



THE UNIVERSITY OF THE WEST INDIES
Mona Campus

Semester I ☒ Semester II ☐ Supplemental/Summer School ☐

Mid-Semester Examinations of: October ☒ /February/March ☐ /June ☐ 2013/2014

Course Code and Title: **COMP2201 Discrete Mathematics for Computer Scientists**

Date: **Friday, October 25, 2013**

Time: **2:00 p.m.**

Duration: **1 Hour.**

Paper No: **1 (of 1)**

Materials required:

Answer booklet: Normal ☒ Special ☐ Not required ☐

Calculator: Programmable ☐ Non Programmable ☒ Not required ☐
(where applicable)

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

Auxiliary/Other material(s) – Please specify: None

Candidates are permitted to bring the following items to their desks: Pencil or pen, Ruler, ID card, Exam card

Instructions to Candidates: This paper has 2 pages & 6 questions.

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

All questions are COMPULSORY.

Calculators are allowed.

1. (a) Write the formula to find the number of integer solutions of

$$a_1 + a_2 + a_3 + a_4 = 20$$
 subject to $a_1 \geq 0, a_2 > 1, a_3 > 2, a_4 \geq 5$ [1]
- (b) In an arithmetic series, the sum of the third term and the sixth term is 45. Three consecutive terms of the same series are $4x + 27$, $2x + 26$ and $3x + 34$. If the sum of the terms in the series is 105
 - i. Find x [1]
 - ii. Find the common difference, d [1]
 - iii. Find the first term, a [1]
 - iv. Find the number of terms in the series, n [2]
2. Consider the recurrence function

$$T(n) = 8T(n/2) + \log n$$
 Give an expression for the runtime $T(n)$ if the recurrence can be solved with the Master Theorem. Assume that $T(n) = 1$ for $n \leq 1$. [5]
3. Let $f_1(x)$ and $f_2(x)$ be functions defined $f_i: \mathbb{Z}^+ \rightarrow \mathbb{R}$ where \mathbb{Z}^+ is the set of Positive integers and \mathbb{R} is the set of Real numbers. Prove the following statement

If $f_1(x) = \Theta(g_1(x))$ and $f_2(x) = \Theta(g_2(x))$, then $(f_1 f_2)(x) = \Theta((g_1 g_2)(x))$ [4]
4. (a) Use the Binomial Theorem to show that

$$\sum_{k=0}^n 2^{n-k} C(n, k) = 3^n$$
 [3]
- (b) What is the row of Pascal's triangle containing the binomial coefficients

$$\binom{5}{k}, 0 \leq k \leq 5$$
 [1]
5. (a) Cards of different colours and varied weights are placed in a bag. The Red card is three times as likely to be pulled as the Orange card and Yellow card. The Yellow card is two times as likely to be pulled as the Green and Blue cards. The Blue card is two times as likely to be pulled as the Indigo and Violet cards. Assign probabilities to the seven outcomes in the sample space. [5]
- (b) In a given town only 6 percent of all cases of domestic violence will be reported to the police. Find the probability that among 90 such cases in that town, at least two will be reported to the police. [3]
6. Solve the following question using Tree Diagrams. A four-person committee composed of Paul, Que, Rosie and Steve is to select a president, vice president, and secretary. How many selections are there in which Rosie is vice president? [3]

END OF QUESTION PAPER