

1. Queries in Predicate Logic and in SQL

Suppose there is a database with the schema of the lecture $\mathbf{R} = \{\text{Movie}, \text{Schedule}\}$, which contains the relations

Movie: title, director, actor Schedule: theater, title

Consider the following queries:

1. Which theaters show some movies directed by Polanski?
2. Which theaters do not show any movies directed by Polanski?
3. Which theaters show only movies directed by Polanski?
4. Which theaters show all movies directed by Polanski?

1. Queries in Predicate Logic

A predicate logic formula $\varphi(x)$ with free variable x can be seen as specifying the collection of objects x satisfying $\varphi(x)$. From this point of view, the formula

$$\exists y (\text{Schedule}(y, x))$$

specifies all objects x for which there exists an object y such that the pair (x, y) is in the relation `Schedule`. Intuitively, our formula specifies the “titles of films that are currently on schedule”.

Of course, to find these objects we have to know which pairs are in the relation `Schedule`. If a database contains an instance for the relation `Schedule`, then the set of all x satisfying the above formula with respect to the instance is well defined.

To clearly indicate the free variables of a formula, we will use the set notation

$$\{x \mid \varphi(x)\}, \tag{1}$$

which we read as “which are the x such that $\varphi(x)$?”

Express all the queries above with predicate logic formulas like in (1).

2. Queries in SQL

Express the same queries in SQL.