

 **INTI** International
University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session : AUGUST 2018

Programme : Diploma In Information And Communication Technology (DICTN)

Course : MAT1104: Discrete Mathematics

Date of Examination : 7 December 2018, (Friday)

Time : 8:00am – 10:00am 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 Micheal Chong

Moderator : Mr. Cheng Siak Peng

This paper consists of 6 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: AUGUST 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) Convert the following accordingly (show all your working clearly):
- (i) 01101011 binary to denary (2 marks)
 - (ii) 213.6875 denary to octal (3 marks)
 - (iii) AE4.2B hexadecimal to denary (3 marks)
- (b) Using two's complement, numbers are stored on 12-bit register. Show how $101_{10} - 201_{10}$ would be evaluated. (5 marks)
- (c) Find the 16-bit computer representations of 2750. (2 marks)
- (d) Find the 32-bit computer representations of the decimal number “-32.0625”, assuming 8 bits are used for the characteristic, and the exponent bias is $2^7 - 1$. (5 marks)
- (e) Perform the following calculation in BCD arithmetic:
- $2724 + 5348$ (5 marks)

Question 2

- (a) Let $A = \{1, 2, 3, 4\}$ and $B = \{1, 3, 6\}$. Find
- (i) $|A|$ (cardinality of A) and $|B|$ (cardinality of B) (2 marks)
 - (ii) $A \cup B$ (1 mark)
 - (iii) $A \cap B$ (1 mark)
 - (iv) $A - B$ (1 mark)
- (b) Prove the Distributive law $x + yz = (x + y)(x + z)$ using truth-table. (5 marks)
- (c) Find the sum-of-products expansion of the following Boolean function:
 $f(x, y, z) = x(y + \bar{z}) + \bar{y}z$ (5 marks)
- (d) Use a Karnaugh map to find the minimal sum for the following expression:
 $F = \bar{a}bcd + \bar{a}b\bar{c}d + \bar{a}bc\bar{d} + abc\bar{d} + \bar{a}\bar{b}\bar{c}\bar{d} + \bar{a}\bar{b}c\bar{d} + \bar{a}bc\bar{d}$ (5 marks)
- (e) Draw the logic circuit with inputs x, y, z and output $F(x,y,z)$ which corresponds to the following Boolean expression:
 $F = x\bar{y}z + xy\bar{z} + x\bar{y}\bar{z}$ (5 marks)

Question 3

- (a) Determine the following sentences are propositions or not.
- (i) $20-14=7$ (1 mark)
 - (ii) Singapore is in Europe. (1 mark)
 - (iii) Ice floats in water. (1 mark)
- (b) Prove that $\neg(p \vee q) \vee (\neg p \wedge q) \equiv \neg p$ using the laws of logical equivalences. (5 marks)
- (c) 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)

(d) Show that $[(p \rightarrow q) \wedge \neg q] \rightarrow \neg p$ is a tautology. (8 marks)

(e) Find the length of a shortest path between a and z in the given weighted graph in Figure Q3(e). (5 marks)

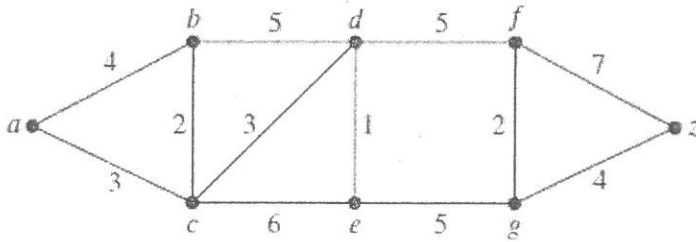


Figure Q3 (e)

Question 4

(a) An undirected graph is shown in Figure Q 4(a). Find:

- (i) The number of vertices (1 mark)
- (ii) The number of edges (1 mark)
- (iii) Degree of each vertices (4 marks)

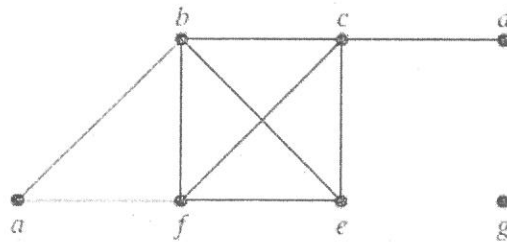


Figure Q4 (a)

(b) Let $f(x) = x^3 + 1$ and $g(x) = x + 2$. Find

- (i) $f \circ g$ (2 marks)
- (ii) $g \circ f$ (2 marks)
- (iii) $f^{-1}(x)$ (3 marks)

(c) Consider the following encoding function e :

$$e(0,0)=00000$$

$$e(1,0)=00111$$

$$e(0,1)=01110$$

$$e(1,1)=11111$$

- (i) Find the minimum distance of e . (4 marks)
- (ii) How many errors can it detect? (1 mark)

(d) Let set $A = \{1, 2, 3, 4\}$ and R is a relation on set A , where

$$R = \{(1, 1), (1, 4), (1, 3), (2, 2), (2, 4), (3, 1), (4, 2), (4, 4)\}$$

- (i) Represent the relation of R in a form of zero-one matrix. (2 marks)
- (ii) Find R^{-1} . (1 mark)
- (iii) Draw the graphical representation of R . (1 mark)
- (iv) Determine whether R is a reflexive, symmetric, transitive or none of these. (3 marks)

Question 5

(a) Consider the (8,7) parity check code, for the received word, determine whether an error will be detected.

$$11100111 \quad (3 \text{ marks})$$

(b) Encrypt the message LOAD using the RSA system with $n = 53 \cdot 61$ and $e = 17$. (9 marks)

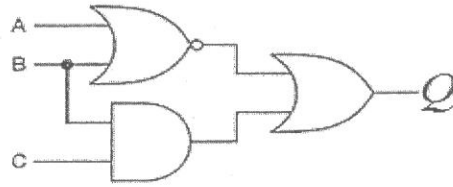
(c) Prove that

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

whenever n is a nonnegative integer by using Mathematical Induction method.

(6 marks)

(d)



- (i) Find a Boolean expression for the above network diagram (in terms of A, B and C). (2 marks)
- (ii) Create a truth table for Q. (5 marks)

-THE END-

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