FOPC as a Database Query Language

In the *Domain Relational Calculus* (and the closely related *Tuple Relational Calculus*) we view the tables of the database as an axiomatization of the corresponding relations. They specify the complete enumerations of a set of predicates. That is, they give all the tuples of values for which the corresponding predicate is *true*. We further make the *Closed World Assumption*, that the predicates are false for all other tuples.

A *query* is an existential FOPC sentence which we wish to know whether it is a consequence of the axiomatization. In response we want to know not merely whether the sentence is a consequence, but all the *instantiations* of designated outer-level existentially quantified variables that make the sentence true.

For example, if we have a table called **registered**, then we might have the query:

$$\exists s(\mathbf{registered}(s, \mathsf{cs80}))$$

In this case we want back a list of the students that are registered for cs 80.

The Beer Drinkers Example

Consider a database that stores information about the beer consumption habits of HMC profesors, and the practices at the local bars. It consists of three tables:

Likes	
person	**beer**
hodas	corona
⋮	⋮

Frequents	
person	**bar**
keller	thepress
⋮	⋮

Serves		
bar	**beer**	**price**
hibrow	bud	$1.50
⋮	⋮	⋮

The Beer Drinkers Example

Language:

$$\begin{aligned}\mathcal{A} = \ \{ & \\ & hodas, tam, erlinger, \ldots \\ & hibrow, thepress, \ldots \\ & bud, corona, \ldots \\ & \$0.01, \$0.02, \ldots \\ \} & \end{aligned}$$

$$\mathcal{F} = \{\}$$

$$\begin{aligned}\mathcal{P} = \ \{ & \\ & likes, frequents, serves, \\ & \doteq, <, \leq, \ldots \\ \} & \end{aligned}$$

The Beer Drinkers Example

- Show all rows of **Likes**

- Show all rows of **Likes** for Professor Hodas

- Show all the beers that professor Hodas likes

- Show all the beers available for under $3.00

- Show all the beers sold exclusively for under $3.00

The Beer Drinkers Example

- Show the bars that serve some beer that Hodas likes

- Show the bars that serve all the beers that Hodas likes

- Show the bars that serve a beer that at least one person likes

The Beer Drinkers Example

- Show the beers that are liked by someone but not served anywhere

- Show the people who only like beers not served anywhere

- Show the people who like all the beers sold by the HiBrow

- Show the people who like only the beers sold by the HiBrow