

Arjg. 2  $\rightarrow$  result format:  $(A, B, X_1, \dots, X_n, Y_1, \dots, Y_m)$

$\tau$  [remove  $R_1.a$   $R_2.a$   $R_1$   $(A, X_1, \dots, X_n)$   
 $R_2.b$   $R_2$   $(A, B, Y_1, \dots, Y_m)$

a)  $\exists [R_1.a = R_2.a \wedge (R_1.b = R_2.b \vee R_1.b \text{ is null} \vee R_2.b \text{ is null})]$  non-null maybe null

$\tau_1$   $\tau_2$

b)  $\hat{=}$  SQL: not exists

$R_1, R_2$  written:

select \*  
 from  $\tau_1$   
 where not exists (select \* from  $\tau_2$   
 where  $\tau_2.a = \tau_1.a \wedge (\tau_2.b = \tau_1.b \vee \tau_1.b \text{ is null} \vee \tau_2.b \text{ is null})$ )

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SQL ( $P_1$  Minus  $P_2$ ) not allowed in SQL syntax!

only possibility for Negation in SQL is (Filter (!bound))

$\Rightarrow$  rewrite

select  
 from ...  
 where {  $P_1$  OPTIONAL  $P_2$   
 Filter (!bound(?y)) }  
 for ?y occuring in  $P_2$  and not in  $P_1$ !

NOTE: what if no such y exists

$\hookrightarrow$  next slide

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ex: all cities that are not capitals

where { ?X a County ; hasCity ?C

Optional { ?X capital ?C .

} Filter ( !bound( ?N ) ) }  
?X name ?N

(cf. Exercise 1.a)

create a new var that is only bound (and otherwise useless) in the OPT part

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continue: ( P1 OPT P2 )  
 Note: if P2 is of the form

$$P_2 = ( P_2' \text{ OPT } P_2'' )$$

=> The variable to be checked must be in P2'

a)  $\Omega_1 \bowtie \Omega_2 = \Omega_1 \bowtie \Omega_2 \cup \Omega_1 \setminus (\Omega_1 \bowtie \Omega_2)$

left skew join  
↓

↑  
classical set minus

note: it is not necessary to join additional null columns as in the rel. algebra!

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