FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2022**
Programme	:	Diploma In Information Technology (DITN**)** Diploma In Computer Science (DCS**)**
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	05 August 2022 (Friday)
Time	:	08.00am-10.30am Reading Time : Nil
Duration	:	02 Hours 30 Minutes

Note: 30 minutes is added into the duration of the examination to factor in any connectivity matters and for you to scan and upload your scripts.

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks. Working must be shown..

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

Examiner(s)	:	**Dr. Nurulanati Othman,** S.M. Elizabethrani
Chief Moderator	:	Ah Ann Tee

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

DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
DIPLOMA IN COMPUTER SCIENCE PROGRAMME (DCS)
MAT1104: DISCRETE MATHEMATICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2022 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks. Working must be shown.

Question 1

(a) Show that 11111110.000101_2 and $\text{FE}.14_{16}$ are equivalent to 254.078125.

(3 marks)

(b) Solve $11010.1_2 \times 101.1_2$ in binary and give your final answer in hexadecimal.

(3 marks)

(c) Present complete working of the conversion to binary of each of the terms in the following expression.

$$1248.5 - 9\text{C}.\text{B}6_{16} + 201.44_8$$

Hence, simplify the expression.

(7 marks)

(d) Use two's complement representation to show the evaluation of $125_{10} - 56_{10}$. Assume that the number is stored in 8-bit system.

(6 marks)

(e) Find the 32-bit computer representation of 789.5, where 8 bits are used for characteristics, and the exponent bias is $2^7 - 1$.

(6 marks)

[Total 25 marks]

Question 2

(a) Given the following truth table.

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

(i) Use the truth table to find the Boolean expression for output X.

(2 marks)

(ii) Use Boolean algebra to simplify X in part (i).

(5 marks)

(iii) Hence, verify your answer in part (ii) using Karnaugh map.

(5 marks)

(b) Use the laws of logic to prove that $[\sim a \vee (a \wedge b)] \wedge \sim b \equiv \sim(a \vee b)$.

(7 marks)

(c) Construct a truth table for the following expression. Indicate whether the expression is a tautology, a contradiction, or contingent.

$$[\sim r \rightarrow (\sim s \vee t)] \leftrightarrow (r \oplus t)$$

(6 marks)

[Total 25 marks]

Question 3

(a) A survey has been conducted on 600 people on their preference for three major Malaysia internet service providers.

x people preferred provider U only.
160 people preferred provider M only.
130 people preferred provider C only.
y people preferred provider U and provider M only.
105 people preferred provider U and provider C.
90 people preferred provider M and provider C.
80 people preferred all three providers.

Draw a Venn diagram to represent the above information.

(4 marks)

Hence, use the diagram to find

(i) the value of y, given that 270 people preferred provider M.

(2 marks)

(ii) the value of x.

(2 marks)

(iii) the number of people who preferred only one service provider.

(2 marks)

(iv) the number of people who preferred at least two service providers.

(2 marks)

(b) Prove that the function $g: \mathbb{Z} \rightarrow \mathbb{Z}$ defined by $g(x) = \frac{x+1}{2}$ is an injective function.

(3 marks)

(c) Define a function $f: \mathbb{Z} \rightarrow \mathbb{N}$, by $f(x) = x^2 + 1$. Prove that f is not one-to-one.

(3 marks)

(d) Show by mathematical induction

$$2 + 2(2)^2 + 3(2)^3 + \cdots + n(2)^n = 2 + (n-1)2^{n+1}$$

for all positive integers n.

(7 marks)

[Total 25 marks]

Question 4

(a) An undirected graph is shown in the Figure 1.

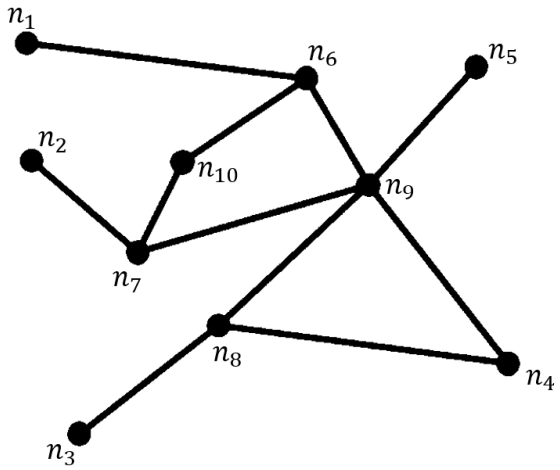

Figure 4(a)

Identify the number of edges and the degree of each node, hence, verify the Handshaking theorem.

(8 marks)

(b)

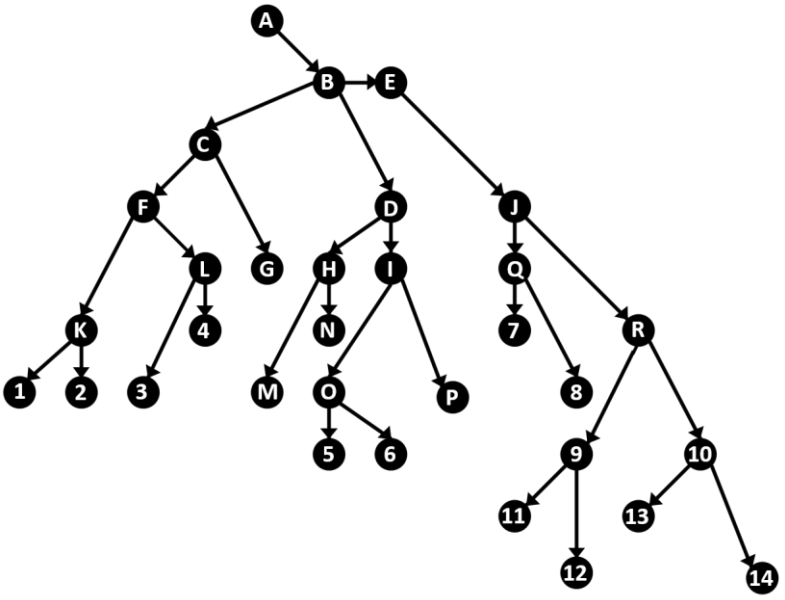

Figure 4(b)

Based on the rooted tree shown in Figure 4(b), identify

(i) the siblings of K,

(1 mark)

(ii) the ancestors of 11,

(1 mark)

(iii) the children of 8,

(1 mark)

(iv) the descendants of B,

(1 mark)

(v) the tree height, and

(1 mark)

(vi) sketch the subtree rooted at I.

(1 mark)

(c) Find the Hamming distance of $x = 11010010$ and $y = 00100111$.

(3 marks)

(d) Apply RSA system with $n = 43 \bullet 59$ and $e = 3$ to encrypt the message 'MANAGE'.

(8 marks)

[Total 25 marks]

~THE END~

MAT1104 (F)/April 2022 Session/ formatted