

**THE UNIVERSITY OF THE WEST INDIES**

**Mona Campus**

Semester l Semester II □ Supplemental/Summer School □

**Mid-Semester Examinations of: October /February/March** □ **/June** □ **2012/2013**

Course Code and Title: **COMP2101/CS20S Discrete Mathematics for Computer Scientists**

Date: **Friday, October 19, 2012** 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.**

2

1. Assuming that the functions *f*, *g* and *h* take on only positive values, Prove or disprove the following:

*f* (*n*) (*h*(*n*)) *and g*(*n*) (*h*(*n*)), then *f* (*n*) *g*(*n*) *h*(*n*) (*h*(*n*))

# [3]

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | (a) | Consider the random experiment of tossing nine fair coins. What is the |  |
|  |  | probability that the number of heads and the number of tails differ by at |
|  |  | most 3? | **[3]** |
|  | (b) | By using the inclusion-exclusion principle |  |
|  |  | Calculate the number of bit strings of length 8 that begin with two 0s, |  |
|  |  | have seven consecutive 0s, or end with a 1 bit | **[4]** |

3. The seven “Double” dominoes of a certain pack are placed in a bag. The Double-Blank is three times as likely to be pulled as the dominoes Double-Ace, Double-Four and Double-Six. The Double-Six is two times as likely to be pulled as Double-Three and Double-Five. Double-Five is two times as likely to be pulled as Double-Deuce.

|  |  |  |
| --- | --- | --- |
| i. | Assign probabilities to the seven outcomes in the sample space | **[5]** |
| ii. | Suppose that the random variable X, is assigned the value of the digit |  |
|  | that appears when the domino is pulled. Therefore Double-Blank is |  |
|  | assigned 0, Double-Ace is assigned 2, Double-Deuce is assigned 4, |  |
|  | Double-Three is assigned 6, and so on. If the expected value is denoted by |  |

*n*

*E(X) =* *p*(*xi* ) *X* (*xi* ) where *p*(*xi*) is the probability for the event *xi*,

*i*0

|  |  |  |  |
| --- | --- | --- | --- |
| 4. | (a) | what is the expected value of X?  In a given town only 2 percent of all robberies will be reported to the | **[2]** |
|  |  | police. Find the probability that among 300 robberies in that town, at least three will be reported to the police. | **[3]** |
|  | (b) | If you study intensely the probability of passing this COMP2101 Mid-term examination is 85%, if you studied lightly the probability of passing the examination is 40%, and if you studied none at all the probability of passing is 5%. The course lecturer is sure that 60% of the students study intensely,  35% of them study lightly and 5% do not study. Given that you pass this Mid-term examination, what is the probability that you studied intensely? | **[4]** |

**Let**

**N - Study None at all**

**L - Study at Average Level/ Studied Lightly**

**I - Studied Intensely**

**C - Passing the course COMP2201**

**Given**

**P(C|I) = 0.85**

**P(C|L) = 0.40**

**P(C|N) = 0.05**

**P(I) = 0.60**

**P(L) = 0.35**

**P(N) = 0.05**

**Required P(I|C)**

**P(I|C) =**

**=**

**=**

**=**

**= 0.7816**

1. Consider the recurrence function

*T(n) = 8T(n/2) + ½n3*

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 ≤ 1*. **[4]**

1. If there are 71 students who have completed a Computer Science course and 12 possible grades that could have been attained, use the Pigeonhole Principle to show

that there is a grade that at least six students attained. **[2]**

Using the third form of the pigeonhole principle we have,

k = , where n = 71 and m = 12

=

=

= 6

**Therefore there exists a grade that at least 6 students attained.**

**END OF QUESTION PAPER**