ID:_____   Name:_____

1. Quantifications:

To create a proposition from a propositional function, we can use __quantification__, which

express that a predicate is true over a range of elements. In English, __all__ , __some__ , __many__ ,

__none__ , and __few__ are used for quantifications.

All students are here.

Some people wear blue today.

2. The Universal Quantifier '∀':

'∀x' means __for all x / for each x (in the domain)__.

The **universal quantifications** of $P(x)$, denoted by the notation __∀x P(x)__ , is the

statement __P(x) for all value of x in the domain__

and '∀$xP(x)$' is read as __for all x, p(x).__ .

An element for which $P(x)$ is **false** is called a __Counterexample__ to ∀$xP(x)$.

3. If $N(x)$ is ''Computer x is connected to the network'' and the domain consists of all

computers on campus. What does the statement '∀$xN(x)$' mean?

∀x N(x) means " for every computer x on campus, the
computer x is connected to the network"

or " Every computer on campus is connected to
the network"

4. Let $P(x)$ be ''$x + 1 > x$''. What is the truth value of '∀$xP(x)$', where the domain consists of

all real numbers?

∀xp(x) means " for all real number x , $x+1 > x$ "
and it is true. (∀xp(x) is true)

5. Determine the truth value of '$\forall x(x^2 > 0)$'.

This means "for all x, x^2 is greater than 0".

This is not true, because when $x=0 \Rightarrow x^2=0$

↑
counterexample

and this statement is false

6. The Existential Quantifier '$\exists$':

'$\exists x$' means "There exists an x (in the domain)"

The **existential quantifications** of $P(x)$, denoted by the notation $\exists x\, P(x)$, is the statement there exists an element x in the domain such that $P(x)$ and

'$\exists x P(x)$' is read as there exists an x such that $P(x)$.

• There is at least one x

7. • For some x,

Statement	When Ture?	When False?
$\forall x P(x)$	$P(x)$ is true for all x	There is an x for which $P(x)$ is false
$\exists x P(x)$	There is an x for which $P(x)$ is true	$P(x)$ is false for all x

8. What is the meaning of '$\exists x(x > 3)$' when the domain consists of all real number?

$\exists x (x>3)$ means "there exists a real number x such that $x>3$"

$x>3$ ↓ propositional function

9. What is the truth value of '$\exists x(x > 3)$'?

From 8, we have the proposition $\exists x (x>3)$ and it is true.