Relational Databases Theory and Logic

The following slides provide a first logic oriented view to relational database theory. It is not very feasible in practice!

Better methods will be discussed as the course proceeds.

(Thanks to Prof. Enrico Franconi, University Bozen-Bolzano, for the following slides)

Relational Algebra

SINGER		
NAME	COUNTRY	TYPE
Pavarotti	Italy	Classic
Eagles	U.S.A.	Pop
Ramazzotti	Italy	Pop
Queen	U.K.	Rock

CONCERT			
ARTIST	PLACE	DATE	TICKET
Eagles	Paris	22/6/1998	YES
Pavarotti	Barcelona	28/6/1997	NO
Pavarotti	Bologna	27/4/1998	YES

Tell me the places and the dates of italian artists concerts.

$$\pi_{\{\mathrm{PLACE},\mathrm{DATE}\}}\left(\sigma_{\mathrm{COUNTRY}=\mathtt{Italy}}\left(SINGER \bowtie_{\mathrm{NAME}=\mathrm{ARTIST}} CONCERT\right)\right)$$

RESULT	
PLACE	DATE
Barcelona	28/6/1997
Bologna	27/4/1998

Relational Calculus

SINGER		
NAME	COUNTRY	TYPE
Pavarotti	Italy	Classic
Eagles	U.S.A.	Pop
Ramazzotti	Italy	Pop
Queen	U.K.	Rock

CONCERT			
ARTIST	PLACE	DATE	TICKET
Eagles	Paris	22/6/1998	YES
Pavarotti	Barcelona	28/6/1997	NO
Pavarotti	Bologna	27/4/1998	YES

Tell me the places and the dates of italian artists concerts.

$$\exists z, k, w. \quad \mathit{CONCERT}(z, \mathbf{x}, \mathbf{y}, k) \wedge \mathit{SINGER}(z, \texttt{Italy}, w)$$

RESULT	
PLACE	DATE
Barcelona	28/6/1997
Bologna	27/4/1998

Relational Theory

FACT: $\mathit{SINGER}\ (\texttt{Pavarotti}, \texttt{Italy}, \texttt{Classic}).$

$\vdots$

$\mathit{CONCERT}\ (\texttt{Pavarotti}, \texttt{Bologna}, \texttt{27/4/1998}, \texttt{YES}).$

UNA: $\texttt{Eagles} \neq \texttt{Queen}, \ldots, \texttt{Paris} \neq \texttt{Barcelona}.$

DO: $\forall x.\ ((x = \texttt{Pavarotti}) \vee \cdots \vee (x = \texttt{Eagles})).$

CO: $\forall x_1 \cdots x_3.\ (\mathit{SINGER}\ (x_1, \ldots, x_3) \longrightarrow$
$(x_1 = \texttt{Pavarotti} \wedge \cdots \wedge x_3 = \texttt{Classic}) \vee$
$\cdots \vee$
$(x_1 = \texttt{Queen} \wedge \cdots \wedge x_3 = \texttt{Rock})).$

$\forall x_1 \cdots x_4.\ (\mathit{CONCERT}\ (x_1, \ldots, x_4) \longrightarrow$
$(x_1 = \texttt{Eagles} \wedge \cdots \wedge x_4 = \texttt{YES}) \vee \cdots \vee$
$(x_1 = \texttt{Pavarotti} \wedge \cdots \wedge x_4 = \texttt{YES})).$

$$\exists z, k, w. \quad \mathit{CONCERT}(z, \mathbf{x}, \mathbf{y}, k) \wedge \mathit{SINGER}(z, \texttt{Italy}, w)$$