Section 1.4: Predicates and Quantifiers

The concept of a Predicate

A predicate, denoted as P(x), is a statement that incorporates a variable x such that when x is replaced the a value, the predicate is either true or false.



Let P(x) be the predicate for "x is even".

Let
$$x = 2$$
, 17, 22.

P (2):

P (17):

P (22):

Let P(x) be the predicate for "x > 15".

Let
$$x = 4$$
, 11, 15.

P (4):

P (11):

P (15):

Let $D = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Which elements satisfy each predicate and predicate negation?

Predicate

Values of D

Negated Predicate

Values of D

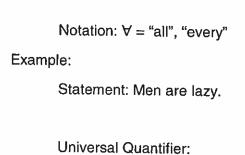
 $x \ge 8$

(x > 5 and x is even)

 $x \ge x^2$

Quantifiers (Definitions and Symbols)

A universal quantifier are words such as "all" and "every" that are added to a statement to make a statement true for every instance.



An existential quantifier are words such as "there exists" and "some" that are added to statements to make a statement true for at least one instance.

Notation: \exists = "Some", "there exists"

Example:

Statement: Sharks attack humans.

Existentially Quantified:

The symbol \in indicates membership in a set.

Example:

 $n \in D$: "n is an element in set D."

Example: $D = \{5, 10, 15, 20, 25\}.$

 \forall n \in D, n < 20. True or False?

 \forall n \in D, (n < 5) \lor (n is a multiple of 5). True or false?

Example: $D = \{-2, -1, 0, 1, 2\}$.

 \exists n \in D, n \ge -2. True or False?

 \forall n \in D, n > -2. True or False?

 \forall n \in D, (n > -3) \land (n < 3). True or False?

 $\exists \ n \in D$, $(n > 10) \lor (n \le -2)$. True or False?