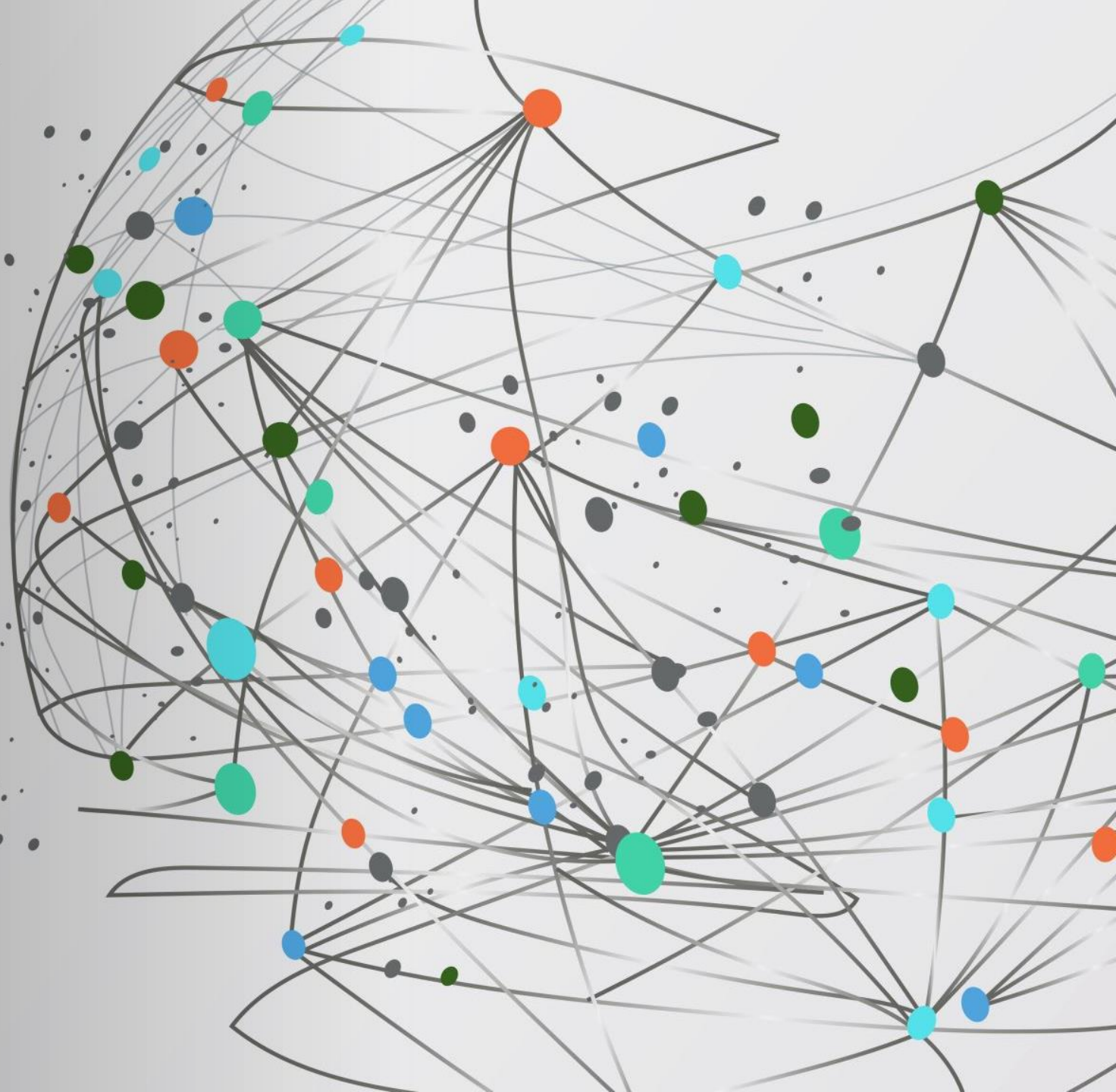
Relational Algebra

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:

+ $\Pi_{sname}\ (\Pi_{sid}\big((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\big) \bowtie Suppliers)$
+ $(\Pi_{sname}\ \big((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\big) \bowtie Suppliers)) \cap$
  $(\Pi_{sname}\ ((\sigma_{color=green}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers))$
+ $(\Pi_{sid}\big((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)\big) \cap (\Pi_{sid}\ \Big(\big(\sigma_{color=green}Parts\big) \bowtie$
  $(\sigma_{cost<100}Catalog) \bowtie Suppliers)\Big)$
+ $\Pi_{sname}\ (\big(\Pi_{sid,name}\big((\sigma_{color=red}Parts) \bowtie (\sigma_{cost<100}Catalog)\big)\big) \bowtie Suppliers\big) \cap$
  $(\Pi_{sid,name}(\big(\sigma_{color=green}Parts\big) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)))$

See you next week ☺