INTI
International College Subang
LAUREATE INTERNATIONAL UNIVERSITIES*

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2013**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104 : Discrete Mathematics**
Date of Examination	:	July 29, 2013
Time	:	5:00pm – 7:00pm Reading Time:
Duration	:	2 Hours
Special Instructions	:	

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

Materials permitted :
Non-Programmable Calculator

Materials provided :
Nil

Examiner (s)	:	**Mr. Aung Min,** Kumatha Thinakaran.
Moderator	:	Dr. Ch'ng Pei Eng

This paper consists of 5 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE SUBANG

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
MAT 1104 : DISCRETE MATHEMATICS
FINAL EXAMINATION: APRIL 2013 SESSION

Instructions: 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 of the following expression in binary and simplify the expression. Convert the final answer to octal and hexadecimal.

$75.625_{10} + 100111.001_2 + 43.2_8 + 3C.4_{16}$ (8 marks)

(b) Find the 16-bit computer representations of the following integers:

(i) 1153 (3 marks)

(ii) -425 (3marks)

(c) Find the 32-bit computer representations of the decimal number ""– 0.253125", assuming 8 bits are used for the characteristic, and the exponent bias is $2^7 - 1$.
(8 marks)

(d) Perform the following calculation in BCD arithmetic:

2746+3534 (3 marks)

Question 2

(a) A Boolean expression is given as $F = \bar{x}y\bar{z} + \bar{x}yz$. Simplify this circuit using Boolean algebra. Draw the logic circuits before and after simplification. (7 marks)

(b) Find the Boolean expression for output G from the given table below. Then minimize it by using Karnaugh map. (6 marks)

x	y	z	G
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

(c) For the logic circuit in Figure Q2(c), determine the Boolean expression.

(4 marks)

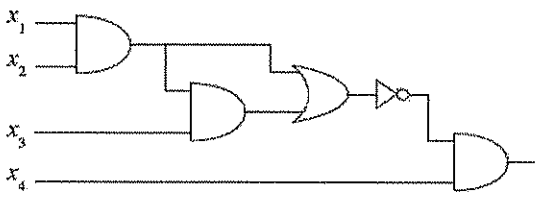

Figure Q 2(c)

(d) By using Boolean algebra and De Morgan's laws show that

$$\overline{A\bar{B}.(A+C)} + \bar{A}B.\overline{A+\bar{B}+\bar{C}} = \bar{A}+B$$ (8 marks)

Question 3

(a) Show that $[\neg p \vee (p \wedge q)] \wedge \neg q \Leftrightarrow \neg(p \vee q)$ by using logical equivalence identities.

(7 marks)

(b) Proof that "If x^2 is odd, then so is x."

(5 marks)

(c) Let p be "Sam is rich" and q be "Sam is happy". Write each of the following in symbolic form.

(i) Sam is poor and happy. (1 mark)

(ii) Sam is neither poor nor happy. (1 mark)

(iii) Sam is poor or else he is both rich and happy. (2 marks)

(d) Prove that $a + ar + ar^2 + \cdots\cdots + ar^n = \frac{ar^{n+1}-a}{r-1}$ (when r≠1) for all nonnegative integer n by using Mathematical Induction method. (9 marks)

Question 4

(a) Let A, B and C be the subsets of set U. By using set builder notation and logical equivalences, show

(i) $A - B = A \cap \bar{B}$ (4 marks)

(ii) $(A \cup B) - (C \cap \bar{A}) = (A \cup B) \cap (\bar{C} \cup A)$ (5 marks)

(b) Let S be the relation defined on $\mathbb{R}$ by $S = \{(x, y): xy \geq 0\}$.

Determine whether S is reflexive, symmetric, transitive, or none of these. Give reasons for your answers. (5 marks)

(c) Let R_1 and R_2 be the relations on {1, 2, 3, 4} given by

$$R_1 = \{(1,1),(1,2),(3,4),(4,2)\}$$
$$R_2 = \{(1,1),(2,1),(2,2),(3,1),(4,4)\}.$$

(i) Represent each of the relations R_1 and R_2 in a form of zero-one matrix, labeled as M_{R_1} and M_{R_2}. (4 marks)

(ii) List the elements of $R_1 - R_2$, $R_2 - R_1$, $R_1 \cap R_2$ and $R_1 \cup R_2$. (7 marks)

Question 5

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

e(00)=000000
e(01)=101010
e(10)=011110
e(11)=111000

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

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

(b) Encrypt the message 'ATTACK' using the RSA system with $n = 43 \cdot 59$ and $e = 13$. (10 marks)

(c) Use the Dijkstra's algorithm to find the shortest path between the nodes *g* and *f* in the weighted graph in Figure Q5(c).

(4 marks)

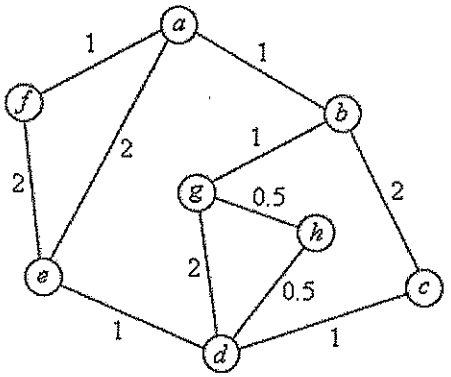

Figure Q5 (c)

(d) Write down the degree of each vertex in the following graph. Hence verify the Handshaking Theorem. (6 marks)

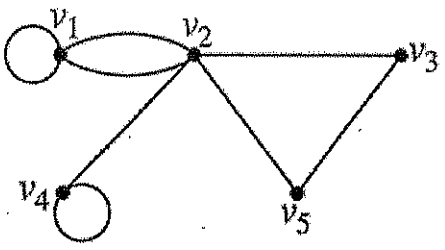

Figure Q5 (d)

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