	<b>Alexandria Higher Institute of Engineering &amp; Technology (AIET)</b>	
	<b>Computer Engineering (CE) Department</b>	<b>2<sup>rd</sup> Year</b>
	<b>MAT 171</b>	<b>Introduction to Discrete Mathematics</b>
	<b>Instructor</b>	<b>Dr Fatma Ahmed</b>
		<b>I<sup>st</sup> Semester, 2018-2019</b>
		<b>Sheet (3)</b>

### Sheet (3)

### The Logic of Quantified Statements

#### **Question 1:**

Let  $R(m, n)$  be the predicate “If  $m$  is a factor of  $n^2$  then  $m$  is a factor of  $n$ ,” with domain for both  $m$  and  $n$  being the set  $Z$  of integers.

- Explain why  $R(m, n)$  is false if  $m = 25$  and  $n = 10$ .
- Give values different from those in part (a) for which  $R(m, n)$  is false.
- Explain why  $R(m, n)$  is true if  $m = 5$  and  $n = 10$ .
- Give values different from those in part (c) for which  $R(m, n)$  is true.

#### **Question 2:**

Find the truth set of each predicate.

- predicate:  $6/d$  is an integer, domain:  $Z$
- predicate:  $6/d$  is an integer, domain:  $Z^+$
- predicate:  $1 \leq x^2 \leq 4$ , domain:  $R$
- predicate:  $1 \leq x^2 \leq 4$ , domain:  $Z$

#### **Question 3:**

Let  $R$  be the domain of the predicate variables  $a, b, c$ , and  $d$ . Which of the following are true and which are false? Give counterexamples for the statements that are false.

- $a > 0$  and  $b > 0 \Rightarrow ab > 0$
- $a < 0$  and  $b < 0 \Rightarrow ab < 0$
- $ab = 0 \Rightarrow a = 0$  or  $b = 0$
- $a < b$  and  $c < d \Rightarrow ac < bd$

#### **Question 4:**


Find Counterexamples to show that the following statements are false :

- $\forall$  positive integers  $m$  and  $n, m \cdot n \geq m + n$ .
- $\forall$  real numbers  $x$  and  $y, x + y = x + y$ .
- $\forall x \in R, x > 1/x$ .
- $\forall a \in Z, (a - 1) / a$  is not an integer.

#### **Question 5:**

Write negations for each of the following statements:

- $\forall$  fish  $x, x$  has gills.
- $\forall$  computers  $c, c$  has a CPU.
- a movie  $m$  such that  $m$  is over 6 hours long.
- a band  $b$  such that  $b$  has won at least 10 Grammy awards.

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**Question 6:**

Indicate whether the following arguments are valid or invalid. Support your answer by drawing diagrams.

- (a) All dogs are carnivorous.  
Felix is not a dog.  
 $\therefore$  Felix is not carnivorous.
- (b) All people are mice.  
All mice are mortal.  
 $\therefore$  All people are mortal.
- (c) All honest people pay their taxes.  
Darth is not honest.  
 $\therefore$  Darth does not pay his taxes.
- (d) All discrete mathematics students can tell a valid argument from an invalid one.  
All thoughtful people can tell a valid argument from an invalid one.  
 $\therefore$  All discrete mathematics students are thoughtful

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