

Homework 3

1. (55 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 query

- (15 pts) For each of the queries, write a relational algebraic expression
- (30 pts) Draw their expression trees with selection and projection conducted as early as possible. Use left-deep joins whenever joins are needed.
- (10 pts) How many left-deep plans are there for joining all four tables in this question without cross product? What are they? (hint: if two tables do not have a common attribute, then natural join is defined as cross product, and thus should be avoid).

- Find the names of the technicians who examine a plane on 2/10/2019 or 2/11/2019

a) $\Pi_{\text{tech_name}}(\text{Technicians} \bowtie (\sigma_{\text{date}=2/10/2019 \text{ or } 2/11/2019}(\text{Examine})))$

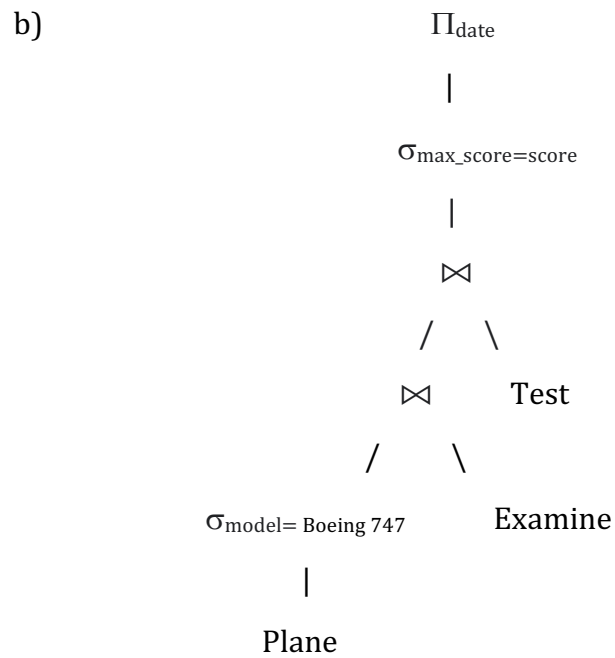
b)

$$\begin{array}{c}
 \Pi_{\text{tech_name}} \\
 | \\
 \bowtie \\
 / \backslash \\
 \sigma_{\text{date}=2/10/2019 \text{ or } 2/11/2019} \quad \text{Technicians} \\
 | \\
 \text{Examine}
 \end{array}$$

c) $2 (\text{Examine} \bowtie \text{Technicians}, \text{Technicians} \bowtie \text{Examine})$

- Find the date that at least one Boeing 747 plane got full scores in its tests

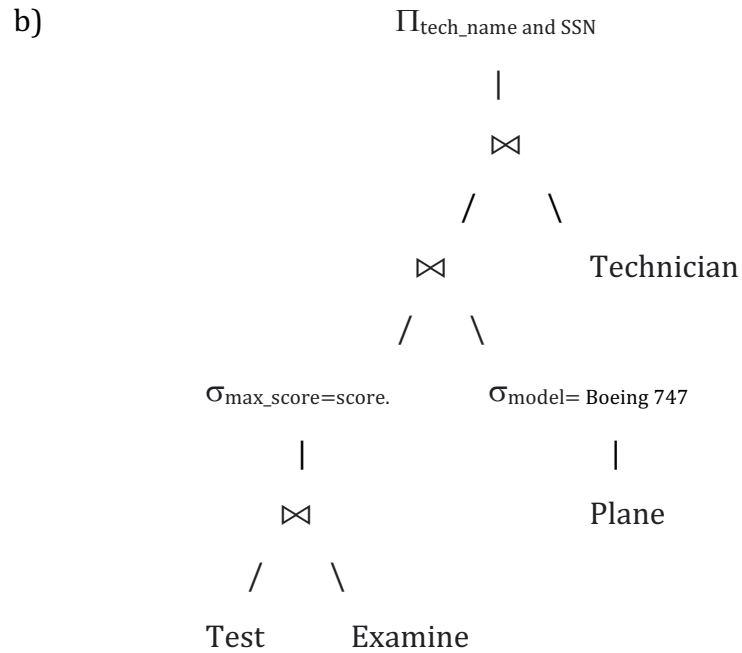
a) $\Pi_{\text{date}}((\sigma_{\text{max_score}=\text{score}}(\text{Test} \bowtie (\text{Examine} \bowtie (\sigma_{\text{model}=\text{Boeing 747}}(\text{Plane}))))))$



c) $4 (\text{Test} \bowtie (\text{Examine} \bowtie \text{Plane}), \text{Test} \bowtie (\text{Plane} \bowtie \text{Examine}), \text{Plane} \bowtie (\text{Test} \bowtie \text{Examine}), \text{Plane} \bowtie (\text{Examine} \bowtie \text{Test}))$

- Find the name and ssn of the technicians who have conducted at least one test on any Boeing 747 plane

a) $\Pi_{\text{tech_name and SSN}} (\text{Technician} \bowtie ((\sigma_{\text{max_score}=\text{score}}(\text{Test} \bowtie \text{Examine})) \bowtie (\sigma_{\text{model}=\text{Boeing 747}}(\text{Plane}))))$



c) $\pi_{\text{tech_name and SSN}} ((\text{Test} \bowtie (\text{Plane} \bowtie (\text{Technician} \bowtie \text{Examine}))), (\text{Plane} \bowtie (\text{Test} \bowtie (\text{Examine} \bowtie \text{Technician}))), (\text{Technician} \bowtie (\text{Test} \bowtie (\text{Plane} \bowtie \text{Examine}))), (\text{Test} \bowtie (\text{Technician} \bowtie (\text{Examine} \bowtie \text{Plane}))), (\text{Technician} \bowtie (\text{Plane} \bowtie (\text{Test} \bowtie \text{Examine}))), (\text{Technician} \bowtie (\text{Plane} \bowtie (\text{Examine} \bowtie \text{Test}))))$

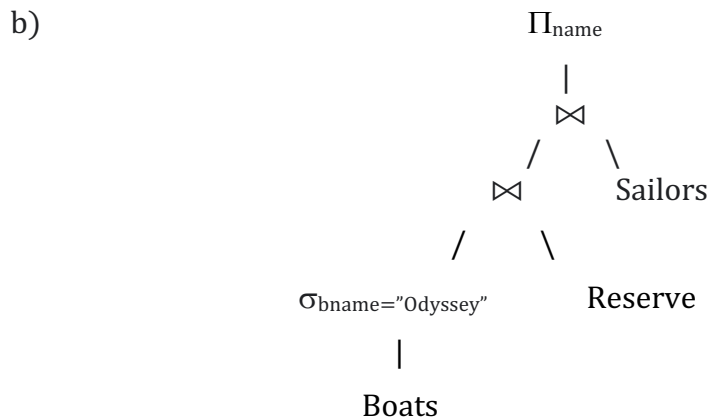
2. (45 points) Consider three relations *Sailors*(sid, *sname*, *rating*, *age*), *Boats*(bid, *bname*, *color*), and *Reserve*(sid, bid, day) and the following queries

a) (15 pts) Write the relational algebraic expressions for each of the above queries.

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

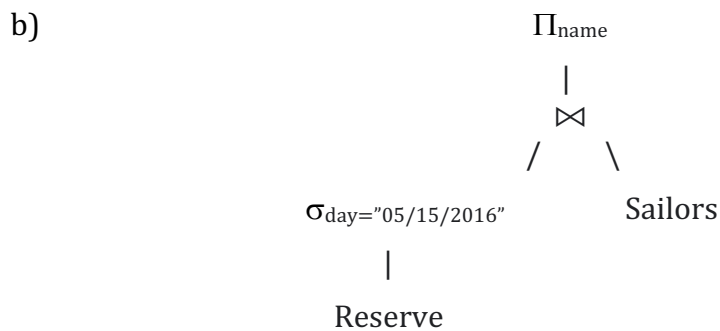
- Find the names of sailors who reserved boat "Odyssey"

a) $\Pi_{\text{name}}(\text{Sailors} \bowtie (\text{Reserve} \bowtie (\sigma_{\text{bname}=\text{"Odyssey"}}(\text{Boats}))))$



- Find the names of sailors who reserved at least one boat on day "05/15/2016"

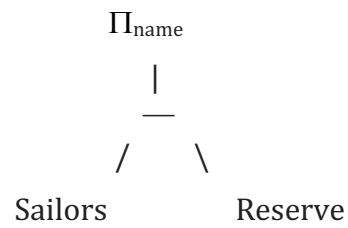
a) $\Pi_{\text{name}}(\text{Sailors} \bowtie (\sigma_{\text{day}=\text{"05/15/2016"}}(\text{Reserve})))$



- Find the names of sailors who have not reserved any boat

a) $\Pi_{\text{name}}(\text{Sailors} - \text{Reserve})$

b)



Submission Instruction

Please use Microsoft Words or other tools to type your answer. Don't handwrite. Submit your work through your Canvas account. The due time is midnight of 11/04.