



FINAL
Examination Paper
(COVER PAGE)

Session : January 2014

Programme : Diploma In Information And Communication Technology (DICTN)

Course : MAT1104 : Discrete Mathematics

Date of Examination : March 10, 2013

Time : 8:00am – 10:00am 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 : Mr. Cheng Siak Peng

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

INTI INTERNATIONAL COLLEGE SUBANG

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
MAT 1104 : DISCRETE MATHEMATICS
FINAL EXAMINATION: JANUARY 2014 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) Convert the following binary numbers to decimal, octal and hexadecimal:
- (i) 100110_2 (3 marks)
- (ii) 101011.100110_2 (6 marks)
- (b) Convert the following octal and hexadecimal numbers to binary:
- (i) $34C_{16}$ (1 mark)
- (ii) 247_8 (1 mark)
- (c) Perform the following calculations in binary arithmetic :
- (i) $1101101_2 + 1011110_2$ (2 marks)
- (ii) $1100010_2 - 1010111_2$ (2 marks)
- (d) Show that $16 - 40$ is performed correctly in a computer.
(use 8-bits computer representation) (4 marks)
- (e) Find the 32-bit computer representations of the decimal number “-27.625”,
assuming 8 bits are used for the characteristic, and the exponent bias is $2^7 - 1$. (6 marks)

Question 2

- (a) Find the sum-of-products expansion of the following Boolean function:

$$f(a, b, c) = a(b + \bar{c}) + a\bar{b} + \bar{b}c \quad (5 \text{ marks})$$

- (b) Use a Karnaugh map to find the minimal sum for the following expression:

$$F = \bar{a}bcd + \bar{a}b\bar{c}d + a\bar{b}c\bar{d} + \bar{a}b\bar{c}\bar{d} + \bar{a}\bar{b}c\bar{d} + abc\bar{d} \quad (6 \text{ marks})$$

- (c) Draw the logic circuit for the minimized Boolean expression from Q2 (b). (4 marks)

- (d) Show that
- $(1.1) + (\overline{0.1} + 0) = 1$
- , then translate the equation into a propositional equivalence. (5 marks)

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

$$\overline{(x + z)(y + z)} = \bar{z}(x + \bar{y}) \quad (5 \text{ marks})$$

Question 3

- (a) Rewrite the following statements without using the conditional:

(i) If profit increases, then salary rises.

(ii) He works hard if and only if the pay is good. (6 marks)

- (b) Proof that "The sum of two even numbers x and y is even." (5 marks)

- (c) Use the laws of logic to classify the following statement as tautology or contradiction.

$$[p \rightarrow (q \rightarrow p)] \leftrightarrow q \wedge \neg q \quad (7 \text{ marks})$$

- (d) Prove that
- $2 + 4 + 6 + \dots + 2n = n(n + 1)$
- for all nonnegative integer n by using Mathematical Induction method. (7 marks)

Question 4

- (a) In a survey of 100 students, it was found that 55 like you tube, 43 like face book, 42 like games, 20 like both you tube and face book, 25 like you tube and games, and 15 like face book and games. 10 like all.

- (i) Draw a Venn diagram representing that information. (4 marks)

Find the number of students who:

- (ii) like at least one of the three web sites. (2 mark)
- (iii) like exactly only one web site. (2 mark)
- (iv) don't like any of these three. (1 mark)
- (b) Let $A=\{1,2,3,4\}$, $B=\{a,b,c,d\}$, $C=\{x,y,z\}$ and

$$R=\{(1,a),(2,d), (3,a),(3,b),(3,d)\}, \quad S=\{(b,x),(b,z),(c,y),(d,z)\}$$

- (i) Draw the diagrams of R and S. (3 marks)
- (ii) Find the matrix of each relation R, S and $R \circ S$. (4 marks)
- (iii) Write R^{-1} , S^{-1} and $R \circ S$ as sets of ordered pairs. (4 marks)

- (c) Given that

$$U = \{x/ 10 \leq x \leq 55, x \text{ is an integer}\}$$

$$P = \{x/ x \text{ is divisible by } 5\}$$

$$Q = \{x/ x \text{ is a square number}\}$$

$$R = \{x/x \text{ is an odd number divisible by } 3\}$$

Find the elements in the following:

- (i) P, Q and R (3 marks)
- (ii) $P \cap R$ (1 mark)
- (iii) $P \setminus (Q \cup R)$ (1 mark)

Question 5

(a) For the rooted tree T (with root 9) in the Figure Q 5(a), find:

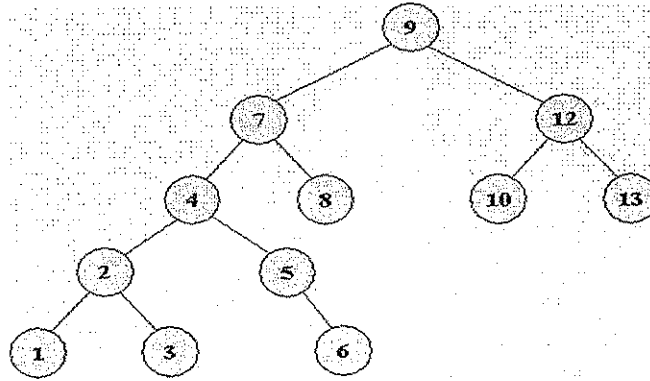


Figure Q 5(a)

- (i) the parent of 4 and the children of 4, (1 mark)
- (ii) the siblings of 4 and all ancestors of 4, (1 mark)
- (iii) all descendants of 4, (1 mark)
- (iv) all leaves. (2 marks)
- (v) Draw a sub tree that is rooted at 7. (2 marks)

(b) In the following graph in Figure Q5 (b), the vertices represent offices and an edge represents a communication link between two offices. Find:

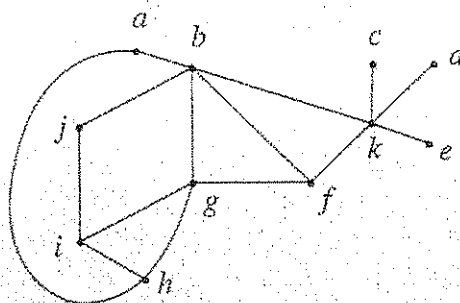


Figure Q 5(b)

- (i) The number of vertices (1 mark)
 - (ii) The number of edges (1 mark)
 - (iii) The number of loops (1 mark)
 - (iv) The number of pendant vertices (1 mark)
 - (v) Names of vertices which have parallel edges (1 mark)
 - (vi) The degree of each vertex and verify the Handshaking Theorem. (5 marks)
- (c) Encrypt the message 'CLOSED' using the RSA system with $n = 43 \cdot 59$ and $e = 15$. (8 marks)

-THE END-

MAT1104(final)January 2014/Aung Min