Predicate Logic
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**Definition:** Let $x$ be a variable with domain $D$. A *predicate* $P(x)$ is a statement that has a truth value (True or False) for each value of $x$ in $D$.

**Definition:** the *universal quantification of $P(x)$* is the proposition:

$P(x)$ is True for all values of $x$ in the domain of $x$. This is denoted by the notation $\forall x \ P(x)$, which is read “for all $x$, $P$ of $x$” (or “for every $x$, $P$ of $x$).

**Definition:** the *existential quantification of $P(x)$* is the proposition:

There exists an element in the domain of $x$ such that $P(x)$ is true. This is denoted by the notation $\exists x \ P(x)$, which is read “there exists an $x$ such that $P(x)$ is true.”
DeMorgan's Laws for Quantifiers

\[ \neg \exists x \, P(x) \equiv \forall x \, \neg P(x) \]

\[ \neg \forall x \, P(x) \equiv \exists x \, \neg P(x) \]