INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2016**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	March 10, 2016 (Thursday)
Time	:	2.00pm – 4.00pm 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)	:	**Ms. S.M. Elizabethrani** and Ms. Foong Jin Yuan
Moderator	:	Mr. Cheng Siak Peng

This paper consists of 8 printed pages, including the cover page

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

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 of the expression

$$FA6.3_{16} + 0.125_{10} - 36.1_8$$

in binary, and simplify the expression. Convert your final answer to decimal and hexadecimal.

(7 marks)

(b) By expressing the decimal quantities 2784 and 573 in BCD, add them together and convert the BCD result to decimal.

(5 marks)

(c) Find the 24-bit computer representation of -88.828125, where 8 bits are used for the characteristic and the exponent bias is $2^7 - 1$.

(5 marks)

(d) Decode 0111 1001 0011 0101 if it is 8-4-2-1 BCD.

(2 marks)

(e) Show how 37 - 55 would be evaluated in 8-bit register using two's complement method. Justify your answer.

(6 marks)

Question 2

(a) Determine each of the following sentences is proposition. If the sentence is a proposition, write its negation.

(i) There exist integers x, y such that $x + y = 5$. (2 marks)

(ii) Paris is the capital of France. (2 marks)

(b) Let p: There is a traffic jam on the street.
q: I will be late to the office.

Show the conjunction, disjunction and conditional statement for p and q.
(3 marks)

(c) Let $p = F,\ q = T,\ r = T$. Find the truth value of the following Boolean expressions:

(i) $p \rightarrow (\neg r \leftrightarrow q \wedge p)$ (3 marks)

(ii) $(\neg p \vee r) \rightarrow (q \wedge \neg r)$ (3 marks)

(d) At a school, a survey was carried out among the 168 Secondary Two pupils to find out which of the Humanities subjects- History, Geography and Literature- they would like to take in Secondary Three. The results of the survey were tallies as follows:

35 pupils liked to take all the three subjects,
16 pupils liked to take History and literature only,
23 pupils liked to take History and Geography only,
20 pupils liked to take Literature and Geography only,
81 pupils liked to take Literature ,
118 pupils liked to take Geography,
98 pupils liked to take History.

None of the pupils indicated that they would not take any of the above subjects. Draw a clearly labeled Venn Diagram to illustrate the above information.
(3 marks)

Hence, find the number of students who indicated that they would like to take

(i) exactly two subjects,

(ii) Geography only,

(iii) Literature and Geography but not History.
(3 marks)

(e) In a beauty contest, three judges A, B and C register their votes as '0' or '1' through switches allocated to them. Contestants will be disqualified if two or more judges register '0' votes for them. Based on the truth table below, filled the output column with '0' for disqualified or '1' for qualified.

Input			*Output*
A	**B**	**C**	**Z**
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

(1 mark)

(i) Write an appropriate Boolean expression for the output 'qualified' from the truth table.

(2 marks)

(ii) Simplify the expression by using a Karnaugh map.

(3 marks)

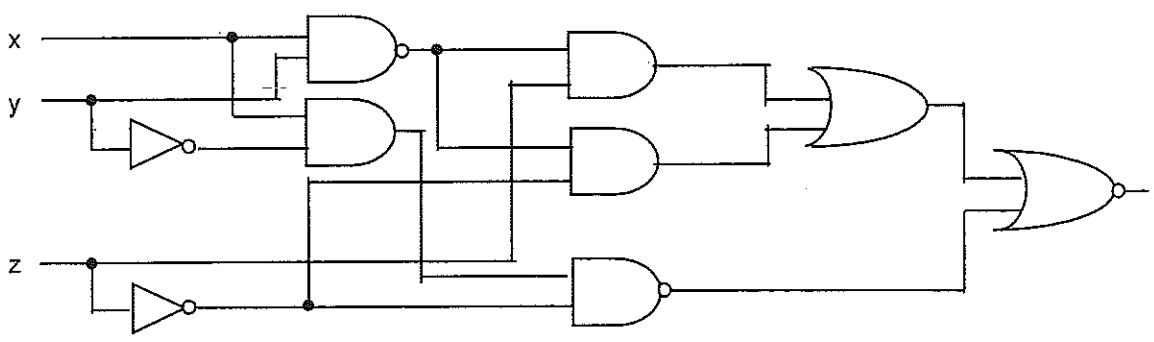
Question 3

(a) Given Y = ($\overline{\overline{A} \bullet \overline{B}} + \overline{AB}$),

(i) create a truth table for Y . (5 marks)

(ii) draw a logic network for Y without simplifying it . (4 marks)

(b) (i) Obtain a Boolean expression for the following logical network diagram. (3 marks)



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

(i) Draw a digraph that represents R. (4 marks)

(ii) Hence find R^{-1}. (1 mark)

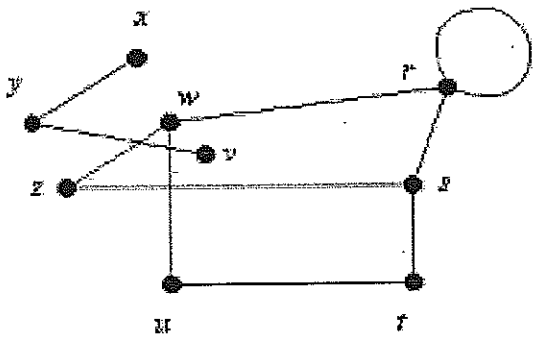
(iii) Determine whether R is symmetric, reflexive, antisymmetric and/or transitive. (4 marks)

(d) Prove using Boolean Algebra and De Morgan's Law that

$$\overline{AB \cdot (A+C)} + \overline{AB} = \overline{A} + \overline{B} \quad \text{(4 marks)}$$

Question 4

(a) Consider the following graph. Find



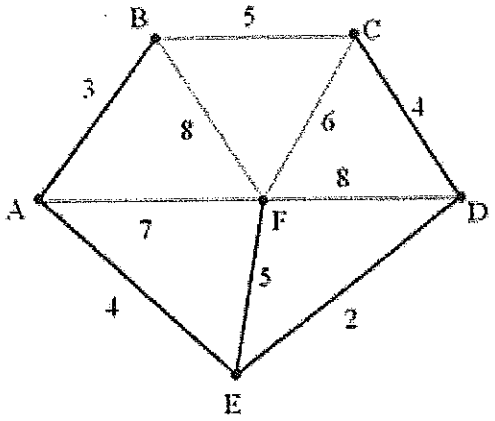
(i) the number of vertices. (1 mark)

(ii) the number of edges. (1 mark)

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

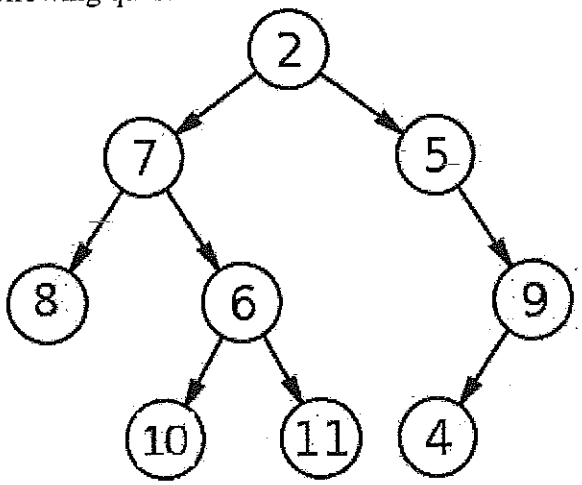
(iv) the number of loops. (1 mark)

(b) Use the Dijkstra's algorithm to find the shortest path between the nodes A and *D* in the diagram shown below:



(5 marks)

(c) Answer the following questions for the tree.



(i) Find the parent of *6* . (1 mark)

(ii) Find the ancestors of *11*. (1 mark)

(iii) Find the children of 7. (1 mark)

(iv) Find the descendents of 2. (1 mark)

(v) Find the siblings of *5*. (1 mark)

(vi) Draw the subtree rooted at 7. (1 mark)

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

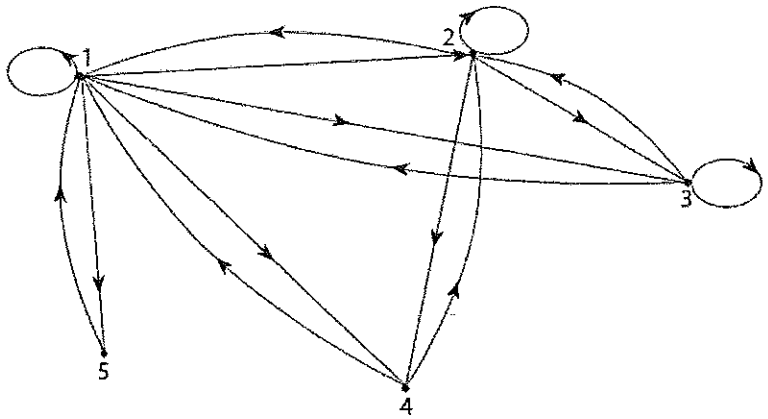
(d) Draw a binary search tree for the given words.

{Maija, Asta, Viivi, Elli, Antti, Ville, Yvjo} (4 marks)

(e) Let set $A = \{a, b, c\}$ and R is a relation on set A, where $R = \{(a, a), (b, b), (b, c), (c, c), (c, b)\}$. Determine if R is a reflexive relation on A. (2 marks)

Question 5

(a) (i) List the relation for R for the digraph given below. (2 marks)



(ii) Determine whether the relation is symmetric, anti-symmetric, and/or transitive? (2 marks)

(b) Consider the (2, 8) encoding function e,

$e(00) = 00000000$
$e(01) = 10110100$
$e(10) = 01100010$
$e(11) = 11010111$

(i) Find the minimum distance of the encoding function. (3.5 marks)

(ii) How many errors will the encoding function detect? (1.5 marks)

(c) Use mathematical induction to prove that the following statement is true for all positives integers k.

$$1+4+7+.....+(3n-2)=\frac{n\,(3n-1)}{2}$$

(5 marks)

(d) Use the Huffman coding to encode the following symbols with the frequencies listed: s1:0.5, s2:0.25, s3:0.125, s4=0.125. What is the average number of bits required to encode a symbol?

(9 marks)

(e) Consider the (8,7) parity check code, for the received word, determine whether an error will be detected.

10110101 (2 marks)

~THE END~