Course Code and Title:  MATH 1029 – Discrete Mathematics

Programme:  BASc ICT

Date and Time:  Wednesday 16th April, 2014 9.00 a.m.– 12.00 p.m.  Duration: 3 hours

CAREFULLY READ ALL INSTRUCTIONS BEFORE STARTING THIS EXAMINATION

Instructions to Candidates

1.  This paper has 3 pages and 8 questions.
2.  You are required to answer ALL QUESTIONS.
3.  Please RETURN QUESTION PAPER with ANSWER SCRIPT.
4.  A Formula Sheet and Distribution Tables are provided.

Key Examination Protocol

1.  Students please note that academic dishonesty (or cheating) includes but is not limited to plagiarism, collusion, falsification, replication, taking unauthorised notes or devices into an examination, obtaining an unauthorised copy of the examination paper, communicating or trying to communicate with another candidate during the examination, and being a party to impersonation in relation to an examination.

2.  The above mentioned and any other actions which compromise the integrity of the academic evaluation process will be fully investigated and addressed in accordance with UTT’s academic regulations.

3.  Please be reminded that speaking without the Invigilator’s permission is NOT allowed.
1. Prove by Mathematical Induction that $2^n < n!$ for every positive integer $n$ with $n \geq 4$.

2. Prove the following: $A \cup (B - A) = A \cup B$.

3. Estimate the $100^{\text{th}}$ term of the Fibonacci sequence using Binet's formula.

4. A committee requires one accountant, two marketing agents and four board members. If there are four accountants, three marketing agents, and seven board members available for selection how many committees can be formed?

5. The expansion of $(3x^2 - 2y^3)^{3k-9}$ has 22 terms. What is the value of $k$? Determine the value of the coefficient of the $10^{\text{th}}$ term.

6. Use Dijkstra's algorithm to determine the shortest path from 1 to 2, 1 to 3, 1 to 4, 1 to 5 and 1 to 6 in the following graph.

7. Complete the following binary search tree.
8. Construct a binary tree for the following using an in-order method: 2, 1, 3, 4, 6, 8, 10.

Formulae

Binet’s Formula

\[ F_n = \frac{\varphi^n - (-\varphi)^{-n}}{\sqrt{5}} \]