INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	April 2016
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	30 July, 2016 (Saturday)
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)	:	**Foong Jin Yuan** and S.M. Elizabethrani Allappan
Moderator	:	Cheng Siak Peng

This paper consists of 7 printed pages, including the cover page

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY (DICTN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: APRIL 2016 SESSION

Instruction: This 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

$$14.36_8 + B0.21_{16} - 113_{10} - 101101.1001_2$$

into binary and simplify the expression. Convert your final answer to octal. (7 marks)

(b) Using two's complement, numbers are stored on 10 bit register. Show how 118_{10} - 201_{10} would be evaluated. (5 marks)

(c) Calculate 3291 + 5764 in BCD. (5 marks)

(d) Find the 16-bit computer representation of -30.125, 6 bits are used for characteristics, and the exponent bias is 2^5-1. (6 marks)

(e) Determine the 9's complement of 3265_{10}. (2 marks)

Question 2

(a) Determine whether the following sentences are propositions or not:

(i) 'Send your brother to hospital'.

(ii) $10 - 2(3 + 5) = 64$. (2 marks)

(b) Decode 1000001101011001 which is in 8-4-2-1 BCD. (1 mark)

(c) A survey has been conducted on 400 students on the preference of color for their sports day T-shirt:

80 prefer blue color only(B),
70 prefer red color only (R),
30 prefer yellow color only(Y),
60 prefer blue and red,
70 prefer blue and yellow,
30 prefer red and yellow,
10 prefer all three colors.

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

(i) one color only? (1 mark)

(ii) any two colors? (1 mark)

(iii) blue and yellow but not red? (1 mark)

(iv) red or yellow? (1 mark)

(d) (i) Draw a logic circuit for the following expression without simplifying it

$$\overline{X.Y} + \overline{X + Y + \overline{Z}}$$ (3 marks)

(ii) Simplify the expression in part (ii) using De Morgan's Law and Boolean Rules. (3 marks)

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

(i) $[\neg p \wedge (p \rightarrow q)] \rightarrow \neg p$ (3 marks)

(ii) $[(p \vee q) \wedge (p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow r$ (5 marks)

Question 3

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

(a) (i) Obtain a Boolean expression for Z in terms of A, B and C based on the truth table above. (2 marks)

(ii) Simplify X by using Karnaugh Map. Give two possible answers for X. (5 marks)

(b) Use the laws of logic to classify the following expression as tautology or contradiction:

$$[\neg s \wedge (s \rightarrow t)] \rightarrow \neg s$$ (4 marks)

(c) Simplify the following Boolean expression by using Boolean algebra and De Morgan's laws (6 marks)

$$\overline{A\bar{B} \cdot (A + C)} + \bar{A}B \cdot \overline{A + \bar{B} + \bar{C}}$$

(d) Prove that $a + ar + ar^2 + ar^3 + \cdots + ar^{n-1} = \frac{a(r^n-1)}{r-1}$ where $r \neq 1$ for all nonnegative integer n by using Mathematical Induction method. (8 marks)

Question 4

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

$$f: R \to R, f(x) = 5x - 3$$
$$g: R \to R, g(x) = 6x + 4$$

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

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

(b) Draw a binary search tree for the given works.

{Mahesh Kumar, Norhaslinda, Diwagar, Desmond, Reuben, Samuel, Leonard}
(4 marks)

(c) Let set A = {a, b, c} and R is a relation on set A, where R_1 = {(a, a), (b, b), (b, c), (c, c), (c, b)} and R_2 = {(a, a), (b, a), (b, c), (c, a), (c, b), (c, c)}

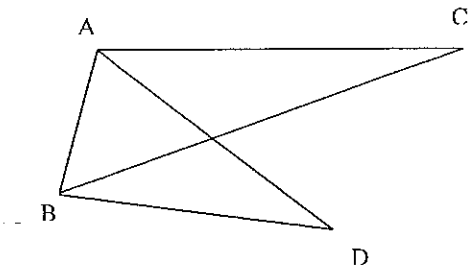
i. Represent the relation of R_1 and R_2 in a form of zero-one matrix. (4 marks)

ii. List the elements of $R_1 - R_2$, $R_1 \oplus R_2$, $R_1 \cap R_2$ and $R_1 \cup R_2$, (4 marks)

iii. Find ${R_1}^{-1}$ (2 marks)

iv. Determine whether R_1 is a reflexive, symmetric, transitive or none of these.
(3 marks)

(d) Determine the Eulerian path and Harmiltonian circuit of figure below, assuming that you start from vertex A. (4 marks)



Question 5

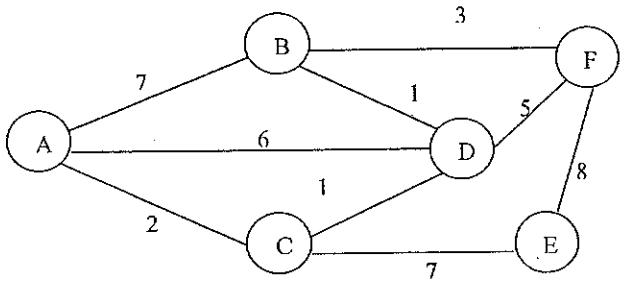
(a) Consider the following (2, 6) encoding function e:

$e(00) = 001101$
$e(01) = 011011$
$e(10) = 110011$
$e(11) = 111101$

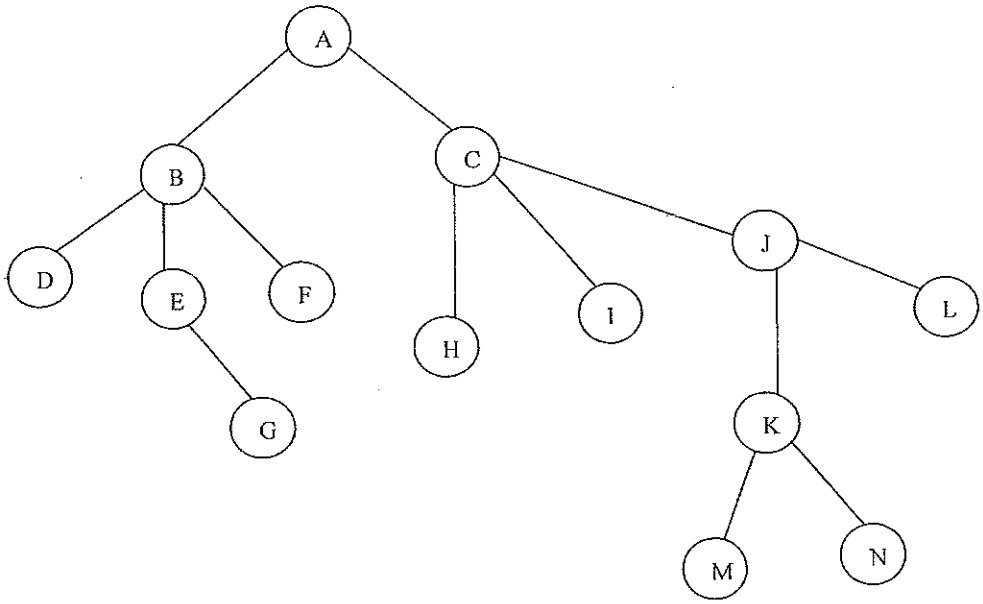
(i) Find the minimum distance of e. (4 marks)

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

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



(c) 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 C (1 mark)

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

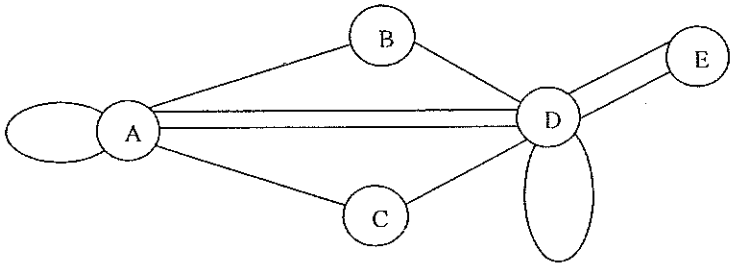
(v) Find the siblings of H (1 mark)

(vi) Find all the leaves (2 marks)

(vii) Draw the subtree rooted at J (2 marks)

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

(d) 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 (3 marks)

(iv) The number of loops (1 mark)

~ The End ~

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