COMP 330: Relational Databases 2

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Relational Calculus

Nothing more than a FOL predicate...

Embedded within a set constructor

Example: Bad Beer People

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Who goes to a bar serving Pabst Blue Ribbon (PBR)?

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FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Who goes to a bar serving Pabst Blue Ribbon (PBR)?

$\{f.\text{DRINKER} \mid \text{FREQUENTS}(f) \wedge \exists(s)(\text{SERVES}(s)$
$\wedge s.\text{BEER} = \text{“PBR”} \wedge s.\text{DRINKER} = f.\text{DRINKER})\}$

Example: Not Bad Beer People

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Who has not gone to a bar serving Pabst Blue Ribbon (PBR)?

Example: Not Bad Beer People

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Who has not gone to a bar serving Pabst Blue Ribbon (PBR)?

$\{f.\text{DRINKER} \mid \text{FREQUENTS}(f) \wedge \text{ not } \exists(s)(\text{SERVES}(s)$
$\wedge s.\text{BEER} = \text{“PBR”} \wedge s.\text{DRINKER} = f.\text{DRINKER})\}$

Example: People Who Like to Drink

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Who goes to a bar that serves a beer they like?

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Query: Who goes to a bar that serves a beer they like?

$$\{f.\text{DRINKER} \mid \text{FREQUENTS}(f) \wedge \exists(s, l)(\text{SERVES}(s) \wedge \text{LIKES}(l) \wedge s.\text{BEER} = l.\text{BEER} \wedge s.\text{BAR} = f.\text{BAR})\}$$

Example: Super Cool Bars

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which bars serve all of the beers that Chris likes?

Example: Super Cool Bars

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FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which bars serve all of the beers that Chris likes?

$\{s.\text{BAR} \mid \text{SERVES}(s) \wedge \forall(l)(\text{if } l \text{ is from LIKES and corresponds to “Chris”, then the bar serves it})\}$

Example: Super Cool Bars

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which bars serve all of the beers that Chris likes?

$$\{s.\text{BAR} \mid \text{SERVES}(s) \wedge \forall(l)(\text{LIKES}(l) \wedge l.\text{DRINKER} = \text{“Chris”}$$
$$\rightarrow \exists(s_2)(\text{SERVES}(s_2) \wedge s_2.\text{BAR} = s.\text{BAR} \wedge s_2.\text{BEER} = l.\text{BEER}))\}$$

Note: we invariably have a “$\rightarrow$” within a $\forall$ quantifier. Why?

Example: People Who Avoid Bad Bars

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which people only go to bars that serve a beer they like?

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FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which people only go to bars that serve a beer they like?

$\{f.\text{DRINKER} \mid \text{FREQUENTS}(f) \wedge \forall(f_2)(\text{if } f_2 \text{ tells us a bar that } f.\text{DRINKER goes to then that bar needs to serve a beer that } f.\text{DRINKER likes})\}$

Example: People Who Avoid Bad Bars

LIKES (DRINKER, BEER)

FREQUENTS (DRINKER, BAR)

SERVES (BAR, BEER)

Query: Which people only go to bars that serve a beer they like?

$$\{f.\text{DRINKER} \mid \text{FREQUENTS}(f) \wedge \forall(f_2)(\text{FREQUENTS}(f_2)$$
$$\wedge f.\text{DRINKER} = f_2.\text{DRINKER} \rightarrow \exists(s, l)(\text{SERVES}(s) \wedge \text{LIKES}(l)$$
$$\wedge s.\text{BAR} = f_2.\text{BAR} \wedge l.\text{BEER} = s.\text{BEER}$$
$$\wedge l.\text{DRINKER} = f_2.\text{DRINKER}))\}$$

- Why do we need both f and f_2 here?

Questions?