

 **INTI International
University & Colleges**

**FINAL
Examination Paper**

(COVER PAGE)

Session : APRIL 2018

Programme : Diploma In Information And Communication Technology (DICTN)
Diploma In Information Technology (DITN)

Course : MAT1104: Discrete Mathematics

Date of Examination : July 28, 2018 (Saturday)

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) : S.M Elizabethrani Allappan and Dr Ch'ng Pei Cheng

Moderator : Mr. Cheng Siak Peng

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

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: APRIL 2018 SESSION

Instruction: 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 hexadecimal.

$$75.09375_{10} + 100111.001_2 - 43.2_8 \quad (5 \text{ marks})$$

- (b) Convert the following accordingly (show all your working clearly):

$$129.5625 \text{ denary to binary} \quad (3 \text{ marks})$$

- (c) Find the 16-bit computer representations of the following integers using twos complement format:

(i) 1153 (3 marks)

(ii) -425 (3 marks)

- (d) 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 $2^7 - 1$. (5 marks)

- (e) Show that $[\neg p \vee (p \wedge q)] \wedge \neg q \Leftrightarrow \neg(p \vee q)$ by using logical equivalence identities. (6 marks)

Question 2

- (a) A Boolean expression is given as $F = (x + y)(xz + x\bar{z}) + xy + y$. Simplify this circuit using Boolean algebra. Draw the logic circuits before and after simplification. (7 marks)
- (b) Find the Boolean expression for output G in terms of x, y and z from the given table below. Then minimize it by using Karnaugh map. (7 marks)

x	y	z	G
0	0	0	0
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

(7 marks)

- (c) For the logic circuit in Figure Q 2(c), determine the Boolean expression. Hence, create a truth table for F. (6 marks)

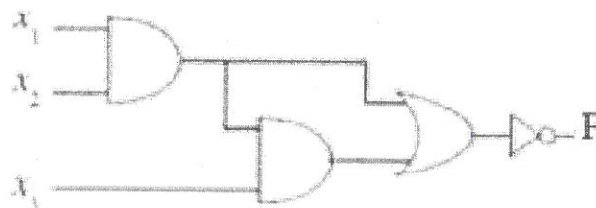


Figure Q 2(c)

(6 marks)

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

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

(5 marks)

Question 3

- (a) Determine whether the following logical expression is a Tautology or Contradiction using Laws of logic.

$$(p \rightarrow (q \rightarrow r)) \rightarrow ((p \wedge q) \rightarrow r) \quad (6 \text{ marks})$$

- (b) 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 unhappy. (2 marks)

- (c) Prove that $a + ar + ar^2 + \dots + ar^n = \frac{ar^{n+1} - a}{r - 1}$ (when $r \neq 1$) for all nonnegative integer n by using Mathematical Induction method. (6 marks)

- (d) Use the laws of logic to classify the following expression as tautology or contradiction.
 $[s \rightarrow (r \rightarrow s)] \vee (s \wedge \neg r)$ (6 marks)

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

Question 4

- (a) 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. (4 marks)

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

Question 5

- (a) Consider the (2, 6) encoding function
- e
- ,

$$e(00) = 000000$$

$$e(01) = 011110$$

$$e(10) = 101010$$

$$e(11) = 111000$$

Find the minimum distance of e .

(4 marks)

- (b) Use the Dijkstra's algorithm to find the shortest path between the nodes A and Z in the weighted graph in Figure Q5(b).

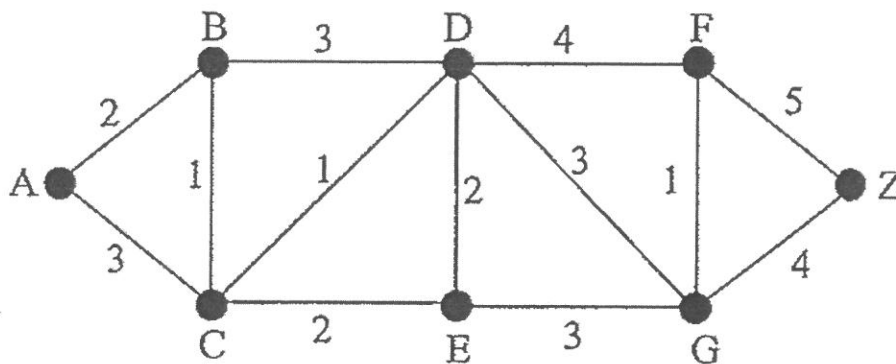
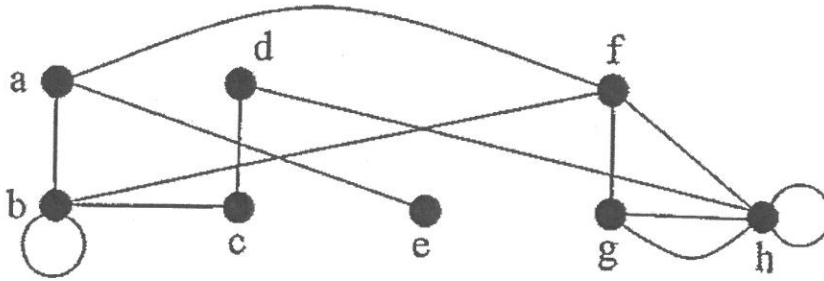


Figure Q5 (b)

(5marks)

- (c) An undirected graph $G=(V,E)$ is shown in the following figure. Find the



- (i) Number of vertices (1 mark)
- (ii) Number of edges (1 mark)
- (iii) Degree of each vertex (4 marks)
- (iv) Pendant vertices. (1 marks)
- (v) Also verify the Hand Shaking Theorem. (2 marks)
- (d) Construct a truth table for the following expression. Indicate whether the expression is a tautology, a contradiction, or contingent.

$$[\neg(p \oplus q) \rightarrow (r \leftrightarrow p)] \wedge (\neg r \rightarrow q)$$

(7 marks)

~ The End ~
MAT1104(final)April 2018

