Assignment #3

1)

a. S should be the outer relation

Minimal I/O cost $= M + M * P_S * N$

$= 400 + 400 * 100 * 120$

$\boxed{\text{minimal I/O cost} = 4,800,400}$

b. R should be the outer relation

Minimal I/O cost $= M + \left\lceil \dfrac{M}{B-2} \right\rceil * N$

$= 120 + \left\lceil \dfrac{120}{52-2} \right\rceil * 400$

$\boxed{\text{minimal I/O cost} = 1,320}$

c. I/O cost $= 2 * M + 2 * N$

Probing phase $= M + N$

total cost $= 3(M+N)$

$= 3(400 + 120)$

$\boxed{\text{total cost} = 1,560}$

d. I/O cost = cost to sort + cost to merge

$= 100 \log_2 (100) + 400 + 120$

$\boxed{\text{I/O cost} \approx 1,184 \text{ (rounded to the nearest whole \#)}}$

e. I/O cost $= M + M * P_S *$ cost of retrieving

$= 400 + 400 * 100 * 3$

$\boxed{\text{I/O cost} = 120,400}$

f. $S \bowtie R$ I/O cost $= 120,400$

$R \bowtie S$ I/O cost $= M + M * P_R$

$= 120 + 120 * 200$

$\boxed{R \bowtie S \text{ I/O cost} = 24,120}$

$\boxed{R \bowtie S \text{ is the optimal plan because R is sorted and indexed, so we don't need } * \text{cost of retrieval so the I/O cost is lower}}$

2)

a.

q1.

$$\Pi_{\substack{\text{Tech\_name,} \\ \text{phone\_number}}} \left(\sigma_{\substack{\text{date} \geq \text{'2021-10-27'} \\ \wedge \text{ date} \leq \text{'2022-10-28'}}} (\text{Technicians} \bowtie \text{Examine}) \right)$$

q2.

$$\Pi_{\text{date}} \left(\sigma_{\substack{\text{model} = \text{'Boeing 747'} \wedge \\ \text{score} > 0.8 * \text{max\_score}}} (\text{Planes} \bowtie \text{Tests} \bowtie \text{Examines}) \right)$$
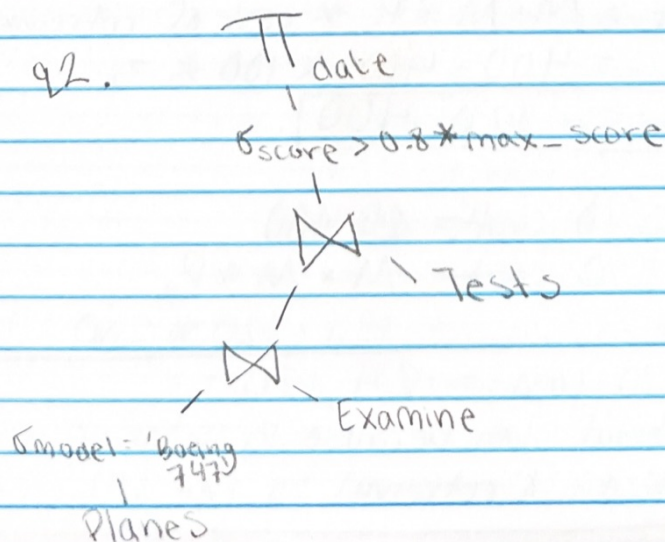
q3.

$$\Pi_{\substack{\text{tech\_name,} \\ \text{SSN}}} \left(\text{Technicians} - \left(\sigma_{\substack{\text{model} = \text{'Boeing} \\ \text{747'}}} (\text{Planes} \bowtie \text{Technicians}) \right) \bowtie \text{Examine} \right)$$

b.

q1.

$$\Pi_{\text{tech\_name, phone\_number}}$$
$$|$$
$$\bowtie$$

Technician　　　$\sigma_{\text{date} \geq \text{'2021-10-27'} \wedge \text{ date} \leq \text{'2022-10-28'}}$
$$|$$
Examine

q2.

$$\Pi_{\text{date}}$$
$$|$$
$$\sigma_{\text{score} > 0.8 * \text{max\_score}}$$
$$|$$
$$\bowtie$$
　　　　　Tests

$$\bowtie$$
　　　　Examine
$$\sigma_{\substack{\text{model} = \text{'Boeing} \\ \text{747'}}}$$
$$|$$
Planes

q3.

$$\pi_{Tech\_name, SSN}$$

$$\big(Technicians \bowtie \big((Technicians \bowtie Examines) \bowtie \sigma_{model = 'Boeing\ 747'}(Planes) \big) \big)$$

Technicians — ⋈

⋈ — $\sigma_{model = 'Boeing\ 747'}$ — Planes

Technicians — Examines
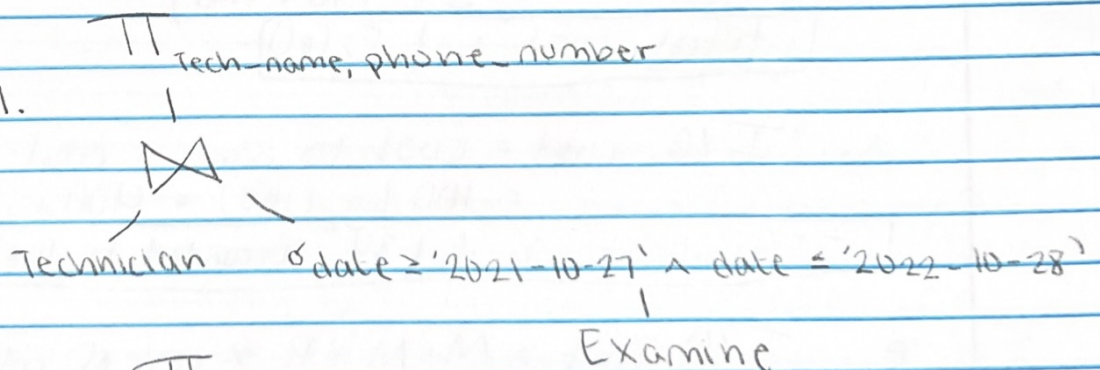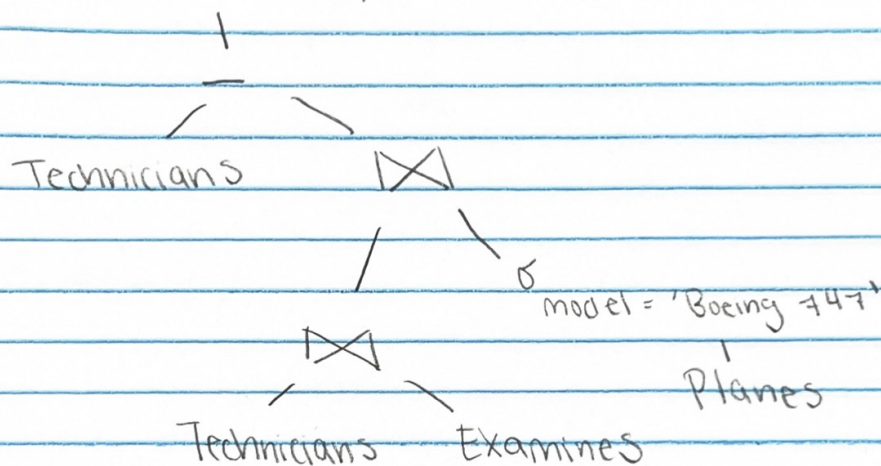
c.

i. ((Examines ⋈ Planes) ⋈ Test) ⋈ Tech

ii. ((Examines ⋈ Planes) ⋈ Tech) ⋈ Test

iii. ((Examines ⋈ Test) ⋈ Tech) ⋈ Plane

iv. ((Examines ⋈ Test) ⋈ Plane) ⋈ Tech

v. ((Examines ⋈ Tech) ⋈ Test) ⋈ Plane

vi. ((Examines ⋈ Tech) ⋈ Plane) ⋈ Test