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***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.
   1. (12 pts) For each of the queries, write a relational algebraic expression.

**Q1:** Π tech\_name, phone\_number (б date = 10/27/2021 V date = 10/28/2021(Technicians ⋈Examine)

**Q2:** Π date (б max\_score > 80 ^ model = “Boeing 747” (Examine ⋈Tests ⋈ Planes)

**Q3:** Π tech\_name, SSN (Π tech\_name, SSN (Technicians) - Π tech\_name, SSN (б model = “Boeing 747” (Examine ⋈Technicians ⋈ Planes)

* 1. (30 pts) Draw their expression trees with selection and projection conducted as early as possible. Use left-deep joins whenever joins are needed.

**Q1**:

Diagram

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**Q2:**

Chart

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**Q3:**

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* 1. (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).

Diagram

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Chart, radar chart

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**Submission Instruction**

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