UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

END OF SEMESTER ONE EXAMINATIONS

ACADEMIC YEAR 2024/2025

DEPARTMENT	**:**	**ICT**
YEAR OF STUDY	**:**	**ONE**
PROGRAMME	**:**	**Diploma in Computer Science (DCS)**
COURSE	**:**	**Computational Mathematics**
COURSE CODE	**:**	**CMT112**
DATE	**:**	**11th December 2024**
TIME	**:**	**9:00AM – 12:00NOON**
DURATION	**:**	**3 Hours**

INSTRUCTIONS

(a) **This paper consists of two sections A and B**
(b) **Section A carry 40 marks and is compulsory**
(c) **Attempt any THREE questions from section B**
(d) **Any number in section B carry equal marks**
(e) **Credit will be given for use of relevant examples and illustrations**
(f) **Begin each number on a new page of the answer sheet**

SECTION A (COMPULSORY) – [40 MARKS]

Question 1

(i) Determine all the permutations of letters in the word MAT. **(4 Marks)**

(ii) Determine the combinations of 3 letters taken from the word PATHS **(4 marks)**

(iii) $FA5_{Hexa}$ to binary. **(4 Marks)**

(iv) 672355_{octal} to Hexadecimal **(4 Marks)**

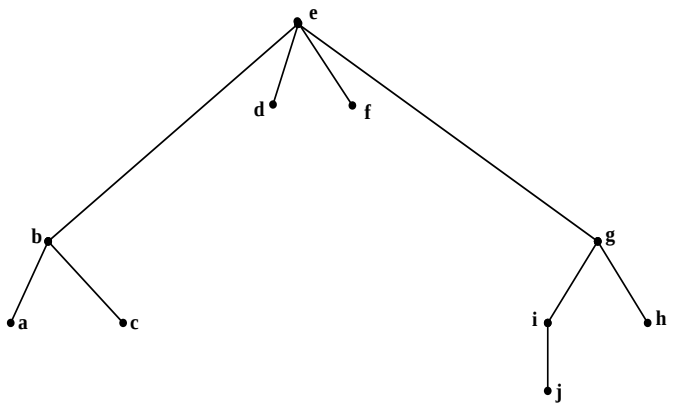
(v) Simple Graph **(2 Marks)**

(vi) Directed graph **(2 Marks)**

(vii) Evaluate ${}^5P_2$ **(4 Marks)**

(viii) Evaluate ${}^4C_2$ **(4 Marks)**

Use the tree given below to answer the following questions:



(ix) List two descendants of node g. **(2 Marks)**

(x) Determine the depth of node h. (**2 Marks)**

(xi) State one application of trees in the computing industry. **(2 Marks)**

(xii) Define a multigraph as used in graph theory. **(2 Marks)**

(xiii) Determine the number of permutations obtained from the letters of the word: "SUCCESS". **(4 Marks)**

SECTION B – [60 MARKS]

Attempt any three questions.

Question Two

(a) Show whether the propositions below are equivalent

(p ® q) Ú (p ® r) º (p Ú q) ® r **(5 Marks)**

(b) Show whether this is a tautology. **(5 Marks)**

(p Û q) Ú (p® q)

(c) Given two variables, p and q draw truth table for:

(i) OR **(4 Marks)**

(ii) AND **(4 Marks)**

(iii) NOT **(2 Marks)**

Question Three

a) Given U = { Numbers greater from 1 to 10}

A = {Odd numbers less than 10}

B = {Prime numbers between 0 and 10}

(i) Write down the bit stream representing set B **(4 Marks)**

(ii) Write down the bit stream representing set A **(4 Marks)**

(iii) Find **A - B** **(4 Marks)**

(b) Draw a K_5 bipartite graph **(4 Marks)**

(e) Given that R is a relation from A to B such that (a,b) € R if the sum of a and b is even. **(4 Marks)**

Question Four

(a) Define the term "Relation" as used in computational mathematics. **(2 Marks)**

(b) If A = { 1, 2, 3 } and B = { 2, 4 }; find the Cartesian product A X B. **(4 Marks)**

(c) Let set V be a set of vertices and A be a set of edges such that:

E = { (1,4), (1,2), (1,3), (4,3), (2,4) } and V = { 1, 2, 3, 4 }

Draw a digraph to represent the above information. **(4 Marks)**

(d) Given that R is a relation from A to B such that (a,b) € R if the sum of a and b is even

(i) Determine R **(4 Marks)**

(ii) Given p ® q, write down statements for the converse, inverse and contrapositive of the statement. **(6 Marks)**

Question Five

(a) Expand the expression $(1 + x)^3$ hence evaluate $(1.1)^3$. **(6 Marks)**

(b) In a family meeting of five members the father is supposed to sit in the middle. How many different sitting arrangements can be made, if the members sit in a straight row? **(4 Marks)**

(c) Determine the 5^{th} term of the expansion of $(1 + x)^5$ **(4 Marks)**

(d) 5 students from DCS and 4 from ITB have been recommended by the Academic Registrar to attend a Hackerthon. The sponsors have only three slots for the students. The HOD making the final list of three students to attend the Hackerthon must include a student from each of the two programs. In how many different ways can the 3 students be selected? **(6 Marks)**

Question Six

(a) Define the following terms as used in set theory

(i) Cardinality **(2 Marks)**

(ii) Empty set **(2 Marks)**

(b) UICT undertook a survey involving 170 students. 115 of the students like Chelsea (C), 110 like Arsenal (A) and 130 like Liverpool (L). 75 like C and A, 85 like C and L, while 95 like A and L.

Using Venn diagrams determine how many students like:

(i) all the three clubs **(3 Marks)**

(ii) only Arsenal **(3 Marks)**

(iii) Chelsea but not Liverpool **(3 Marks)**

(c) Using Venn diagrams show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ **(3 Marks)**

(d) Given below are vertices and the edges between the vertices:

Vertices: A, B, C, D

Edges: AB, AC, BD, CD

Construct the corresponding adjacency matrix. **(4 marks)**

END