Assignment 2 — Databases and Information Systems

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Calculus vs. Algebra

1.

a) P⋈Q

b) Q⋈R

c) $P \cup P$

d) P ⋈ $(\pi_z(Q))$

e) $Q - R$

f) $P \bowtie ((\pi_{x,y}(P)) - R)$

g) $(\pi_x(Q) - \pi_x(R)) \bowtie Q$

h) $(\pi_z(P \bowtie Q)) \times R$

2.

a) Q(x0,y0)∧R(x1,y1)

b) ∃y. ∃z. P(x,y,z) ∧ x=y ∨ y=z

c) $Q(x, y) \wedge (R(y, z) \wedge y = z)$

d) $P(x, y, s) \wedge (Q(x, y) \vee R(x, y) \wedge s = x)$

Relational Algebra

Quick note!

We will handin a .txt file as well, containing the unedited relational algebra. This is to make it easier for our TA to copy and paste; to easily verify the validity of our submission.

a) see attached .txt

b) see attached .txt

c) see attached .txt

d) see attached .txt

e) see attached .txt. Beneath is the expression tree generated from the RA.
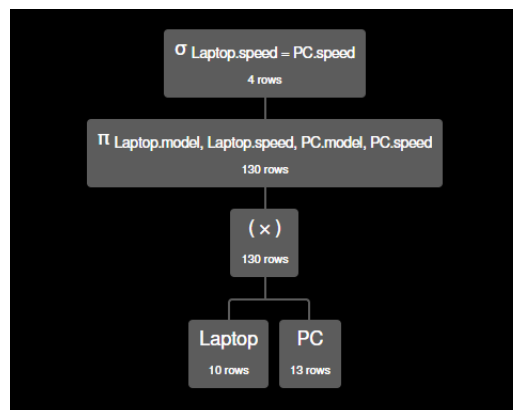
f) see attached .txt

g) see attached .txt

h) see attached .txt

i) see attached .txt. Beneath is the expression tree generated from the RA.
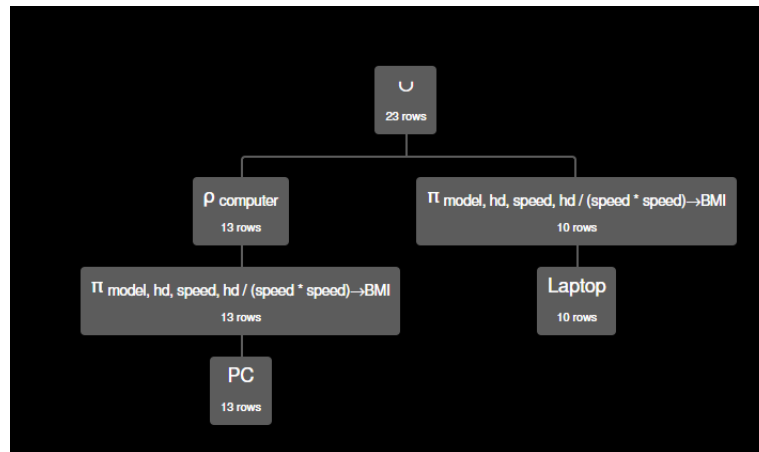
3. SQL Queries

– a) Output: model,GHz,GB: 1002,2.1,250; 1003,1.42,80; 1004,2.8,250; – 1005,3.2,250; 1007,2.2,200; 1008,2.2,250; 1009,2,250; 1010,2.8,300; – 1011,1.86,160; 1012,2.8,160; 1013,3.06,80.

```
SELECT model, speed AS "GHz", hd AS "GB"
FROM PC
WHERE price < 1000;
```

– b) Output: D, E, H.

```
SELECT DISTINCT maker FROM Product
WHERE type = 'printer'
```

– c) Output: maker, speed: A,2; A,2.16; A.2; B,1.83; E,2; E,1.73; E,1.8; F,1.6; F,1.6; G,2.

```
SELECT P.maker, L.speed
FROM Product as P
INNER JOIN Laptop as L ON P.model = L.model
WHERE hd >= 30;
```

– d) Output: model, price: 1004,649; 1005,630; 1006,1049; 2007,1249.

```
SELECT model, price
FROM PC
WHERE EXISTS (SELECT 1
FROM Product
WHERE Product.model = PC.model
AND maker = 'B')
UNION ALL
SELECT model, price
FROM Laptop
WHERE EXISTS (SELECT 1
FROM Product
WHERE Product.model = Laptop.model
AND maker = 'B');
```

– e) Output: F, G.

```
SELECT DISTINCT maker
FROM Product AS p1
WHERE type = 'laptop'
AND NOT EXISTS (
SELECT 1
FROM Product AS p2
WHERE p2.maker = p1.maker
AND type = 'pc'
);
```

– f) The output is 0.

```
SELECT P.model, L.speed
FROM Product AS P
INNER JOIN Laptop AS L ON P.model = L.model
WHERE L.speed < (SELECT MIN(speed)
FROM PC);
```

– g) Output: E.

```
SELECT P.maker
FROM Product as P
INNER JOIN Printer as PR ON P.model = PR.model
WHERE PR.color IS TRUE AND PR.price = (SELECT MIN(price) FROM
Printer);
```

– h) Output: model, price: 1005,630; 1006,1049; 2005,2500.

```
(SELECT model, price
FROM Laptop
WHERE Laptop.speed = (SELECT MAX(speed) FROM LAPTOP)
GROUP BY model, price)
UNION
(SELECT model, price
FROM PC
WHERE PC.speed = (SELECT MAX(speed) FROM PC)
GROUP BY model, price);
```

– i) Output: maker, average_screen: B,13.3; E,17.5; F,14.75; G,15.4; A,15.23.

```
SELECT P.maker, AVG(screen) AS Average_Screen
FROM Laptop AS L
INNER JOIN Product AS P ON L.model = P.model
GROUP BY P.maker;
```

– j) Output: A, B, D, E.

```
SELECT P.maker
FROM Product AS P
INNER JOIN PC ON P.model = PC.model
GROUP BY P.maker
HAVING COUNT(DISTINCT PC.model) >= 3;
```

– k) Output: maker,max_price: B,1049; C,510; D,770; E,959; A,2114.
```
SELECT P.maker, MAX(PC.price) AS max_price
FROM PC
INNER JOIN Product AS P ON PC.model = P.model
GROUP BY P.maker;
```

–l) Output: maker, average_hd: D,266.6; E,133.3.

```
SELECT P.maker, AVG(PC.hd) AS average_hd
FROM Product AS P
INNER JOIN PC ON P.model = PC.model
WHERE P.maker IN (SELECT maker
FROM Product
WHERE type = 'printer')
GROUP BY P.maker;
```

4. SQL Modifications

a)
INSERT INTO Product (Maker, Model, Type)
VALUES ('C', 1100, 'pc');

INSERT INTO PC (Model, Speed, Ram, Hd, Price)
VALUES (1100, 3.2, 1024, 180, 2499);

b)
DELETE FROM PC WHERE hd < 100;

c) Delete from Laptop Table:

DELETE FROM Laptop
WHERE model IN (
SELECT P.model
FROM Product AS P
WHERE P.maker NOT IN (
SELECT maker
FROM Product
WHERE type = 'printer'
)
AND P.type = 'laptop'
);

Delete from Product Table:

DELETE FROM Product
WHERE type = 'laptop' AND maker NOT IN (
SELECT maker
FROM Product
WHERE type = 'printer'
);

d) UPDATE Product
SET maker = 'A'
WHERE maker = 'B';

e) UPDATE PC
SET ram = ram * 2,
hd = hd + 60;

f) UPDATE Laptop
SET screen = screen + 1,
price = price - 100
FROM Product
WHERE Laptop.model = Product.model AND Product.maker = 'B';

g) DROP TABLE Product;