

# Assignment 1

CS 631-002

Zachary Kaplan

February 23<sup>rd</sup> 2018

## 1 Schema

SUPPLIERS ( SID: *integer*, SNAME: *string*, STREET: *string*, CITY: *string*, ZIP: *string* )

PARTS ( PID: *integer*, PNAME: *string*, COLOR: *string* )

CATALOG ( SID: *integer*, PID: *integer*, COST: *real* )

## 2 Problems

0.  $\pi_{\text{CITY}}(\pi_{\text{PID}}(\sigma_{\text{COLOR}=\text{'red'}}(\text{PARTS})) * \sigma_{\text{COST}>100}(\text{CATALOG}) * \pi_{\text{SID,CITY}}(\text{SUPPLIERS}))$   
All cities in which at least one supplier sells at least one red part that costs more than 100.

1. Find the name of parts for which there is some supplier:

$$\pi_{\text{PNAME}}(\text{PARTS} * \text{CATALOG})$$

2. Find the names of parts supplied by suppliers who are at 1 Central Ave.

$$\pi_{\text{PNAME}}(\text{PARTS} * \text{CATALOG} * \sigma_{\text{STREET}=\text{'1 Central Ave.'}}(\text{SUPPLIERS}))$$

3. Find the names of suppliers who supply some red part.

$$\pi_{\text{SNAME}}(\sigma_{\text{COLOR}=\text{'red'}}(\text{PARTS}) * \text{CATALOG} * \text{SUPPLIERS})$$

4. Find the SIDs of suppliers who supply some red or green part.

$$\pi_{\text{SID}}(\sigma_{\text{COLOR}=\text{'red'}} \text{ OR } \text{COLOR}=\text{'green'}}(\text{PARTS}) * \text{CATALOG} * \text{SUPPLIERS})$$

5. Find the SID of suppliers who supply some red part or whose address is '221 Packer Street'.

$$\pi_{\text{SID}}(\sigma_{\text{COLOR}=\text{'red'}} \text{ OR } \text{STREET}=\text{'221 Packer Street'}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}))$$

6. Find the SIDs of suppliers who supply some red part and some green part.

$$\begin{aligned} \text{RED} &\leftarrow \pi_{\text{SID}}(\sigma_{\text{COLOR}=\text{'red'}}(\text{PARTS}) * \text{CATALOG} * \text{SUPPLIERS}) \\ \text{GREEN} &\leftarrow \pi_{\text{SID}}(\sigma_{\text{COLOR}=\text{'green'}}(\text{PARTS}) * \text{CATALOG} * \text{SUPPLIERS}) \\ \text{RESULT} &\leftarrow \text{RED} \cap \text{GREEN} \end{aligned}$$

7. Find the PIDs of parts that are red or are supplied by a supplier who is at the city of Newark.

$$\pi_{\text{PID}}(\sigma_{\text{COLOR}=\text{'red'}} \text{ OR } \text{CITY}=\text{'Newark'}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}))$$

8. Find the PIDs of parts supplied by a supplier who is at the city of Newark and by a supplier who is at the city Trenton.

$$\begin{aligned}\text{NEWARK} &\leftarrow \pi_{\text{PID}}(\text{PARTS} * \text{CATALOG} * \sigma_{\text{CITY}=\text{'Newark'}}(\text{SUPPLIERS})) \\ \text{TRENTON} &\leftarrow \pi_{\text{PID}}(\text{PARTS} * \text{CATALOG} * \sigma_{\text{CITY}=\text{'Trenton'}}(\text{SUPPLIERS})) \\ \text{RESULT} &\leftarrow \text{NEWARK} \cap \text{TRENTON}\end{aligned}$$

9. Find the PIDs of parts supplied by every supplier.

$$\pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \div \pi_{\text{SID}}(\text{SUPPLIERS})$$

10. Find the PIDs of parts supplied by every supplier who supplies at least one part.

$$\pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \div \pi_{\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS})$$

11. Find the PIDs of parts supplied by every supplier who is at the city of Newark or at the city of Trenton (equivalently: find the PIDs of parts supplied by every supplier who is at the city of Newark and by every supplier who is at the city of Trenton).

$$\pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \div \pi_{\text{SID}}(\sigma_{\text{CITY}=\text{'Newark'}} \text{ OR } \text{CITY}=\text{'Trenton'}}(\text{SUPPLIERS}))$$

12. Find the PIDs of parts supplied by every supplier who is at the city of Newark or by every supplier who is at the city of Trenton.

$$\begin{aligned}\text{NEWARK} &\leftarrow \pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \div \pi_{\text{SID}}(\sigma_{\text{CITY}=\text{'Newark'}}(\text{SUPPLIERS})) \\ \text{TRENTON} &\leftarrow \pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \div \pi_{\text{SID}}(\sigma_{\text{CITY}=\text{'Trenton'}}(\text{SUPPLIERS})) \\ \text{RESULT} &\leftarrow \text{NEWARK} \cup \text{TRENTON}\end{aligned}$$

13. Which one of the queries 11 and 12 is more restrictive (if any)?

Query 11 is more restrictive than 12. An equivalent form for query 11 would be the same as query 12 if you change  $\cup$  to  $\cap$ . Since  $A \cap B \subseteq A \cup B$ , the aforementioned form for query 11 is clearly more restrictive (in fact a subset of) query 12.

14. Find the pairs of PIDs such that the part with the first PID is sold at a higher price than the part with the second PID by some supplier.

$$\begin{aligned}\text{PARTS1} &\leftarrow \rho_{\text{PID} \rightarrow \text{P1}, \text{COST} \rightarrow \text{C1}}(\text{PARTS} * \text{CATALOG}) \\ \text{PARTS2} &\leftarrow \rho_{\text{PID} \rightarrow \text{P2}, \text{COST} \rightarrow \text{C2}}(\text{PARTS} * \text{CATALOG}) \\ \text{RESULT} &\leftarrow \pi_{\text{P1}, \text{P2}}(\text{PARTS1} \bowtie_{\text{C1} > \text{C2}} \text{PARTS2})\end{aligned}$$

15. Find the SIDs of suppliers who supply at least two different parts (you are not allowed to use a grouping/aggregation operation for this query).

$$\begin{aligned}\text{PS} &\leftarrow \pi_{\text{PID},\text{SID}}(\text{PARTS} * \text{CATALOG} * \text{SUPPLIERS}) \\ \text{PS1} &\leftarrow \rho_{\text{PID} \rightarrow \text{P1}, \text{SID} \rightarrow \text{S1}}(\text{PS}) \\ \text{PS2} &\leftarrow \rho_{\text{PID} \rightarrow \text{P2}, \text{SID} \rightarrow \text{S2}}(\text{PS}) \\ \text{RESULT} &\leftarrow \pi_{\text{SID}}(\rho_{\text{S1} \rightarrow \text{SID}}(\text{PS1} \bowtie_{\text{P1} \neq \text{P2}} \text{ AND } \text{S1}=\text{S2}} \text{PS2}))\end{aligned}$$

16. Find the SIDs of suppliers who supply at least two different parts (you have to use a grouping/aggregation operation for this query).

$$\pi_{\text{SID}}(\sigma_{\text{COUNT}(\text{PID}) \geq 2}(\pi_{\text{SID}}(\mathcal{F}_{\text{COUNT}(\text{PID})}(\text{SUPPLIERS} * \text{CATALOG} * \text{PARTS}))))$$

17. For every part supplied by a supplier who is at the city of Newark, print the PID and the SID and the name of the suppliers who sell it at the highest price.

$$\begin{aligned}\text{MAX\_COST} &\leftarrow \rho_{\text{MAX}(\text{COST}) \rightarrow \text{COST}}(\text{PID } \mathcal{F}_{\text{MAX}(\text{COST})}(\text{CATALOG})) \\ \text{RESULT} &\leftarrow \pi_{\text{PID}, \text{SID}, \text{SNAME}}(\text{MAX\_COST} * \text{CATALOG} * \text{SUPPLIERS})\end{aligned}$$

18. For every part, find its PID, its PNAME and the number of suppliers who sell it.

$$\pi_{\text{PID}, \text{PNAME}, \text{COUNT}(\text{SID})}(\text{PID } \mathcal{F}_{\text{COUNT}(\text{SID})}(\text{CATALOG}) * \text{PARTS})$$

19. List the PID, PNAME and average cost of all parts.

$$\pi_{\text{PID}, \text{PNAME}, \text{AVG}(\text{COST})}(\text{PID } \mathcal{F}_{\text{AVG}(\text{COST})}(\text{CATALOG}) * \text{PARTS})$$

20. Find the average cost of red parts.

$$\mathcal{F}_{\text{AVG}(\text{COST})}(\sigma_{\text{COLOR}=\text{'red'}}(\text{PARTS}) * \text{CATALOG})$$

21. Find the average cost of parts supplied by suppliers named 'Yosemite Sham'

$$\mathcal{F}_{\text{AVG}(\text{COST})}(\sigma_{\text{SNAME}=\text{'Yosemite Sham'}}(\text{SUPPLIERS}) * \text{CATALOG})$$