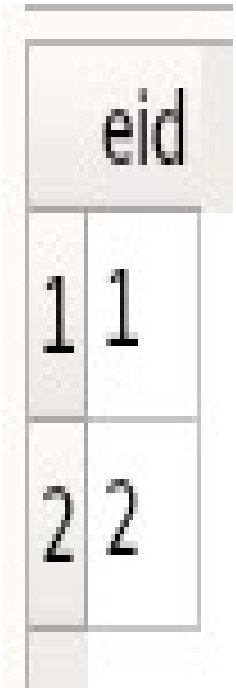
	eid
1	4
2	7

vii) **SQL:** SELECT E.eid FROM Employees E WHERE E.salary = (SELECT MAX (E2.salary) FROM Employees E2 WHERE E2.salary != (SELECT MAX (E3.salary) FROM Employees E3))



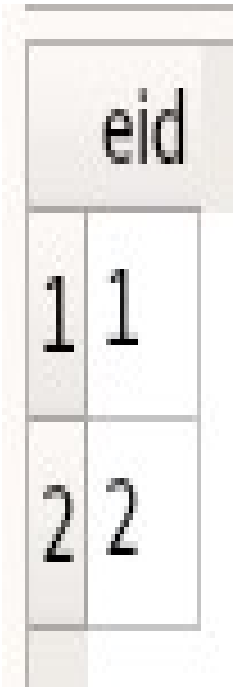
	eid
1	5

viii) **SQL:** DROP VIEW IF exists Temp;
CREATE VIEW Temp AS SELECT C.eid AS eid, COUNT (C.aid) AS cnt FROM Certified C GROUP BY C.eid;
SELECT Temp.eid from Temp WHERE Temp.cnt = (SELECT MAX (Temp.cnt) FROM Temp);



	eid
1	1
2	2

ix) **SQL:** SELECT C1.eid
FROM Certified C1, Certified C2, Certified C3
WHERE (C1.eid = C2.eid AND C2.eid = C3.eid AND C1.aid != C2.aid AND C2.aid != C3.aid AND C3.aid != C1.aid)
EXCEPT
SELECT C4.eid
FROM Certified C4, Certified C5, Certified C6, Certified C7
WHERE (C4.eid = C5.eid AND C5.eid = C6.eid AND C6.eid = C7.eid AND C4.aid != C5.aid AND C4.aid != C6.aid AND C4.aid != C7.aid AND C5.aid != C6.aid AND C5.aid != C7.aid AND C6.aid != C7.aid)



	eid
1	1
2	2

x) **SQL:** SELECT SUM(E.salary) from Employees E;

	SUM(E.salary)
1	450000