TUTORIAL 1

BIDM 313 • Discrete Mathematics

Department	:	Faculty of Information & Communication Technology
Program/Class	:	BSIT Y3S1, BSBT Y3S1, BSSM Y3S1
Semester	:	1
Commence Date	:	**(Week 1)**
Deadline Date	:	**(Week 1)**
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Questions & Instructions:

1. Proofs

   Using the applicable methods, prove the below statements

   a. If $(3n)^2$ is even the n is even

   b. $x \times y$ is odd if and only if x and y are odd

   c. If x and y are even numbers then, 4 divides $(x-y)^2$

2. Mathematical Induction

   Use mathematical induction to prove that

   a. $1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n(n+1)(2n+1)}{6}$

   b. $n^3 + 2n$ is divisible by 3

   c. $3^n > n^2$ for all $n > 2$

   d. $n! > 2^n$ for all $n \geq 4$

3. Quantifiers
   a. Let $Q(x,y,z)$ denote the statement $x^2+y^2=z^2$. What is the truth value of the value of $Q(3,4,5)$? What is the truth value of $Q(2,2,3)$? How many values of (x,y,z) make the predicate true?
   b. Let $P(x)$ be the predicate "x must take a discrete mathematics course" and $Q(x)$ be the predicate "x is a computer science student". The universe of discourse for both $P(x)$ and $Q(x)$ is all LUCT students.
      i. Express the statement "Every computer science student must take a discrete mathematics course".
      ii. Express the statement "Everybody must take a discrete mathematics course or be a computer science student".
   c. What is the truth value of $\forall x \forall y\left(\left(x<y\right)\rightarrow\left(x^2<y^2\right)\right)$? Consider that the domain of discourse for x and y are elements of $\Re$.

4. Conditional Propositions and Logic Equivalence
   a. Proposition p: Thabo is smart
      Proposition q: Thabo is honest
      Construct the following
      i. Thabo is not smart but is honest
      ii. Either Thabo is smart, or she is not smart but honest
      iii. If Thabo is smart, then she is not honest
   b. Using a truth table show that the following is a tautology
      $\left(\left(t\rightarrow w\right)\wedge \sim w\right)\rightarrow \sim w$
   c. Prove the following
      i. $\neg(p\vee(\neg p\wedge q))\equiv\neg p\wedge -q$
      ii. $\left(p\wedge q\right)\rightarrow\left(p\vee q\right)\equiv T$