

Ex. 1.3: Names of all countries $\geq 1,000,000$ inhabitants, not member of the EU.

\Rightarrow Algebra

$\pi(\text{name})$
 $\sigma(\text{pop} > 1,000,000)$

all codes of non-EU countries

$\sigma(\text{code} \rightarrow \text{code})$ Country
 $\pi(\text{code})$ Country
 $\sigma(\text{code} = \text{EU})$ and $\sigma(\text{code} = \text{EU})$ is member

Country	type	member
 EU | no | no

May 11-14:09

Calculus:

$F(N) = \exists C, \text{pop}, A (\text{country}(N, C, \text{Cap}, \text{GDP}, P, A) \wedge P \geq 1000000 \wedge \neg \exists T : \text{isMember}(C, \text{EU}, T))$

\rightarrow SRNF, etc ✓
 \rightarrow RANF?

not conjunctive selection
 $\pi = \{N, C, \text{Cap}, \text{GDP}, P, A\} = \text{True} \checkmark$

\rightarrow RelAlg

$\sigma(\text{pop} > 1,000,000)$
 $\sigma(\text{pop} > 1,000,000)$ Country
 $\sigma(\text{pop} > 1,000,000)$ Country
 $\sigma(\text{pop} > 1,000,000)$ Country

outsiders:
 here only countries from C
 value of C from country \$2\$

R-Theory Optimization
 \rightarrow Algebra + join Algos

$\pi(\text{code})$ Country
 $\sigma(\text{code} = \text{EU})$ is member

May 11-14:23

Ex 1.4: $r(a,b) \quad s(b) \rightarrow \tau = s(a)$

$\{ N \in \text{Top}(E) \mid \exists x, y \subseteq \tau \}$
 all possible E tuples from the DB \Rightarrow ADDM

$F(X) = \text{ADDM}(X) \wedge \forall Y : (s(Y) \rightarrow \tau(X, Y))$

SRNF: $\text{ADDM}(X) \wedge \neg \exists Y : (s(Y) \wedge \neg \tau(X, Y))$

RANF:
 $\tau(B) = \text{true} \rightarrow$ no
 Rel ADDM(X) into $\neg \exists Y \dots$

$\text{ADDM}(X) \wedge \neg \exists Y (\text{ADDM}(X) \wedge s(Y) \wedge \neg \tau(X, Y))$

\rightarrow Algebra

$\sigma(\text{code} = \text{EU})$ Country
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optimization with anti-join

\Rightarrow Effect of "E": how to restrict X to $\tau \cdot \Phi$?
 $\text{ADDM}(X) = \pi(X)(\text{ADDM}(X) \setminus \tau) \dots$ later

May 11-14:54



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