

Q1.

A)

$$\pi_{sname}(\pi_{sid}(\sigma_{grade=10}Enrolled) \bowtie Students)$$

B)

$$\pi_{age}(\pi_{sid}(\pi_{cid}(\sigma_{credits=3}Courses) \bowtie Enrolled) \bowtie Students)$$

C)

$$\pi_{sname}(\pi_{sid}(\pi_{cid}(\sigma_{cname='Calculus'}Courses) \bowtie Enrolled) \bowtie Students)$$

D)

$$\pi_{sname}(\pi_{sid}(\pi_{cid}(\sigma_{credits<4}Courses) \bowtie \sigma_{grade \geq 8}Enrolled) \bowtie Students)$$

E)

$$\pi_{sname}((\pi_{sid}(Enrolled) - \pi_{sid}(\sigma_{grade < > 10}Enrolled)) \bowtie Students)$$

F)

$$\pi_{sname}((\pi_{sid}(\pi_{cid}(\sigma_{credits=3}Courses) \bowtie Enrolled) \cup \pi_{sid}(\sigma_{grade=10}Enrolled)) \bowtie Students)$$

G)

$$\pi_{age}((\pi_{sid}(Enrolled \bowtie \sigma_{cname="Calculus"}Courses) - \pi_{sid}(Enrolled \bowtie \sigma_{credits=4}Courses)) \bowtie Students)$$

H)

$$\rho(Enr1, Enrolled) \rho(Enr2, Enrolled) \\ \pi_{sname}((\pi_{grade}Enrolled) - \pi_{Enr1.grade}(Enr1 \bowtie_{(Enr1.grade > Enr2.grade)} Enr2)) \bowtie Enrolled \bowtie Students)$$

I)

$$\rho(Enr1, Enrolled) \rho(Enr2, Enrolled) \\ \pi_{sname}((\pi_{sid}(Enrolled) - \pi_{Enr1.sid}(Enr1 \bowtie_{(Enr1.sid=Enr2.sid) \wedge (Enr1.cid < > Enr2.cid)} Enr2)) \bowtie Students)$$

J)

$$\rho(TMP1, Courses) \quad \rho(TMP2, Courses) \\ \rho(TMP3, \pi_{cid}Courses - \pi_{TMP1.cid}(TMP1 \bowtie_{TMP1.credits < TMP2.credits} TMP2)) \pi_{grade}(TMP3 \bowtie Enrolled)$$

Q2.

a)

$$\pi_{dname} \left(\left(\pi_{did} Dishes - \pi_{did} \left(\sigma_{iname='sugar' OR iname='butter' OR iname='starch'} (Recipes \bowtie Ingredients) \right) \right) \bowtie Dishes \right)$$

b)

$$\pi_{iname} ((\sigma_{unitprice \geq 10} Ingredients) \bowtie Recipes \bowtie (\sigma_{popularity > 10000} Dishes))$$

c)

$$\pi_{origin} ((\sigma_{iname='saffron'} Ingredients) \bowtie (\sigma_{quantity \geq 1} Recipes) \bowtie Dishes)$$

d)

$$\pi_{popularity} ((\pi_{did} Dishes - \pi_{did} ((\sigma_{unitprice < 50} Ingredients) \bowtie Recipes)) \bowtie Dishes)$$

e)

$$\rho(TMP1, Recipes)$$

$$\rho(TMP2, Recipes)$$

$$\rho(TMP3, \pi_{iid} Recipes - \pi_{iid} (TMP1 \bowtie_{(TMP1.iid=TMP2.iid) \wedge (TMP1.did <> TMP2.did)} TMP2))$$

$$\pi_{iname, unitprice} (TMP3 \bowtie Ingredients)$$