

1

Q1. a) Convert to simple English sentences

i)

$$\pi_{sname}(\pi_{sid}((\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers))$$

Get the names of the suppliers that have PPE that costs less than 6.

[Outputs the suppliers that have products tagged with 'PPE' and a cost of less than 6]

ii)

$$\pi_{sname}(\pi_{sid}((\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers))$$

Nothing is returned from this operation.

$[(\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog)]$ returns the products with tag PPE and cost ≤ 6 , columns are: tid, pid, tagname, sid, pid, cost. Natural join with supplier looks at common sid, so that returns the suppliers with products of tag PPE and cost ≤ 6 . Projecting sid will result in each tuple only having an sid. Projecting the sname of a table where the tuples have only sid results in nothing being returned.]

iii)

$$\pi_{sname}((\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers) \cap \pi_{sname}((\sigma_{tagname='SuperTech'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers)$$

Gets the names of the suppliers that offer PPE made by SuperTech that costs less than 6.

iv)

$$\pi_{sid}((\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers) \cup \pi_{sid}((\sigma_{tagname='SuperTech'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers)$$

Gets the supplier IDs of suppliers that offer PPE or (inclusive) SuperTech products, both having a cost less than 6.

v)

$$\pi_{sname}(\pi_{sid,sname}((\sigma_{tagname='PPE'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers) \cap \pi_{sid,sname}((\sigma_{tagname='SuperTech'}ProductTag) \bowtie (\sigma_{cost < 6}Catalog) \bowtie Suppliers))$$

Get the names of the suppliers that offer PPE made up SuperTech with a cost less than 6.

Q1. b) Write relational algebra

i) $\pi_{sname}(\sigma_{(tagname='PPE') \vee (tagname='Testing')} ProductTag \bowtie Catalog \bowtie Suppliers)$

ii) $(\pi_{sid}((\sigma_{tagname='PPE'} ProductTag) \bowtie (\sigma_{cost < 10 \wedge cost > 420} Catalog) \bowtie Suppliers))$

iii) $(\pi_{sid}((\sigma_{tagname='PPE'} ProductTag) \bowtie (\sigma_{cost \geq 10 \wedge cost \leq 1337} Catalog) \bowtie Suppliers))$

iv)

$R1 := \sigma_{tagname='Cleaning'} ProductTag$

$R2 := \pi_{sid,pid}(R1 \bowtie Catalog)$

$R3 := \pi_{pid}(R1 \bowtie Catalog)$

$R4 := R2 \div R3$

(or without \div)

$R4 := \pi_{R1.sid, Suppliers.pid}(R2 \times Suppliers)$

$R5 := \rho_{R4(sid,pid)}(R4)$

$R6 := \pi_{sid}(R5 - R2)$

$R7 := \pi_{sid}(Suppliers) - R6$

v)

$R1 := \rho_{S1}(\rho_{(sid,cost)}(\pi_{Suppliers.sid,Catalog.cost}(Catalog \bowtie Product)))$

$R2 := \rho_{S2}(\rho_{(sid,cost)}(\pi_{Suppliers.sid,Catalog.cost}(Catalog \bowtie Product)))$

$R3 := \sigma_{S1.cost \geq S2.cost \cdot 1.2}(\sigma_{S1.sid \neq S2.sid}(R1 \times R1))$

$R4 := \rho_{(sid)}(\pi_{S1.sid}(R3))$

vi)

$R1 := \rho_{P1}(Catalog)$

$R2 := \rho_{P2}(Catalog)$

$R3 := P1 \times P2$

$R4 := \sigma_{(P1.pid=P2.pid) \wedge (P1.sid \neq P2.sid)}(R3)$

$R5 := \rho_{(pid)}(\pi_{P1.pid}(R4))$

vii)

$R1 := \sigma_{tagname='SuperTech'}(ProductTag) \bowtie Suppliers$

$R2 := \rho_{R2(sid,cost)}(\sigma_{scountry='USA'}(R1))$

$R3 := \rho_{R3}(R2)$

$R4 := \rho_{R4(sid,cost)}(R2 \bowtie_{R2.cost < R3.cost} (R3))$

$R5 := R2 - R4$

$R6 := \pi_{sid}(R5)$

viii)

$R1 := \sigma_{tagname='SuperTech'}(ProductTag) \bowtie Suppliers$

$R2 := \rho_{R2(sid,cost)}(\sigma_{scountry='USA'}(R1))$

$R3 := \rho_{R3}(R2)$

$R4 := \rho_{R4(sid,cost)}(R2 \bowtie_{R2.cost < R3.cost} (R3))$

$R5 := R2 - R4$ [Most Expensive]

$R6 := R2 - R5$ [Table excluding most expensive]

$R7 := \rho_{R7(sid,cost)}(\sigma_{scountry='USA'}(R6))$

$R8 := \rho_{R8}(R7)$

$R9 := \rho_{R9(sid,cost)}(R7 \bowtie_{R7.cost < R8.cost} (R8))$

$R10 := R6 - R9$

$R11 := \pi_{sid}(R10)$

ix)

$R1 := \rho_{R1(pid,sid,cost)}(\pi_{Product.pid,Suppliers.sid}(Product \bowtie Catalog \bowtie Suppliers))$

$R2 := \pi_{pid}(R1)$

$R3 := R1 \div R2$

$R4 := \sigma_{cost < 69}(R3)$

$R5 := \pi_{sid}(R4)$

$$\text{x) } \pi_{pid}(Product \bowtie \sigma_{quantity=0}(Inventory))$$