Lecture 5

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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

$P(2)$: $2^2 \geq 10$ False, Proposition ✓

$P(4)$: $4^2 \geq 10$ True, Proposition ✓

By assigning a value to variable

$x \in$ K20BE

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

R(Nivedita Rai): True

R(Ripu Bhusan): 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

x = Initial value 0

$2 > 1$ if $P(x)$ $\boxed{x > 1}$ $0 > 1$

then $x := 1$

$x = 1$ $x = ??$ $x = 0$

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 on ...

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.

$\forall x\ P(x)$ read as for all x, $P(x)$ is true

universal quantifier

or for every or everyone or for arbitrary, given any

<u>Counter Example:</u> 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 / atleast 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) $\exists n\ (n = -n)$

$0 = -0$ True

Example

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

$(0.1)^2 = 0.01 \ngtr 0.1$ False

Counter example

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

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

Existential quantifier

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

True

Universal Quantif

find for false

find for True

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

$2^2 \neq 2$

True