FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Diploma In Computer Science (DCS) Diploma In Information Technology (DITN) Bachelor Of Science with Honors in Computer Science (BCSCU)
Course	:	**MAT1104/MAT2206: Discrete Mathematics**
Date of Examination	:	July 28, 2021 (Wednesday)
Time	:	8.00am – 10.30am Reading Time : Nil
Duration	:	2 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 :

Answer **ALL FOUR (4)** questions.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**S.M. Elizabethrani Allappan** and Miza
Moderator	:	Ryan Tee Ah Ann

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

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

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

Question 1

(a) Convert the following accordingly. Show all working clearly.

(i) 12.5625_{10} to binary.

(2 marks)

(ii) 10011100.1011011_2 to hexadecimal.

(2 marks)

(iii) $2E.24_{16}$ to octal.

(2 marks)

(b) Show how $120_{10} - 37_{10}$ would be evaluated using two's complement representation. Assume that the number is stored in 8-bit system.

(6 marks)

(c) Calculate $2785 + 3419$ using Binary Coded Decimal.

(5 marks)

(d) Encrypt the message "ONLINE" using the RSA system with $n = 43 \cdot 59$ and $e = 5$.

(8 marks)

[Total 25 marks]

Question 2

(a) In a group of 50 students:

19 students obtain grade A in Mathematics (M).
22 students obtain grade A in Physics (P).
25 students obtain grade A in Chemistry (C).
8 students obtain grade A in both Mathematics and Physics.
9 students obtain grade A in both Mathematics and Chemistry.
11 students obtain grade A in Physics and Chemistry.
5 students obtain grade A in all three subjects.

Draw a Venn diagram to represent the above information.

(4 marks)

Hence, find the number of students who obtain grade A in,

(i) one subject only.

(2 marks)

(ii) any two subjects.

(2 marks)

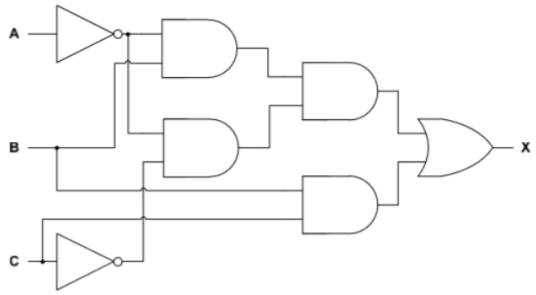
(iii) Mathematics and Physics but not Chemistry.

(2 marks)

(iv) Physics or Chemistry.

(2 marks)

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

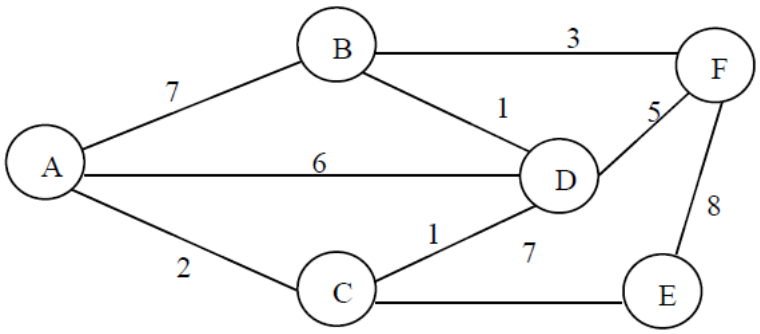


(3 marks)

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

(5 marks)

(d) Use the Dijkstra's algorithm to find the shortest path between the node A and F in the below weighted graph.



(5 marks)

[Total 25 marks]

Question 3

(a) Construct a truth table for the following expression. State whether the expression is tautology, a contraction or neither.

$$[(p \rightarrow q) \wedge \neg q] \rightarrow \neg p$$

(4 marks)

(b) Let A= {1,2,3,4,6}and let R be the relation on A defined by 'x divides y', written as $x|y$. $R = \{(x, y) \in A: x|y\}$.

(i) Write *R* as a set of ordered pairs. (2 marks)

(ii) Determine whether *R* is reflexive, symmetric, antisymmetric and/or transitive. (2 marks)

(iii) Find the zero-one matrix for relation *R*. (2 marks)

(c) Consider the following encoding function e:

$e(00) = 01011010$
$e(01) = 10011010$
$e(10) = 01010001$
$e(11) = 11001010$

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

(ii) How many errors can e detects? (2 marks)

(d) Find the 32-bit computer representation of -302.15, where 8 bits are used for characteristics, and the exponent bias is $2^7 - 1$. (5 marks)

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

$f(x, y, z) = x(y + \bar{z}) + \bar{y}z$ (4 marks)

[Total 25 marks]

Question 4

(a) Given the following logic statement:

X = 1 if ((A is 1 AND B is 1) OR (B is 1 AND C is NOT 1))

(i) Draw the logic circuit. (4 marks)

(ii) Complete the truth table for the given logic statement. (4 marks)

A	B	C	X

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

$$f: R \to R, f(x) = 2x - 6$$
$$g: R \to R, g(x) = 3x + 2$$

(i) $f \circ g$

(2 marks)

(ii) $g \circ f$

(2 marks)

(c) Given a sequence of numbers:

11, 6, 8, 19, 4, 10, 5, 17, 43, 49, 31

Draw a binary search tree by inserting the above numbers from left to right.

(3 marks)

(d) Use mathematical induction to prove that the formula is true for all positive integers.

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{2^n} = \frac{2^n - 1}{2^n}$$

(6 marks)

(e) Rewrite the following statements without using the conditional:

(i) If it is hot, he swims. (2 marks)

(ii) He swims if and only if the weather is hot. (2 marks)

[Total 25 marks]

~ The End ~