INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2019**
Programme	:	Diploma In Information And Communication Technology (DICTN) Diploma in Information Technology (DITN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	December 9, 2019 (Monday)
Time	:	8:00am – 10:00am Reading Time : Nil
Duration	:	2 Hours

Special Instructions :

Answer any **FOUR (4)** structured-type questions.

Materials permitted :
Non-Programmable Calculator

Materials provided :
Nil

Examiner(s)	:	**Dr Ch'ng Pei Cheng**
Moderator	:	Cheng Siak Peng

*This paper consists of **6** printed pages, including the cover page*

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: AUGUST 2019 SESSION

Instruction: This question paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Rewrite each of the terms
$32.4_8 + D6.9_{16} + 697_{10} + 100111.11_2$
into binary and simplify the expression. Convert your final answer to hexadecimal. (7 marks)

(b) Using two's complement, numbers are stored on 8 bit register. Show how 140_{10} - 35_{10} would be evaluated. (5 marks)

(c) Calculate 4378 + 1298 in BCD. (7 marks)

(d) Find the 32-bit computer representation of -43.567, 8 bits are used for characteristics, and the exponent bias is 2^7-1. (6 marks)

(Total: 25 marks)

Question 2

(a) Determine the 2's complement of 11111101_2. (2 marks)

(b) Convert BCD 0010 0011 1001 to denary. (2 marks)

(c) In a group of 43 students:

23 people can write Bahasa Malaysia (BM),
25 people can write English (E),
27 people can write Mandarin (M),
13 people can write both Bahasa Malaysia and English,
14 people can write both prefer Bahasa Malaysia and Mandarin,
15 people can write both prefer English and Mandarin,
10 people can write all three languages.

Draw a Venn diagram to represent the above information. (4 marks)
Hence find the number of students who can write

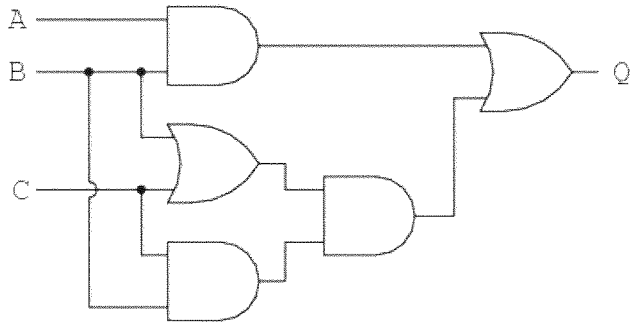
(i) one language only? (2 marks)

(ii) any two languages? (2 marks)

(iii) Bahasa Malaysia and English but not Mandarin? (2 marks)

(iv) English or Mandarin? (2 marks)

(d) Write the logic circuit representation for the below diagram.



(3 marks)

(e) Construct a truth table for the following expression. In each case, state whether the expression is tautology, a contradiction or neither.

$$[\, p \wedge (q \vee \sim r) \,] \rightarrow (\sim p \wedge q)$$

(6 marks)

(Total: 25 marks)

Question 3

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

(a) (i) Obtain a Boolean expression for X in terms of A, B, C and D based on the truth table above. (6 marks)

(ii) Simplify X by using Boolean algebra. (5 marks)

(iii) Simplify X by using Karnaugh Map. (4 marks)

(b) Draw a logic circuit for the expression X:

$$X = (\overline{(AB)} + C) + (A + B + \overline{C})$$ (6 marks)

(c) Use the Dijkstra's algorithm to find the shortest path between the nodes A and G in the weighted graph in Figure 1 (4 marks)

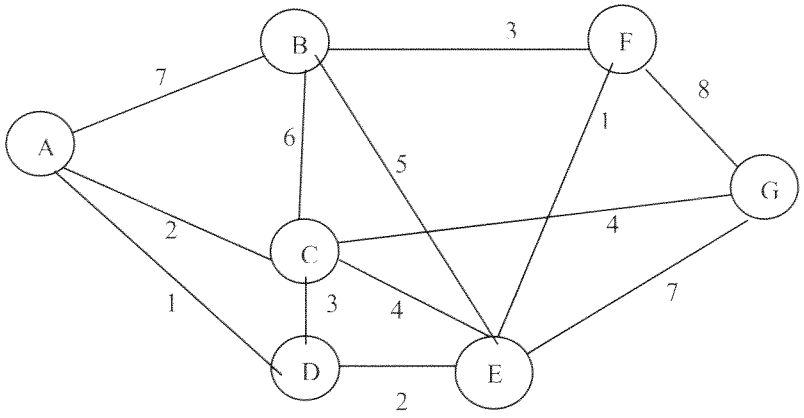


Figure 1

(Total: 25 marks)

Question 4

(a) Let the function f, g be defined as follows:

$$f: R \to R, f(x) = 5x - 3$$
$$g: R \to R, g(x) = 4x + 2$$

(i) $f \circ g$ (2 marks)

(ii) $g \circ f$ (2 marks)

(b) Given a sequence of numbers:

$$\{5, 7, 12, 1, 6, 3, 4, 10, 2\}$$

Draw a binary search tree by inserting the above numbers from left to right. (3 marks)

(c) Let set A = {1, 2, 3, 4, 5} and R is a relation on set A, where

$$R = \{(2, 3), (3, 4), (2, 1), (2, 2), (3, 3), (1, 5), (5, 2), (5,3)\}$$

(i) Represent the relation of R in a form of zero-one matrix. (4 marks)

(ii) Find R^{-1}. (3 marks)

(iii) Draw the graphical representation of R. (3 marks)

(iv) Determine whether R is a reflexive, symmetric, transitive or none of these. (3 marks)

(d) Consider the following encoding function e:

e(0,0) = 00000
e(1,0) = 10011
e(0,1) = 01100
e(1,1) = 11101

(i) Find the minimum distance of e. (4 marks)

(ii) How many errors can it detect? (1 mark)

(Total: 25 marks)

Question 5

(a) Let p and q denote respectively the propositions

p = It is hot
q = I will go swimming

Write down English sentences corresponding to the following propositions:

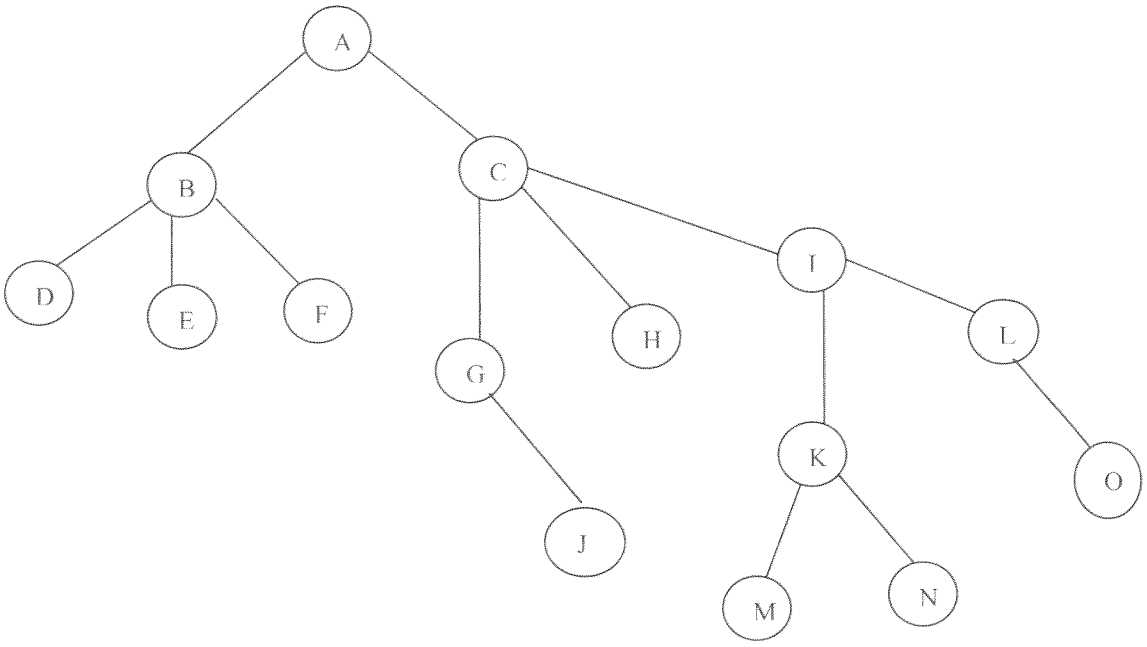
(i) $\neg p \wedge q$ (2 marks)

(ii) $p \rightarrow q$ (2 marks)

(iii) $\neg q \rightarrow p$ (2 marks)

(iv) $(p \vee \neg q) \wedge p$ (2 marks)

(b) Answer the following questions for the tree.



(i) Find the parent of I (1 mark)

(ii) Find the ancestors of G (1 mark)

(iii) Find the children of B (1 mark)

(iv) Find the descendents of J (1 mark)

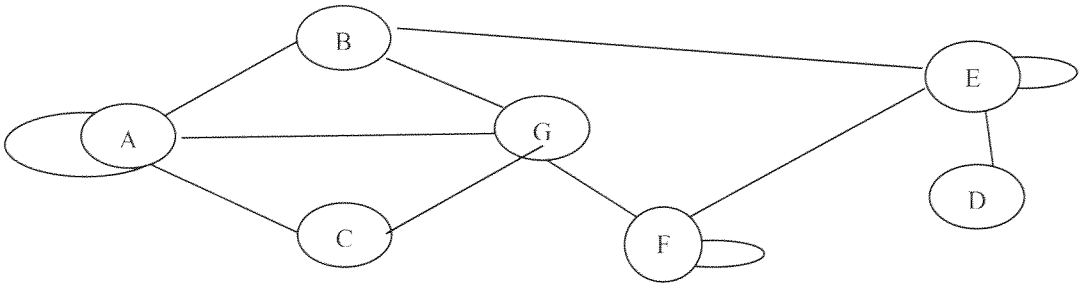
(v) Find the siblings of H (1 mark)

(vi) Find all the leaves (3 marks)

(vii) Draw the subtree rooted at K (1 mark)

(viii) What is the height of this rooted tree (1 mark)

(c) Consider the following graph. Find



(i) The number of vertices (1 mark)

(ii) The number of edges (1 mark)

(iii) The degree of each vertex and verify the Handshaking Theorem (4 marks)

(iv) The number of loops (1 mark)

(Total: 25 marks)

~The End~