



## THE UNIVERSITY OF THE WEST INDIES

Semester I ☒ Semester II ☐ Supplemental/Summer School ☐

**Mid-Semester Examinations of:** October ☒ /February/March ☐ /June ☐ **2016/2017**

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

Mode: On Campus ☒ By Distance ☐

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

Date: **Friday, October 28, 2016**

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:

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

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**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) Find the coefficient of  $x^6y^3$  in the expansion  $(x+y)^9$  [2]  
 (b) Use Pascal's triangle to compute the values of  

$$\binom{6}{3} \quad \text{and} \quad \binom{7}{5}$$
 [2]
2. Consider the recurrence function  

$$T(n) = 9T(n/3) + 4n$$
  
 Give an expression for the runtime  $T(n)$  if the recurrence can be solved with the Master Theorem. Assume that  $T(n) = 1$  for  $n \leq 1$ . [6]
3. (a) In a given university only 5 percent of the students arrive at an examination one hour before it begins. Find the probability that among 120 students in that university, at least three will arrive at an examination one hour before it begins. [3]  
 (b) If a student does not study at all for this COMP2201 Mid-term examination, the probability of passing the examination is 2%. If one studies at an average level, the probability of passing the examination is 48% whereas if study is done intensely, the probability of passing the COMP2201 Mid-term examination is 92%. The course lecturer is sure that 5% of students do not study at all, 75% of them study at an average level and 20% of them study intensely.  
 Draw the Probability Tree that represents the given scenario. [3]
4. Seven (7) marbles of different colours and varied weights are placed in a bag. The Red marble is two times as likely to be pulled as the Orange and Yellow marbles. The Orange marble is three times as likely to be pulled as the Green and Blue marbles. The Blue marble is three times as likely to be pulled as the Indigo and Violet marbles. Assign probabilities to the seven outcomes in the sample space. [5]
5. Let  $f_1(x), f_2(x), g_1(x)$  and  $g_2(x)$  be functions defined  $f_i: \mathbb{Z}^+ \rightarrow \mathbb{R}$ ,  $g_i: \mathbb{Z}^+ \rightarrow \mathbb{R}$  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  $(f_1f_2)(x) = \Theta((g_1g_2)(x))$  [4]
6. (a) Using the sequences  $y$  and  $z$  defined by  $x_n = 3^n + 1$ ,  $y_n = n(n-1)$   
 Find 
$$\left( \sum_{i=1}^3 x_i \right) \left( \sum_{i=2}^4 y_i \right)$$
 [1]  
 (b) Consider the arithmetic series:  

$$5/2 + 11/2 + 17/2 + 23/2 + \dots$$
  
 What is the smallest value of  $n$  such that  $S_n > 300$ ,  
 where  $S_n$  is the sum of the first  $n$  terms of the series? [4]

**END OF QUESTION PAPER**