FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Diploma in Information Technology (DITN) Diploma in Information and Communication Technology (DICTN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	5 August 2020 (Wednesday)
Time	:	4.00pm – 6.30pm Reading Time : Nil
Duration	:	2 Hours 30 Minutes

Special Instructions :

This paper consists of section A and B. Answer ALL questions. All questions carry equal marks.

Material permitted :

Non-Programmable Scientific Calculator

Materials provided :

Nil

Examiner(s)	:	**Dr Ch'ng Pei Cheng, Ms Elizabethrani Allappan**
Chief Moderator	:	Mr Ryan Tee Ah Ann

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

DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
MAT1104: DISCRETE MATHEMATICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instructions: This paper consists of section A and B. Answer ALL questions. All questions carry equal marks.

Section A: (50 marks)

Question 1

(a) Convert the following accordingly (show all working clearly):

(i) 11001100 binary to denary (2 marks)

(ii) 22.4321 denary to octal (2 marks)

(iii) E3A.6 hexadecimal to octal (2 marks)

(b) Using two's complement, numbers are stored on 8 bit register. Show how 213_{10} - 46_{10} would be evaluated. (6 marks)

(c) Calculate 8916 + 5703 in BCD. (7 marks)

(d) Find the 32-bit computer representation of 32.1456, 8 bits are used for characteristics, and the exponent bias is 2^7-1. (6 marks)

Question 2

(a) In a group of 43 students:

22 people like instagram,
23 people like facebook,
24 people like twitter,
11 people like both instagram and facebook,
12 people like both instagram and twitter,
13 people like both facebook and twitter,
4 people like all three.

Draw a Venn diagram to represent the above information. (4 marks)
Hence find the number of students who like

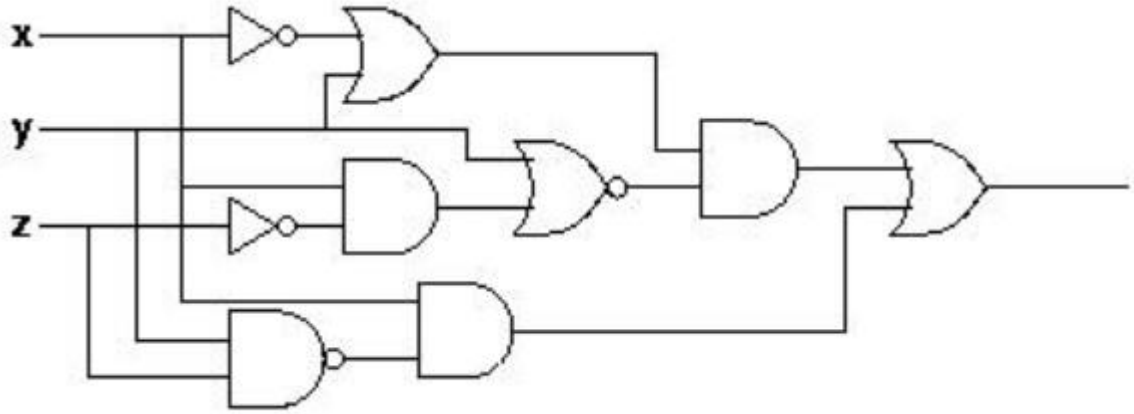
(i) exactly one social media only? (2 marks)

(ii) any two social media? (2 marks)

(iii) instagram and facebook but not twitter? (2 marks)

(iv) facebook or twitter? (2 marks)

(b) Write the logic circuit representation for the below diagram.



(3 marks)

(c) Draw a logic circuit for the expression X:

$$X = \overline{(A + B)\bar{C}}\text{+CB}$$ (6 marks)

(d) Use the Dijkstra's algorithm to find the shortest path between the nodes A and G in the weighted graph in Figure 1 (4 marks)

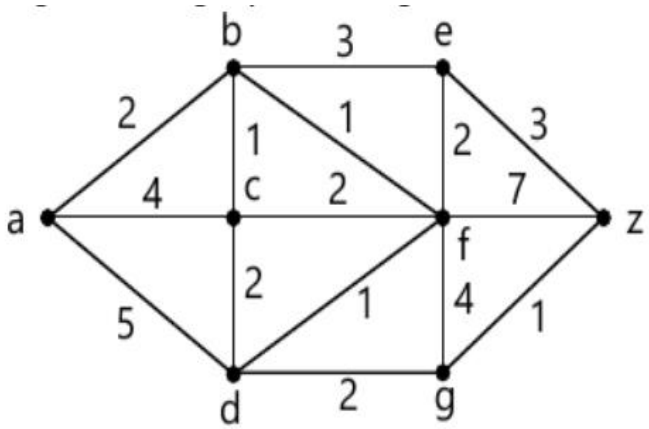


Figure 1

Section B: (50 marks)

Question 1

(a) Construct a truth table for the following expression. In each case, state whether the expression is tautology, a contradiction or neither.

$[p \vee (q \wedge \sim p)] \leftrightarrow ((\sim q) \rightarrow p)$ (4 marks)

(b) Let set A = {1, 2, 3} and R is a relation on set A, where

R= {(1, 1), (1, 2), (1, 3), (2, 1), (3, 1), (2, 2), (3, 3), (2, 3)}

(i) Represent the relation of R in a form of zero-one matrix. (2 marks)

(ii) Find R^{-1}. (1 mark)

(iii) Draw a digraph of R. (2 marks)

(iv) Determine whether R is a reflexive, symmetric, transitive or none of these relation. (3 marks)

(c) Consider the following encoding function e:

e(0,0) = 00000
e(1,0) = 10111
e(0,1) = 00110
e(1,1) = 10001

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

(ii) How many errors can it detect? (2 marks)

(d) Sets P, Q, R, S are given by P ={a, b},Q = {a, ∅}, R= {∅}, S = {t, ∅}.

(i) $P \cup Q$ = (1 mark)

(ii) $Q \cap R$ = (1 mark)

(iii) $P - Q$ = (1 mark)

(iv) $P \times S$ = (2 marks)

(v) $|P \times R|$ = (2 marks)

Question 2

A	B	C	D	X
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

(a) (i) Obtain a Boolean expression for X in terms of A, B, C and D based on the truth table above. (2 marks)

(ii) Simplify X by using Boolean algebra. (5 marks)

(iii) Simplify X by using Karnaugh Map. (4 marks)

(b) Let the function f, g be defined as follows:

$$f: R \to R, f(x) = 3x - 2$$
$$g: R \to R, g(x) = 4x + 5$$

(i) $f \circ g$ (2 marks)

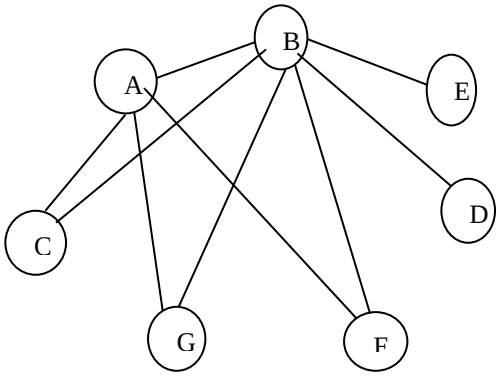
(ii) $g \circ f$ (2 marks)

(c) Given a sequence of numbers:

{3, 9, 1, 5, 4, 6, 2, 10, 8}

Draw a binary search tree by inserting the above numbers from left to right. (3 marks)

(d) 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)

~ The End ~

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