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0.1 Writing first-order logic

0.1.1 Existential quantifier

We introduce a shorthand for “at least one term satisfies a predicate”, that is:

$P(x_0) \vee P(x_1) \vee P(x_2) \vee P(x_2) \vee P(x_3)\ldots$

The short hand is:

$\exists x P(x)$

0.1.2 niversal quantifier

We introduce another shorthand, this time for:

$P(x_0) \wedge P(x_1) \wedge P(x_2) \wedge P(x_2) \wedge P(x_3)\ldots$

The shorthand is

$\forall x P(x)$

0.1.3 Free and bound variables

A bound variable is one which is quantified in the formula. A free variable is one which is not. Consider:

$\forall x P(x, y)$

In this, x is bound while y is free.

Free variables can be interpreted differently, while bound variables cannot.

We can also bind a specific variable to a value. For example 0 can be defined to be bound.

0.1.4 Ground terms

A ground term does not contain any free variables. A ground formula is one which only includes ground terms.

$\forall x\ x$ is a ground term.

$\forall x P(x)$ is a ground formula.