Q1.

a)

$$\pi_{grade}\left((\pi_{cid}(\sigma_{credits=4}Courses)) \bowtie Enrolled \bowtie (\sigma_{age=20}Students)\right)$$

b)

$$\pi_{sname}\left((\pi_{sid}\left(Enrolled \bowtie (\sigma_{cname='Calculus'}Courses)\right) - \pi_{sid}\left(\sigma_{grade='C'}Enrolled\right)\right) \bowtie Students)$$

c)

$$\pi_{age}\left((\pi_{cid}(\sigma_{credits=3}Courses)\right) \bowtie \left(\sigma_{grade='A'}Enrolled\right) \bowtie Students)$$

$$\cup$$

$$\pi_{age}((\pi_{sid}\left(\sigma_{grade='B'}Enrolled\right)) \bowtie Students)$$

d)

$$\rho\left(TMP1, Students \bowtie \pi_{sid}\left(Enrolled \bowtie (\sigma_{cname='Calculus'}Courses)\right)\right)$$

$$\rho(TMP2, TMP1)$$

$$\pi_{age}((\pi_{sid}TMP1 - \pi_{TMP1.sid}(TMP1 \bowtie_{TMP1.age<TMP2.age} TMP2)) \bowtie Students)$$

Q2.

a)

```
SELECT DISTINCT S.AGE
FROM STUDENTS S, ENROLLED E, COURSES C
WHERE S.SID = E.SID AND E.CID=C.CID AND C.CNAME='CS310';
```

b)

```
SELECT S.SNAME
FROM Students S, Enrolled E
WHERE S.sid = E.sid AND S.sid NOT IN (
    SELECT E.sid
    FROM Enrolled E, Courses C
    WHERE E.cid=C.cid AND C.credits <>4
    )
```

c)

```
SELECT C.CID, AVG(E.GRADE)
FROM Students S, Enrolled E, Courses C
WHERE S.sid=E.sid AND E.cid=C.cid
GROUP BY C.cid
HAVING 10 <= (SELECT COUNT(*) FROM Enrolled E1, STUDENTS S1
            WHERE E1.cid=C.cid AND S1.AGE >=25
             )
```

d)

```
SELECT  S.sname
FROM Students S WHERE NOT EXISTS(
```

```
    SELECT C.cid FROM Courses C
    WHERE C.credits=4
    MINUS
    SELECT E.cid FROM Enrolled E
    WHERE E.sid=S.sid
    )
```

e)

```
SELECT C.CID, S.SID
FROM STUDENTS S, ENROLLED E, COURSES C
WHERE S.SID = E.SID AND E.CID=C.CID AND (C.CID, E.GRADE) IN
    (
    SELECT C1.CID, MAX(E1.GRADE)
    FROM ENROLLED E1, COURSES C1
    WHERE E1.CID=C1.CID
    GROUP BY C1.CID
    );
```