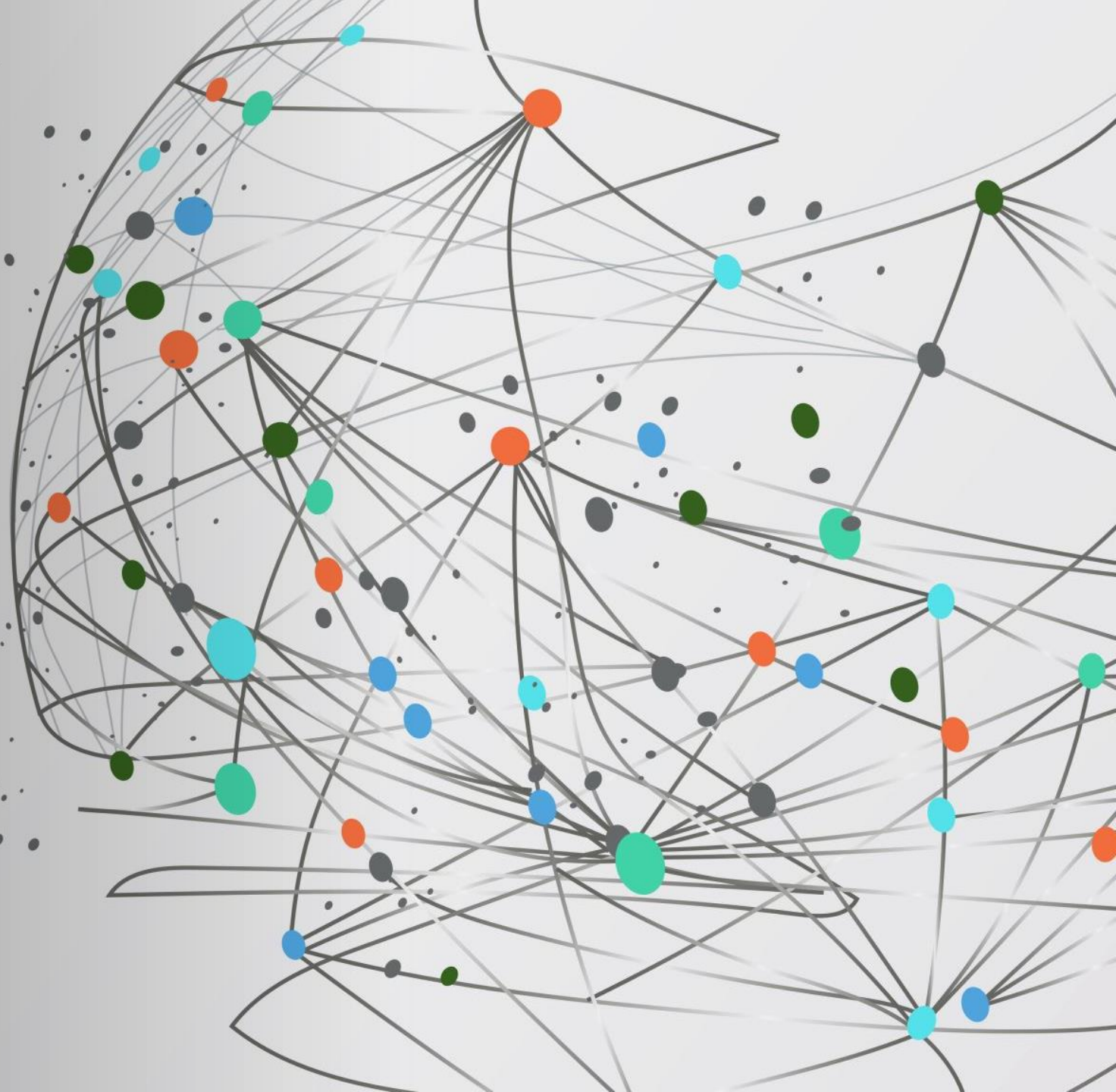
Relational Algebra

Databases 2022



Relational algebra notation (recap)

Operation	Notation	Example
Union	U	**R1** U **R2**
Difference	- or /	**R1** - **R2**
Cartesian product	x	**S1** x **R1**
Select	$\sigma_p(r)$	$\sigma_{\textbf{Age>20}}$**(Student)**
Project	$\prod_p(r)$	$\prod_{\textbf{Lastname, age}}$**(Students)**
Rename	ρOldName ⟶ NewName(r)	ρFather ⟶ Parent(Parternity)
Join	⋈	**R** ⋈ **S**
Division	÷	**R1** ÷ **R2**

Exercise I

- Consider following schema:

  Suppliers (sid: integer, sname: string, address: string)

  Parts (pid: integer, pname: string, color: string)

  Catalog (sid: integer, pid: integer, cost: real)

- Convert the following statements to relation algebra

  Find the names of suppliers who supply some red part. $\pi_{sname}(\pi_{sid}(\sigma_{color=red}(Parts) \bowtie Catalog) \bowtie Suppliers)$

  Find the sids of suppliers who supply some red or green part. $\pi_{sid}(\sigma_{color=red\ OR\ color=green}(Parts) \bowtie Catalog)$

  Find the sids of suppliers who supply some red part or are at 221 Packer Street. $\pi_{sid}(\sigma_{color=red}(Parts) \bowtie Catalog) \cup \pi_{sid}(\sigma_{address=221\ Packer\ St.}(Suppliers))$

  Find the sids of suppliers who supply some red part and some green part. $\pi_{sid}(\sigma_{color=red\ AND\ color=green}(Part) \bowtie Catalog)$

  Find the sids of suppliers who supply every part. $\pi_{sid}(Suppliers) \setminus \pi_{sid}((\pi_{sid}(Supplier) \times \pi_{pid}(Parts)) \setminus \pi_{sid,pid}(Catalog))$

  Find the sids of suppliers who supply every red part. $\pi_{sid}(Suppliers) \setminus \pi_{sid}((\pi_{sid}(Supplier) \times \pi_{pid}(\sigma_{color=red}(Parts))) \setminus \pi_{sid,pid}(Catalog))$

  Find the sids of suppliers who supply every red or green part. $(\pi_{sid}(Suppliers) \setminus \pi_{sid}((\pi_{sid}(Supplier) \times \pi_{pid}(\sigma_{color=red}(Parts))) \setminus \pi_{sid,pid}(Catalog))) \cup \pi_{sid}(\sigma_{color=green}(Parts) \bowtie Catalog)$

  Find the sids of suppliers who supply every red part or supply every green part. $\pi_{sid}(Suppliers) \setminus \pi_{sid}((\pi_{sid}(Supplier) \times \pi_{pid}(\sigma_{color=red\ OR\ color=green}(Parts))) \setminus \pi_{sid,pid}(Catalog))$

  Find pairs of sids such that the supplier with the first sid charges more for some part than the supplier with the second sid.

  $C1 \leftarrow Catalog$
  $C2 \leftarrow Catalog$
  $\pi_{C1.sid,C2.sid}(C1 \bowtie_{C1.pid=C2.pid \wedge C1.cost>C2.cost} C2)$

  Find the pids of parts supplied by at least two different suppliers.

  $C1 \leftarrow Catalog$
  $C2 \leftarrow Catalog$
  $\pi_{C1.pid}(\sigma_{C1.pid=C2.pid \wedge C1.sid != C2.sid}(C1 \times C2))$

Exercise II

For the previous schema, state what the following queries compute:

+ $\Pi_{sname}\left(\Pi_{sid}\left((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\right) \bowtie Suppliers\right)$ names of suppliers who supply red parts that cost less than 100.
+ $\left(\Pi_{sname}\left((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\right) \bowtie Suppliers\right) \cap \left(\Pi_{sname}\left((\sigma_{color=green}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers\right)\right)$ names of suppliers who supply red parts that cost less than 100 and green parts that cost less than 100
+ $\left(\Pi_{sid}\left((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers\right)\right) \cap \left(\Pi_{sid}\left((\sigma_{color=green}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers\right)\right)$ SIDs of suppliers who supply red parts that cost less than 100 and green parts that cost less than 100
+ $\Pi_{sname}\left(\left(\Pi_{sid,name}\left((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\right) \bowtie Suppliers\right) \cap \left(\Pi_{sid,name}\left((\sigma_{color=green}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers\right)\right)\right)$

names of suppliers who supply red parts that cost less than 100 and green parts that cost less than 100

See you next week ☺