INTI
International College Subang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2015**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104 : Discrete Mathematics**
Date of Examination	:	March 11, 2015
Time	:	11:00am – 1:00pm Reading Time:
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,** Pradeep Isawasan.
Moderator	:	Mr. Cheng Siak Peng

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

INTI INTERNATIONAL COLLEGE SUBANG

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: JANUARY 2015 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

$$100111.11_2 + 0.09375_{10} - 36.1_8$$

in binary, and simplify the expression. Convert your final answer to decimal. (5 marks)

(b) By expressing the decimal quantities 2354 and 753 in BCD, add them together and convert the BCD result to decimal. (5 marks)

(c) If numbers are to be stored using 24 bit register in floating point format where 6 bits are allocated for the exponent in excess $2^{n-1}-1$ format, Show how –88.828125 would be stored. (5 marks)

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

(e) Show how 137 - 155 would be evaluated in 10-bit register using two's complement method. Justify your answer. (6 marks)

(f) Store decimal 0.546875 in 10 bits word using sign modulus format. (Show your working clearly) (3 marks)

Question 2

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

(i) $3+7=12$ (2 marks)

(ii) Active imagination is the foundation of a child's intellectual development. (2 marks)

(b) Let p: John is good at time management.
q: John is good at financial planning.

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:

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

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

(d) A suvey was conducted among 150 students in a private college to reveal their academic achievements for the past three semesters in the year 2004. The following are the results obtained from the survey:

42 students received excellent award in Jan semester,
36 students received excellent award in May semester,
x students received excellent award in Sept semester only,
11 students received excellent award in Jan and May semesters,
9 students received excellent award in Sept and May semesters,
13 students received excellent award in Jan and Sept semesters,
4 students received excellent award in all the three semesters.

There are 56 students who did not receive any award in the year 2004. Draw a clearly labeled Venn Diagram to illustrate the above information. (4 marks)

Hence, find the number of students who received award

i) in one semester only,

ii) in May and Jan semester. (2 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)

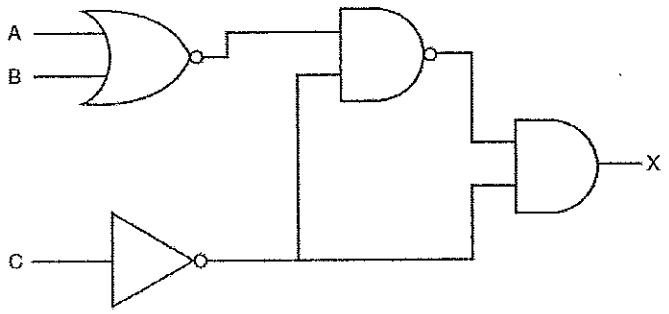
Question 3

(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) Obtain a Boolean expression for the following logical network diagram.



(3 marks)

(c) Let f and g are two functions for all real numbers x:

$$f(x) = x^3$$
$$g(x) = x - 1$$

Find $g \circ f$ and $f \circ g$. (4 marks)

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

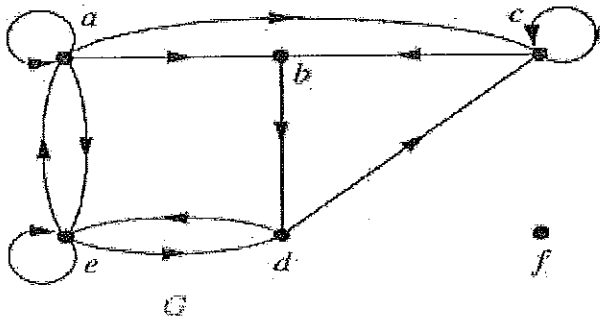
Draw a digraph that represents R. (4 marks)
Hence find R^{-1}. (1 mark)

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

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

Question 4

(a) Consider the following graph. Find



G

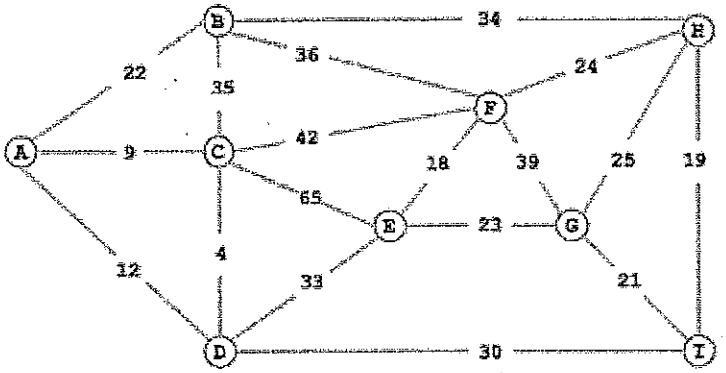
(i) the number of vertices. (1 mark)

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

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

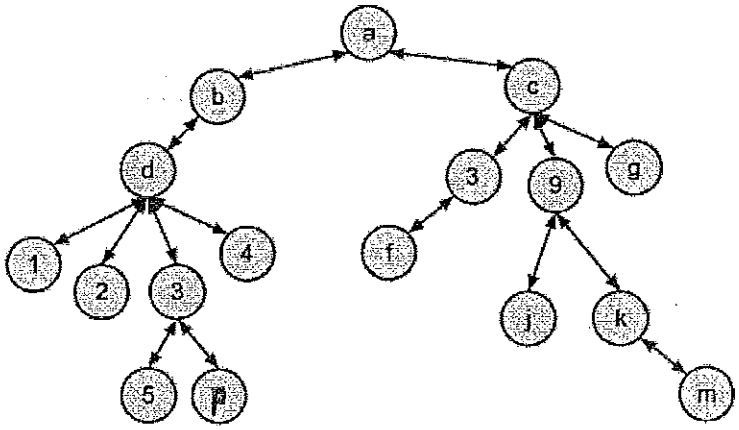
(iv) the number of loops. (1 mark)

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



(5 marks)

(c) Answer the following questions for the tree.



(i) Find the parent of f . (1 mark)

(ii) Find the ancestors of k. (1 mark)

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

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

(v) Find the siblings of j. (1 mark)

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

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

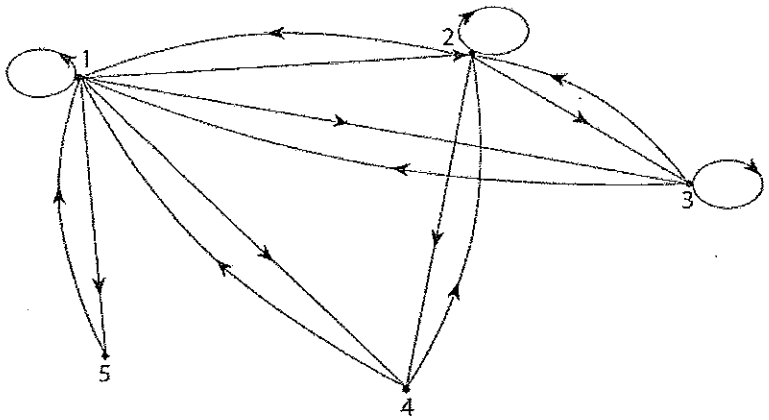
(d) Draw a binary search tree for the given number.

{15, 7, 24, 11, 27, 13, 18, 19, 9 } (4 marks)

(e) Decide whether this relation $R = \{(1,1),(1,5),(5,1),(2,2),(3,3),(4,4),(5,5)\}$ is reflexive, symmetric, antisymmetric and/or transitive. (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? Give your reason.

(6 marks)

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

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

Find the minimum distance of the encoding function. (4 marks)

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

$$1+4+7+...+(3n-2)=\frac{n(3n-1)}{2}$$ (5 marks)

(d) Use the Huffman coding to encode the following symbols with the frequencies listed: a:0.26, b:0.16, c:0.12, d=0.34, e:0.14. What is the average number of bits required to encode a symbol?

(8 marks)

-THE END-