**UNIVERSITY OF GHANA**

**DEPARTMENT OF COMPUTER SCIENCE**

**DCIT 105: Mathematics for IT Professionals**

**Assignment II**

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**Question 1**

Let P(x) be the statement “the word x contains the letter a.”

What are the truth values of the following? [4 marks]

1. P(orange)
2. P(lemon)
3. P(true)
4. P(false)

***Answer***

1. True
2. False
3. False
4. True

**Question 2**

State the value of x after the statement if P(x) then x: x= 1 is executed, where P(x) is the statement “x > 1,”

Given that the value of x when this statement is reached is [3marks]

**a)** x = 0

1. x = 1
2. x = 2

***Answer***

1. 0
2. 0
3. 1

**Question 3**

Let P(x) be the statement “x spends more than five hours every weekday in class,” where the domain for x consists of all students. Express each of these quantifications in English. [4 marks]

**a)** ∃x P(x)

1. ∀x P(x)
2. ∃x ¬P(x)
3. ∀x ¬P(x)

***Answer***

1. Some student spends more than five hours every weekday in class.
2. All student spends more than five hours every weekday in class.
3. Some student does not spend more than five hours every weekday in class.
4. All student does not spend more than five hours every weekday in class.

**Question 4**

Let Q(x) be the statement “x 2x”. If the domain consists of all integers, what are these truth values?

**a)** Q (1)

1. ∃x Q(x)
2. ∀x Q(x)
3. ∃x ¬Q(x)
4. ∀x ¬Q(x)

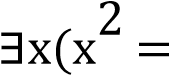
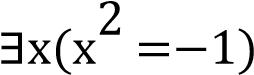
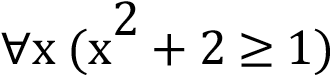
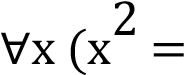
***Answer***

1. False
2. True
3. False
4. True
5. False

[5 marks]

**Question 5**

Determine the truth value of each of these statements if the domain of each variable consists of all real numbers. [4 marks]

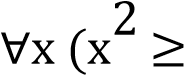
1.  2)
2. 
3. 
4.  x)

***Answer***

1. False
2. False
3. True
4. False

**Question 6**

Find a counter example, if possible, to these universally quantified statements, where the domain for all variables consists of all integers. [4 marks]

1.  x)
2. 

***Answer***

1. {-1,2,3,4}
2. {}
3. {0}

**Question 7**

Show that ∃x(P(x)∨Q(x)) and ∃x P(x)x Q(x) are logically equivalent. [3 marks]

***Answer***

{Car, Carpet, Container, Candle, Carpenter}

P(x) = word containing a

Q(x) = words containing r

P(x)∨Q(x) = {Car, Carpet, Container, Candle, Carpenter}

∃x(P(x)∨Q(x)) = {Car, Carpet, Container, Candle, Carpenter}

∃x P(x)= { Candle }

∃x Q(x)= {Car, Carpet, Container, Carpenter}

∃x P(x)x Q(x) = {Car, Carpet, Container, Candle, Carpenter}

**Question 8**

What are the truth values of these statements? [3 marks]

* 1. ∃!x P(x)→∃x P(x)
  2. ∀x P(x) → ∃!x P(x)
  3. ∃!x ¬P(x)→ ¬∀x P(x)

***Answer***

1. False
2. True
3. False