Ex 6, Sheet 2

$r(A,B)\ ,\ s(B)$

$$r \div s = \{\nu \in Tup(A) : \{\nu\} \times S \subseteq r\}$$

Calculus Expression:

$$F(X) = ADOM(X) \wedge \forall y: S(y) \rightarrow R(x,y)$$

any value of the DB

$$\supseteq \pi[A](R) \cup \pi[B](R) \cup \pi[B](S) \cup \ldots$$

e.g.

R(org, cont)	
EU	Europe
NATO	Europe
UN	Europe
UN	America
UN	Asia
UN	Africa
UN	Australia

S
Cont
Europe
Asia
America
Australia
Africa

$R \div S$
org
UN

$$\hat{=}\ \underbrace{(\exists z: R(x,z))}_{\hat{=}\ \pi[A](R)} \wedge \forall y\ (S(y) \rightarrow R(x,y))$$

is not in SRNF

$$= \exists z: R(x,z) \wedge \neg \exists y: (S(y) \wedge \neg R(x,y))$$

Same form as Ex 5 2), e
(3)

Ex 8

$$\underbrace{\pi[A,B]((\overset{AB}{R} \bowtie_B S) - T)}_{\subseteq R} \cup R \equiv R$$

(A,B,C)

$R(A,B)$
$S(B,C)$
$T(A,B,C)$

$R \bowtie S$	$R(x,y) \wedge S(y,z)$
$(R \bowtie S) - T$	$(R(x,y) \wedge S(y,z)) \wedge \neg T(x,y,z)$
$\pi[\underset{x}{A},\underset{y}{B}](\ldots)$	$\exists z: (\ \ldots\ )$
$\ldots \cup R$	$(\ \ldots\ldots\ ) \vee R(x,y)$

$$\underbrace{(\exists z (R(x,y) \wedge S(y,z) \wedge \neg T(x,y,z)))}_{\text{Sharper than } R(x,y)} \vee R(x,y)$$

$$\equiv R(x,y)$$

c) $\underbrace{\ldots}_{\text{over } A,B}$ $\cup$ $\quad \pi[\cancel{A,B}](\underbrace{\sigma[A<B](R)}_{A,B} \bowtie T)$

A, B ; A, B, C ; ABC ; AB

R	$R(x,y)$
$\sigma[A<B](R)$	$R(x,y) \wedge x<y$
$\ldots \bowtie T$	$R(x,y) \wedge x<y \wedge \exists z: T(x,y,z)$ $R(x,y) \wedge x<y \wedge T(x,y,z)$
$\pi(A,B)(\ldots)$	$\exists z: R(x,y) \wedge x<y \wedge T(x,y,z)$ $F'(x,y)$
$\cup$	$F(x,y)$ from previous slide $\vee$ $F'(x,y)$

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Ex. 3

T(A,B,C) R(A,B) S(B,C)

$$F_h(x,y) = T(y,a,y) \wedge (R(a,x) \vee S(x,c)) \wedge \neg T(a,x,y)$$

$T(y,a,y)$: $\rho[A\to y](\pi[A](\sigma[A=C \wedge B=a](T)))$ E_0

$\vee$ $R(a,x)$: $\rho[B\to x](\pi[B](\sigma[A=a](R)))$ E_1

$S(x,c)$: $\rho[B\to x](\pi[B](\sigma[C=c](S)))$ E_2

$E_1 \cup E_2$

$T(a,x,y)$: $\rho[B\to x, C\to y](\pi[B,C](\sigma[A=a](T)))$ E_3

$\neg T(a,x,y)$: $ADOM^2 - E_3$

whole Formula

$T(\ldots) \wedge (R \vee S) \wedge \neg T(\ldots)$

$\underset{(y)}{E_0} \bowtie \underset{(x)}{E_1} \bowtie (ADOM^2 - E_3)$ $\bowtie$ of above Formulas

$\subseteq \pi[A](T) \times \pi[B](R) \bowtie$ (all possible x,y $- \ldots$)

$= (E_0 \times E_1) - E_3$

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Ex 7:

Definition of a new operator into some framework

semantics — input: set of Pop values of Cities in C — syntax + grouping information

output → bound to a Variable

here: aggregate fct, group by

$F(C, P) :- \exists CN, Cp, CP, P, A$ $country(CN, C, Cp, CP, P, A)$

$\wedge$ P is the sum of city pops in C

P = ... expr.....

term

e.g. sum({ P: city values })

Pop in Ghouchers:

$\exists N, C, Prov, L1, L2:$

$sum\{Pop \mid city(N, Prov, C, Pop, L1, L2)\}$ Term

=> yields the sum of pop of all cities

todo: add grouping info to semantics and syntax

↳ list of variables

→ free vars of the term

$F(C, P) = \exists N, Cp, CP, A, PP$ $country(N, C, Cp, CP, PP, A) \wedge$

$\wedge$ $P = sum\{\underbrace{Pop}_{\text{any expr}} [C] \mid \underbrace{\exists N, Prov, L1, L2: city(N, C, Prov, Pop, L1, L2)}_{\text{any subformula}}\}$

Algebra $\pi[A, B, C]$ ..

an operation

input: a relation/subq

list of ~~grp~~ vars

result: a new column

output format

[country, pop, bla]

↑

$\gamma[bla = sum(pop); [country, pop]]$

|

$\pi[country, prov, pop]$

|

city