

Lecture 5

27 August 2021 10:03

Predicates and Quantifiers

Predicate denotes the **property that the subject of the statement can have.**

Proposition

A declarative sentence which is true or false but not both.

$$x^2 \geq 10$$

x
subject
or
variable

$$x^2 \geq 10$$

Property
Predicate
 P

$P(x)$

Propositional
function

$$P(2): 2^2 \geq 10 \text{ False,}$$

Proposition ✓

$$P(4): 4^2 \geq 10 \text{ True,}$$

Proposition ✓

By assigning a value to variable
 $x \in \{2, 4, 6, 8, \dots\}$

$R(x)$: x is responding through Polling. \rightarrow Not Proposition

$R(\text{Nivedita Rai})$: True

$R(\text{Ripu Bhuyan})$: False

Q10. Let $P(x)$ denote the statement " $x \leq 4$ ", then truth value of

Q10. Let $P(x)$ denote the statement " $x \leq 4$ ", then truth value of

- (i) $P(0)$ $0 \leq 4$ True
 (ii) $P(6)$ $6 \leq 4$ False

(iii) $P(4)$ $4 \leq 4$ True.

Q11. State the value of x after the statement if $P(x)$ then $x := 1$ is executed, where $P(x)$ is the statement " $x > 1$ ", If the value of x when this statement is reached is

(A) $x = 0$

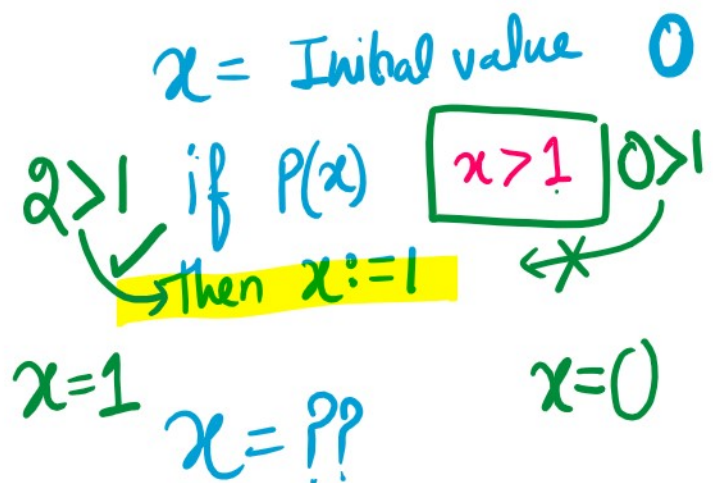
Ans. 0

(B) $x = 1$

Ans 1

(C) $x = 2$

Ans 1



Quantifier

Quantification expresses the extent to which a predicate is true over a range of elements.

all, many, few, some, none $x \in K20BE$

$P(x)$: x is able to do questions on Truth Tables.

$P(x)$: x is able to do questions involving equivalence laws.

All students of K20BE are able to do —

$Q(x)$: x is able to do questions involving equivalence laws.

Some students are able to do —

- **Universal Quantifier**

It tells us that the predicate is true for every element under consideration.

If a property is true for all values of a variable in a particular **domain**, called **domain of discourse** or **universe of discourse**. Such a statement is expressed using universal quantifier.

$\forall x$ $P(x)$
↓
universal quantifier

read as for all x , $P(x)$ is true
or
for every or everyone or
for arbitrary, given any

Counter Example: The value of x for which property is not true, is known as Counter Example.

- **Existential Quantifier**

It tells us that there is one or more element under consideration for which the predicate is true. If a property is true for few elements.

Some / Few / at least one / one or more



$\exists x Q(x)$ read as There exists an element for which $Q(x)$ is true.

Existential Quantifier.

Q11. Determine the truth values of each of these statements if the domain consists of all real numbers

(A) $\exists n (n = -n)$

Example $0 = -0$ True

(B) $\forall x (x^2 \geq x)$

Counter example $(0.1)^2 = 0.01 < 0.1$ False

(C) $\exists x (x^4 < x^2)$

$(0.1)^4 < (0.1)^2$ True

Existential Quantifier

(D) $\forall x (x^2 + 2 \geq 1)$

Universal Quantifier

True.

(E) $\exists x (x^2 \neq x)$

$2^2 \neq 2$

True

find for false

find for True