A:

1)

$\pi_{name}((\sigma_{sid=CSci\ 4707 \wedge semester=Fall\ 2021}Registers) \bowtie Student)$

2)

$\pi_{sid}((\pi_{sid,sid}Registers)/(\pi_{cid}(\sigma_{department=Computer\ Science}Course)))$

3)

$\pi_{name}(\pi_{sid,name}Student - \pi_{sid,name}(\sigma_{gpa1<gpa2}(\rho(C(3->gpa1, 4->gpa2)\ Student\ x\ (\pi_{gpa}Student)))))$

4)

$\pi_{sid}\ (\sigma_{semester1!=semester2}\ (\rho(C(3->semester1, 4->semester2)\ Registers \bowtie_{sid,cid} Registers))) - \pi_{sid}(\sigma_{semester1!=semester2 \wedge semester1 != semester3 \wedge semester2 !=semester\ 3}(\rho(C1(3->semester1, 4->semester2, 5->semester3)\ Registers \bowtie_{sid,cid} Registers \bowtie_{sid,cid} Registers)))$

5)

$\sigma_{sid1< sid2}\ (\rho(C(1->sid1, 2->sid2)\ \pi_{sid}Registers\ x\ \pi_{sid}Registers) - (\pi_{sid1,sid2}\ (\rho(C1(1->sid1, 3->sid2)\ \pi_{sid,cid}Registers\ x\ \pi_{sid}Registers) - \pi_{sid1,sid2}\ (\rho(C2(1->sid1, 3->sid2)\ \pi_{sid,cid}Registers \bowtie_{cid} \pi_{sid,cid}Registers))))$

B:

1)

```
SELECT S.name
FROM Student S, Registers R
WHERE S.sid = R.sid AND R.cid = 'CSci 4707' AND R.semester = 'Fall 2021'
```

2)

```
SELECT Temp.sid
FROM (SELECT R.sid, COUNT (*) AS scount
        FROM Registers R, Course C
        WHERE R.cid = C.cid AND C.Department='CSci'
        GROUP BY R.sid) AS Temp
WHERE Temp.scount = (SELECT COUNT (*)
            FROM Course C
            WHERE C.Department='CSci');
```

3)

```
SELECT S.name
FROM Student S
WHERE S.gpa = (SELECT MAX(S2.gpa)
                FROM Student S2)
```

4)

```
SELECT DISTINCT R.sid
FROM Registers R
GROUP BY R.sid, R.cid
HAVING COUNT (*) = 2;
```

5)

```
SELECT Temp.sid, Temp1.sid
FROM Registers Temp,
        Registers Temp1,
         (SELECT Temp.sid, COUNT (*) AS scount
         FROM (SELECT DISTINCT R.sid, R.cid
                  FROM Registers R) AS Temp
         GROUP BY Temp.sid) AS Temp4,

         (SELECT Temp.sid, COUNT (*) AS scount
         FROM (SELECT DISTINCT R.sid, R.cid
                  FROM Registers R) AS Temp
         GROUP BY Temp.sid) AS Temp5

WHERE Temp.sid > Temp1.sid AND EXISTS (SELECT Temp.sid
                                       FROM Registers Temp3
                                  WHERE Temp.sid = Temp3.sid AND Temp1.cid = Temp3.cid)
          AND Temp4.sid = Temp.sid
          AND Temp5.sid = Temp1.sid
          AND Temp4.scount = Temp5.scount
GROUP BY Temp.sid, Temp1.sid
```