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:

$$\exists s(\text{registered}(s, \text{cs80}))$$

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 professors, and the practices at the local bars. It consists of three tables:

<table>
<thead>
<tr>
<th>Likes</th>
<th>Frequents</th>
</tr>
</thead>
<tbody>
<tr>
<td>person</td>
<td>beer</td>
</tr>
<tr>
<td>hodas</td>
<td>corona</td>
</tr>
<tr>
<td>:</td>
<td>:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serves</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar</td>
</tr>
<tr>
<td>hibrow</td>
</tr>
<tr>
<td>:</td>
</tr>
</tbody>
</table>
The Beer Drinkers Example

Language:

\[ \mathcal{A} = \{ \]
\[ hodas, tam, erlinger, \ldots \]
\[ hibrow, thepress, \ldots \]
\[ bud, corona, \ldots \]
\[ \$0.01, \$0.02, \ldots \]
\[ \} \]

\[ \mathcal{F} = \{ \} \]

\[ \mathcal{P} = \{ \]
\[ likes, frequents, serves, \]
\[ \div, <, \leq, \ldots \]
\[ \} \]
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