LIMKOKWING UNIVERSITY OF CREATIVE TECHNOLOGY

LESOTHO

TUTORIAL 1.1

BIDM 313 • Discrete Mathematics

Department	:	Faculty of Information & Communication Technology
Commence Date	:	**(Week 2-3)**
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Questions & Instructions:

1. Using definitions prove that $(q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a tautology
2. In the questions below suppose $P(x, y)$ is a predicate and the universe for the variables x and y is $\{1, 2, 3\}$. Suppose *P(1,3), P(2,1), P(2,2), P(2,3), P(2,3), P(3,1), P(3,2)* are true and otherwise false. Determine the truth values of the following
   a. $\forall x \exists y P(x, y)$
   b. $\exists x \forall y P(x, y)$
   c. $\neg \exists x \exists y (P(x, y) \wedge \neg P(x, y))$
3. Answer the below questions using direct proofs.
   a. If x is an even number, then x^2 is even.
   b. If x is an odd integer, then $x^2 + 3x + 5$ is odd.
   c. Suppose x and $y \in \mathbb{N}$. if x and y are odd then $(x \times y)$ is odd
   d. If $n \in \mathbb{Z}$ then $5n^2 + 3n + 7$ is odd*
   e. If two integers as the same parity, then their sum is even

**** denotes complexity of proof

f. If x and y are two consecutive integers, the $a+b$ is odd

g. If two integers have opposite parity, then their sum is even

h. If n is an odd integer, then $4n^2+2n-1$ is odd

i. Let a,b and c be integers. If $a>b$ and $b>c$, then *MAX* $(a,b)-c$ is always positive*.

j. If a and b are integers, then $|a|\times|b|=|ab|$ **

4. Answer the below questions using contrapositives.

a. Let $x\in\mathbb{N}$. If $3x-15$ is odd then x is odd

b. If a and $b\in\mathbb{Z}$ then whose product is odd, then both must be odd.

c. If x^2-6x+5 is even, then x is odd.

d. Suppose $x,y\in\mathbb{R}$. If $y^3+yx^2\le x^3+xy^2$ then $y\le x$ **

e. Prove that if $5\nmid xy$ then $5\nmid x$ and $5\nmid y$ for $x,y\in\mathbb{Z}$ and $\nmid$ denotes does not divide**.

f. If $a,b\in\mathbb{Z}$ and a and b have the same parity, then $3a+7$ and $7b-4$ do not have the same parity.

g. Suppose $x\in\mathbb{Z}$, if x^3-1 is even, then x is odd.

h. Suppose $a,b\in\mathbb{Z}$. If $a^2\left(b^2-2b\right)$ is odd, then a does not divide b

5. Answer the below questions using contradictions.

a. Prove that $\sqrt{2}$ is irrational

b. Prove that a sum of two odd perfect squares is never a perfect square****.

**** denotes complexity of proof