INTI International University & Colleges

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Diploma in Information Technology (DITN) Diploma in Computer Science (DCS) Bachelor Of Science with Honors in Computer Science (BCSCU)
Course	:	**MAT1104/MAT2206: Discrete Mathematics**
Date of Examination	:	12 December 2021 (Sunday)
Time	:	12.00noon – 2.30pm
Reading Time	:	Nil
Duration	:	2 Hours 30 Minutes

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)	:	**Nurulanati Othman**
Chief Moderator	:	S.M. Elizabethrani Allappan

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

DIPLOMA IN INFORMATION TECHNOLOGY PROGRAMME (DITN)
DIPLOMA IN COMPUTER SCIENCE PROGRAMME (DCS**)**
BACHELOR OF SCIENCE WITH HONOURS IN COMPUTER SCIENCE (BCSCUN)
MAT1104/MAT2206: DISCRETE MATHEMATICS
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

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

Question 1

(a) Perform the conversion to binary of each of the terms in the following expression and simplify the expression.

$$43.5_8 - 12.5625_{10} + E7.04_{16}$$

Hence, convert your final answer into octal, hexadecimal and decimal. Show your complete working for each of the conversions.

(13 marks)

(b) Use two's complement representation to show the evaluation of $-87_{10} - 33_{10}$. Assume that the number is stored in 8-bit system.

(6 marks)

(c) Find the 32-bit computer representation of -302.15, where 8 bits are used for characteristics, and the exponent bias is $2^7 - 1$.

(6 marks)

[Total 25 marks]

Question 2

(a) The Boolean expression for F in terms A, B, C and D is given as

$$F = \bar{A}BCD + \bar{A}B\bar{C}D + A\bar{B}C\bar{D} + \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}BC\bar{D}.$$

(i) Use Boolean algebra to simplify F.

(7 marks)

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

(5 marks)

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

(6 marks)

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

$$[(p \leftrightarrow q) \rightarrow \sim(r \oplus p)] \vee (r \rightarrow \sim q)$$

(7 marks)

[Total 25 marks]

Question 3

(a) A survey of 150 business students in a university produced the following results:

36 students read The Wall Street Journal (T).
100 students read Fortune (F).
38 students read Business Week (B).
22 students read The Wall Street Journal and Fortune.
2 students read The Wall Street Journal and Business Week.
4 students read Fortune and Business Week.
k students read all three publications.

Given that 3 of them do not read any of the three publications, draw a Venn diagram to represent the above information.

(4 marks)

Hence, identify

(i) the value of k.

(2 marks)

(ii) the number of students who read The Wall Street Journal and Fortune but not Business Week.

(2 marks)

(iii) the number of students who read only one type of publication.

(2 marks)

(iv) the number of students who read only any two types of publications.

(2 marks)

(b) Given that $f(x) = \frac{7}{3-6x}$ and $g(x) = \frac{x+5}{2x-1}$, compute

(i) $f \circ g(x)$.

(3 marks)

(ii) $f^{-1}(x)$.

(3 marks)

(c) Show by mathematical induction

$$1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{n(2n+1)(2n-1)}{3}$$

for all positive integers n.

(7 marks)

[Total 25 marks]

Question 4

(a) An undirected graph $G = (V, E)$ is shown in the Figure 1.

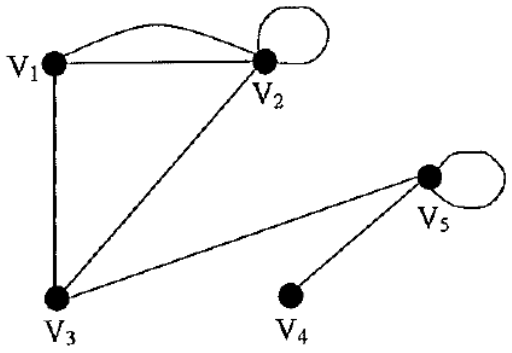

Figure 1

Identify the

(i) number of nodes.

(1 mark)

(ii) number of edges.

(1 mark)

(iii) number of loops.

(1 mark)

(iv) degree of each node and verify the Handshaking theorem.

(4 marks)

(b)

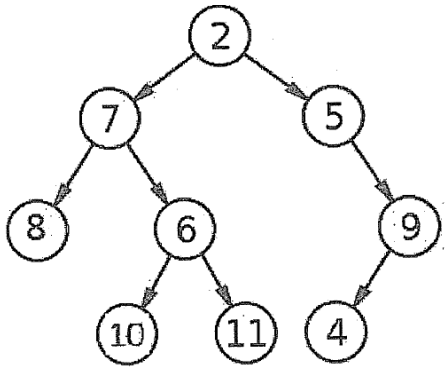

Figure 2

Based on the rooted tree shown in Figure 2, identify

(i) the parent of 6,

(1 mark)

(ii) the ancestors of 11,

(1 mark)

(iii) the children of 7,

(1 mark)

(iv) the descendants of 2,

(1 mark)

(v) the siblings of 5,

(1 mark)

(vi) the tree height, and

(1 mark)

(vii) sketch the subtree rooted at 7.

(1 mark)

(c) Identify 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 'CLOSED'.

(8 marks)

[Total 25 marks]

~THE END~