1)

a) $\Pi_{s\text{-}id, s\text{-}name}\left(\sigma_{dept=CS}(Student) \bowtie \sigma_{credit=3 \wedge dept=EE \wedge take.c\text{-}id=course.c\text{-}id}(takes \bowtie course)\right)$

b) $temp1 \leftarrow \Pi_{s\text{-}id, c\text{-}id}(takes) \div \Pi_{c\text{-}id}\left(\sigma_{credits=4 \wedge dept=MATH}(course)\right)$

$\Pi_{s\text{-}id, s\text{-}name}\left(\sigma_{dept=CS \wedge years=4}(temp1 \bowtie student)\right)$

c) $temp1 \leftarrow \Pi_{s\text{-}id, c\text{-}id}\left(\sigma_{grade=A}(takes) \bowtie \sigma_{p\text{-}id=CS101}(prereq)\right)$

$\Pi_{s\text{-}id, s\text{-}name}\left(\sigma_{dept=CS}(student) \bowtie temp1\right)$

d) $temp1 \leftarrow \left(\sigma_{p\text{-}id=CS101}(prereq) \bowtie takes\right)$

$temp2 \leftarrow \left(\sigma_{grade=A}(temp1) \bowtie \sigma_{temp1.s\text{-}id=student.s\text{-}id}(student)\right)$

$\Pi_{s\text{-}id, s\text{-}name}\left(\sigma_{dept=CS}(temp2)\right)$

e) $temp1 \leftarrow \sigma_{year=3 \wedge dept=CS}\left(\sigma_{c\text{-}id=CS353}(takes) \bowtie \sigma_{takes.s\text{-}id=student.s\text{-}id}(student)\right)$

$temp2 \leftarrow \sigma_{year=3 \wedge dept=CS}\left(\sigma_{c\text{-}id=CS342}(takes) \bowtie \sigma_{takes.s\text{-}id=student.s\text{-}id}(student)\right)$

$\Pi_{s\text{-}id, s\text{-}name}\left(\sigma_{temp1.grade > temp2.grade}\left(temp1 \bowtie_{temp1.s\text{-}id=temp2.s\text{-}id} temp2\right)\right)$

f) $temp1 \leftarrow \sigma_{grade \geq C}$ (take)

$\Pi_{s\text{-}id, s\text{-}name} \left(\sigma_{year = 1 \wedge dept = CS} \bowtie temp1 \right)$

g) $temp1 \leftarrow \sigma_{grade = A \wedge c\text{-}id = CS353}$ (take $\bowtie$ student)

$G_{count(s\text{-}id)} (temp1)$

h) $temp1 \leftarrow \Pi_{number} \sigma_{q\text{-}id \geq 3}$ (prereq $\bowtie$ course)

$\Pi_{c\text{-}id} \left(\sigma_{c\text{-}id = number} (temp1) \right)$

j) $temp1 \leftarrow c\text{-}id \, G_{count(*) \text{ as } num}$ (prereq)

$temp2 \leftarrow G_{max(num)} (temp1)$

$\Pi_{c\text{-}id} (temp1 \bowtie temp2 \bowtie prereq)$

2)

a) $\pi_{t\text{-name}}(\sigma_{home.team=t\text{-name} \land home\text{-points}>away\text{-points} \land away\text{-team}=Anadolu\ efes}(game \bowtie team))$

b) $\pi_{p\text{-id},p\text{-name}}(\sigma_{away\text{-team}=t\text{-name} \land away\text{-points}>home\text{-points} \land home\text{-team}=Anadolu\ efes}(game \bowtie player))$

c) $\pi_{t\text{-name}}(team) \div \pi_{home\text{-team}}(\sigma_{home\text{-points}>away\text{-points}}(game))$

d) $temp1 \leftarrow \pi_{t\text{-name}}(\sigma_{city=istanbul}(team))$

$_{t\text{-name}}\mathcal{G}_{min(age)\ as\ minAge}(temp1)$

e) $temp1 \leftarrow \mathcal{G}_{min(age)}(player \bowtie (\sigma_{city=istanbul}(team)))$

$\pi_{p\text{-id}}(temp1)$

f) $temp1 \leftarrow \sigma_{home\text{-points}>away\text{-points} \land away\text{-team}=Anadolu\ efes}(game)$

$\pi_{t\text{-name}}(_{t\text{-name}}\mathcal{G}_{min(budget)\ as\ lowest}(temp1 \bowtie teams))$

3)

R is

Q	X
1	a
2	b
3	c
4	d

S is

Q	X
5	e
6	f
7	g
8	h

R U S

Q	X
1	a
2	b
3	c
4	d
5	e
6	f
7	g
8	h

$\sigma_a(R \cup S) \rightarrow$

Q
1
2
3
4
5
6
7
8

S is

$\sigma_a(R) \rightarrow$

Q
1
2
3
4

Union is not possible because $\sigma_a(R)$ do not have X attribute.