CSE 191 Recitation

2/20/23 - 2/25/23 - Predicate and Quantifiers

Predicates

A **predicate** is a function of one or more variables that returns either TRUE or FALSE (but not both).

The **domain of discourse** of a variable is the set of all possible values that variable can take.

Predicate Examples

Let ***P*(*x*, *y*): *x*** likes ***y***, where:

the domain of ***x*** is {people in this room}

the domain of ***y*** is {all movies}

Which of the following are propositions:

***P*(*x*, "Hitch")**

***P*(Ethan, "Mean Girls")**

***P*(Doniyor, "Forrest Gump")**

***P*(The TA, "Monopoly")**

Quantifiers

Quantification expresses the extent to which a predicate is true over a range of elements. For example, in English: all, some, none, many, few, …

The **universal quantifier**, $\forall$, states that a predicate is true for all elements of the domain of the bound variable. ie $\forall x\, P(x)$ is the proposition that $P(x)$ is TRUE for all possible values of x. The possible values of x are defined by the domain of P

The **existential quantifier**, $\exists$, states that a predicate is true for some element of the domain of the bound variable. ie $\exists x\, P(x)$ is the proposition that $P(x)$ is TRUE for some possible value of x.

Quantifier Examples

Let $P(x, y)$: x likes y, where:
the domain of x is {people in this room}
the domain of y is {all movies}

For each of the following, what are the domains of each variable, translate to english, determine the truth value:

$$\exists a\ P(a, \text{"Hitch"})$$

$$\exists x\ \forall y\ P(y, x)$$

$$\exists y\ \ \forall x\ (P(\text{The TA}, y) \land ((x \neq \text{The Ta}) \rightarrow \neg P(x, y)))$$

$$\exists x\ \ \exists x'\ \ \forall y\ ((x \neq x') \land (P(x, y) \leftrightarrow P(x', y)))$$

$$\forall x\ (P(x, \text{"Star Wars"}) \oplus P(x, \text{"Star Trek"}))$$

Quantifier Examples

Let ***P*(*x*, *y*): *x*** likes ***y***, where:
the domain of ***x*** is {people in this room}
the domain of ***y*** is {all movies}

For each of the following, translate them to a symbolic form:

Someone in this room likes all movies

Someone in this room doesn't like any movies

At least three people in this room like "Mean Girls"

If the TA likes a movie, so does everyone else in the room

If someone likes "Iron Man" then they don't like "Batman"