THE UNIVERSITY OF THE WEST INDIES

Semester I ☐ Semester II ☐ Supplemental/Summer School ☐

Examination of December 2015

Originating Campus: **Cave Hill** ☐ **Mona** ☐ **St. Augustine** ☐

Mode: **On Campus** ☐ **By Distance** ☐

Course Code and Title: **COMP1210** **MATHEMATICS FOR COMPUTING**

Date: **December 18 , 2015**

Time: 1 p.m.

Duration: **2 Hours** Paper No:

Materials required:

Answer booklet: **Normal** ☐ **Special** ☐ **Not required** ☐

Calculator: *(where applicable)* **Programmable** ☐ **Non Programmable** ☐

Multiple Choice answer sheets: **numerical** ☐ **alphabetical** ☐ **1-20** ☐ **1-100** ☐

Auxiliary/Other material(s) – Please specify:

Candidates are permitted to bring the following items to their desks: Non Programmable Calculator

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Instructions to Candidates:

This paper has 4 pages & 3 questions.
The weight of the paper is 60%.
You must answer ALL questions.
You may use a non-programmable calculator.
Show all workings

Candidates are reminded that the examiners shall take into account the proper use of the English Language in determining the mark for each response.

1. (a) Consider the logical argument below:
A necessary condition for Tim to pass COMP1210 is that he study. If Tim does not watch television too often then he will study.
He passes COMP1210.
Therefore, he did not watch television too often.

It is given that

p : Tim passes COMP1210;
q : Tim study;
r : Tim watch television often.

Translate the argument into symbolic logic using the symbols defined above. Test the argument for validity.

(8 marks)

(b) Write the negation of the statement:

$\forall x, y, z \in \mathbb{R}^+$, if $x > y$ then $\frac{1}{x} < y < zx$. (4 marks)

(c) By using an example, determine the truth value of the following statement:

"For some positive integer n, if n is prime, then $n+1$, $n+2$, $n+3$ and $n+4$ are not prime. " (4 marks)

2. (a) Prove by induction that

$$7^n - 1$$

is a multiple of 6, $\forall n \in \mathbb{Z}^+$.

(8 marks)

(b) Let $U = \{x \mid -4 \leq x \leq 4, x \in \mathbb{R}\}$, $A = \{x \mid -3 < x \leq -1, x \in \mathbb{R}\}$, and $B = \{x \mid -2 \leq x < -1, x \in \mathbb{R}\}$.
Identify each of the following sets. Give your answers in interval notation:

i. $A \cap B$ (3 marks)

ii. $A - B$ (4 marks)

(c) Prove that, for any sets A and B,

$$A' - B' = B - A.$$

(5 marks)

(d) i. Define what is meant by a function f is "surjective"?

(2 marks)

ii. Let $f : \mathbb{R} - \{0\} \to \mathbb{R}$ be such that

$$f(x) = \frac{1}{x} + 1.$$

Determine whether f is bijective. Does f have an inverse? Justify your answer.

(8 marks)

3. (a) Define, clearly, what are the properties that must be satisfied for a relation R to be an equivalence relation on a set S. (6 marks)

(b) By giving an example of each, explain what is meant by a Binary operation being "commutative" and "associative". (5 marks)

(c) State the difference between "permutations" and "combinations". (3 marks)

END OF QUESTION PAPER