\[ Q(x) = "x \text{ likes to play cricket}" \]

\[ \exists x \in D \text{ s.t. } Q(x) \text{ is } F \text{ since all values } x \text{ make } Q(x) \text{ } F \]

(\text{truth set is empty})

\[ \forall x \in D, \overline{Q(x)} \text{ is } T \text{ since predicate all values of } x \text{ make } \overline{Q(x)} \text{ } T \]

All men like to play golf. \hspace{1cm} P(x) = "x \text{ likes to play golf}"

\[ \forall x \in D, \ P(x) \]

\[ \rightarrow \text{ set of all men} \]

but if \[ D = \text{ set of all people} \]
\( \forall x \in D, \ M(x) \rightarrow G(x) \)

\[ \begin{array}{c|c|c}
M & G & \rightarrow \\
--- & --- & --- \\
T & T & T \\
T & F & F \\
F & T & T \\
F & F & T \\
\end{array} \]

\( M(x) = \text{x is a man} \)

\( G(x) = \text{x likes to play golf} \)

All men like to play golf = For all people x, if x is a man, then x likes to play golf

"universal conditional"

All turtles lay eggs.

\( D = \text{set of all animals} \)

\( T(x) = x \text{ is a turtle} \)

\( E(x) = x \text{ lays eggs} \)

\( \forall x \in D, \ T(x) \rightarrow E(x) \)

\[ \begin{array}{c|c|c}
T & E & \rightarrow \\
--- & --- & --- \\
T & T & T \\
T & F & F \\
F & T & F \\
F & F & F \\
\end{array} \]

Some turtles lay eggs

\( \exists x \in D \text{ s.t. } T(x) \land E(x) \)

\[ \begin{array}{c|c|c|c}
T & E & \land \\
--- & --- & --- \\
T & T & T \\
T & F & F \\
F & T & F \\
F & F & F \\
\end{array} \]
An apple is good for you. Apples are good for you.

"Implicit quantification"

∀x ∈ D, A(x) → G(x)  
A(x) ∈ x is an element of a set of foods 
G(x) = x is good for you.

Nelson likes to play a game

Nelson likes to play some game

There is some game that N likes to play.

∃x ∈ D, R(N, x)  
R(γ, x) = γ likes to play x
No man may hinder me.

\( \forall x, \sim H(x) \) \quad H = \text{man may hinder me} \\
All men may not hinder me

\( \sim \forall x, H(x) \) \quad \text{It is not the case that all men may hinder me.} \\
\exists x \text{ s.t. } \sim H(x) \quad \text{Some man may hinder me} \\

\exists x \text{ s.t. } \sim G(x) \quad \text{Someone likes to play golf} \\
\sim (\exists x \text{ s.t. } G(x)) \quad \text{Everyone doesn't like to play golf} \\
\exists x, \sim G(x) \quad \text{No one likes to play golf}
\( D = \{ 0, n, A, 6, c \} \)

\( \forall x \in D, \, g(x) \equiv g(0) \land g(n) \land g(A) \land g(6) \land g(c) \)

\( \neg (\forall x \in D, \, g(x)) \equiv \neg \left[ \right. \) 

\( \equiv \neg g(0) \lor \neg g(n) \lor \neg g(A) \lor \ldots \)

\( \equiv \exists x \in D \text{ s.t. } \neg g(x) \)

\( \exists x \in D, \, g(x) \equiv g(0) \lor g(n) \lor g(A) \lor g(6) \lor g(c) \)

\( \neg (\exists x \in D, \, g(x)) \equiv \neg \left[ \right. \) 

\( \equiv \neg g(0) \land \neg g(n) \land \neg g(A) \land \ldots \)

\( \equiv \forall x \in D, \, \neg g(x) \)
<table>
<thead>
<tr>
<th></th>
<th>golf</th>
<th>mini-golf</th>
<th>cricket</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>d</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>e</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Someone likes to play every game.

There is one person; that person likes every game.
For every game, there's a person who likes it.

\( R(x, y) \leq x \) likes to play \( y \)

\[
\exists x \forall y, \ R(x, y) \equiv F
\]

\[
\forall y \exists x, \ R(x, y) \equiv T \quad \text{since}
\]
\[\exists x, R(x, \text{golf}) \text{ is } T\]

since \( R(m, \text{golf}) \text{ is } T \)

\[\exists x, R(x, \text{mini-golf}) \text{ is } T\]

since \( R(a, \text{mini-golf}) \text{ was } T \)

\[\exists x, R(x, \text{cricket}) \text{ is } T\]

since \( R(a, \text{cricket}) \text{ is } T \)

\[\forall y, R(a, y) \text{ is } F \rightarrow \text{since } R(a, \text{golf}) \text{ is } F\]

\[\forall y, R(a, y) \text{ is } F \rightarrow \text{since } R(ca, \text{golf}) \text{ is } F\]

\[\vdots\]

\[\exists x \text{ s.t. } \forall y, \neg R(x, y)\]