Homework 3.2

1. (50 points) Consider the following relations: Technicians(SSN, tech_name, address, phone_number), Tests(FAAid, test_name, max_score), Planes(Pid, model), and Examine(SSN, FAAid, Pid, date, score), and the following queries:
   - Q1: Find the names and phone_numbers of the technicians who examine a plane on 10/27/2021 or 10/28/2021;
   - Q2: Find the date that at least one Boeing 747 plane got higher than 80% of the max scores in its tests. (Hint: Boeing 747 is a model, not a Pid);
   - Q3: Find the name and ssn of the technicians who have not conducted any test on any Boeing 747 plane.

   a) (12 pts) For each of the queries, write a relational algebraic expression.
   b) (30 pts) Draw their expression trees with selection and projection conducted as early as possible. Use left-deep joins whenever joins are needed.
   c) (8 pts) How many left-deep plans are there for joining all the four tables without cross product? Write down all these plans by drawing their expression trees. (Hint: if two tables do not have a common attribute, then natural join is defined as cross product, and thus should be avoided).

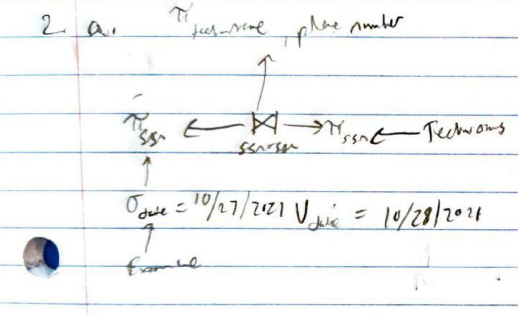
Homework 3.2

1. a. $\pi_{\text{tech_name, plane_number}}\left(\sigma_{\text{date}=10/27/2021 \vee \text{date}=10/28/2021}\left(\text{Examine} \bowtie_{\text{ssn=ssn}} \text{Technicians}\right)\right)$

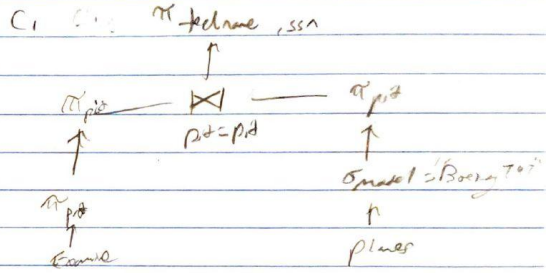
b. $\pi_{\text{date}}\left(\sigma_{\text{model}=\text{boeing 747}} \wedge_{\text{score}\geq \text{max(score)}*.8}\left(\text{Examine} \bowtie_{\text{pid=pid}} \text{planes}\right) \bowtie_{\text{FAAid=FAAid}} \text{Tests}\right)$

c. $\pi_{\text{tech_name, ssn}}\left(\sigma_{\text{model}=\text{"boeing 747"}}\left(\left(\text{Technicians} \bowtie_{\text{ssn=ssn}} \text{Examine}\right) \bowtie_{\text{p_id=pid}} \text{Planes}\right)\right)$

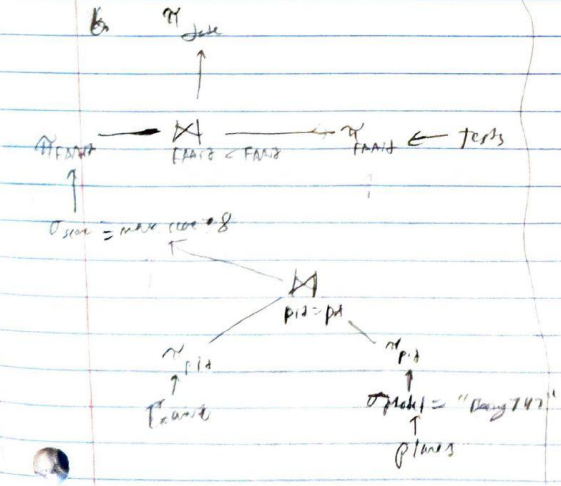
2. a.

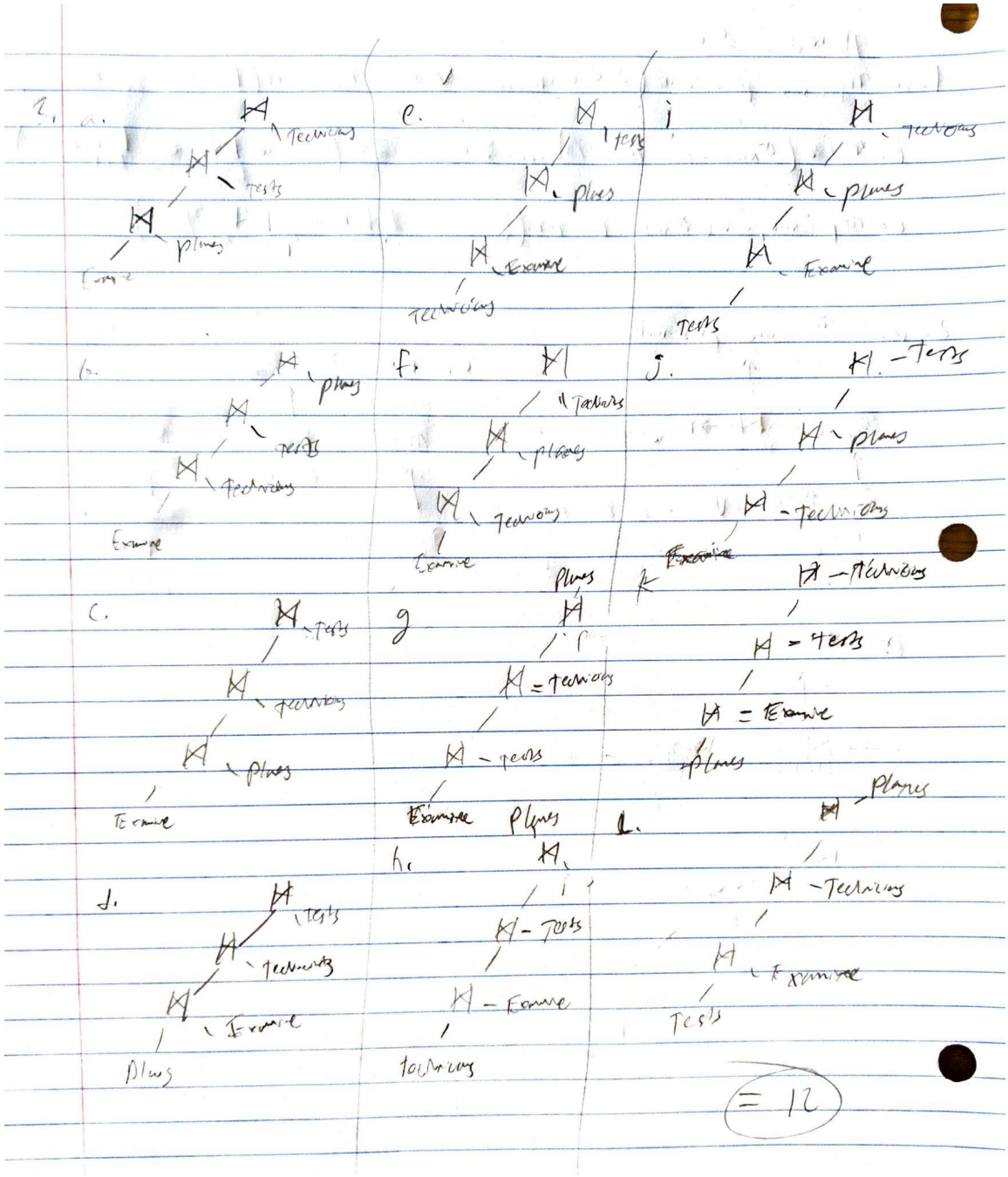


c.



b.





Submission Instruction

You can handwrite, but please make sure it is readable. Save your work as PDF and submit through your Canvas account.