INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2017**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	06 March, 2017 (Monday)
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 Ch'ng Pei Cheng
Moderator	:	Cheng Siak Peng

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

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY PROGRAMME (DICTN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: JANUARY 2017 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) 10011100.1011011 binary to hexadecimal and octal (4 marks)

(ii) 6F0.6A hexadecimal to denary (3 marks)

(iii) 315.5625 denary to octal (3 marks)

(b) Find the 16-bit computer representations of the following integer using two's complement format: -5789 (4 marks)

(c) Find the 32-bit computer representations of the decimal number "−145.125", assuming 8 bits are used for the characteristic, and the exponent bias is $2^7 - 1$. (6 marks)

(d) Perform the following calculation in BCD arithmetic:

3715 + 4518 (5 marks)

Question 2

(a) Prove the De Morgan's law $\overline{(x + y)} = \bar{x}\,\bar{y}$ using truth-table. (4 marks)

(b) Given a Boolean expression $F = \overline{(\bar{x} + z)(y + \bar{z})}$.

(i) Simplify F using Boolean algebra and De Morgan's law. (3 marks)

(ii) Draw a logic circuit for the original expression F. (4 marks)

(iii) Draw the logic circuit for the simplified expression of F. (4 marks)

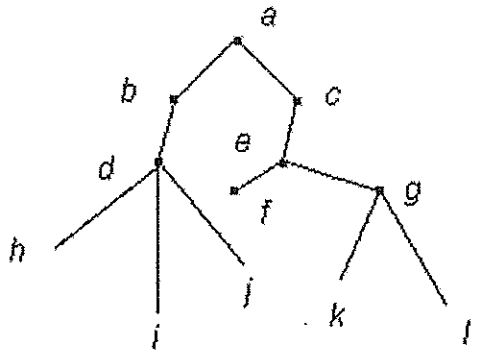
(c) Find the sum-of-products expansion of the following Boolean function:
$f(a,b,c) = a(b + \bar{c}) + a\bar{b} + \bar{b}c$ (3 marks)

(d) Use a Karnaugh map to find the minimal sum for the following expression:

$$F = \bar{a}bcd + \bar{a}b\bar{c}d + a\bar{b}c\bar{d} + \bar{a}bc\bar{d} + \bar{a}\bar{b}cd + \bar{a}bc\bar{d}$$ (7 marks)

Question 3

(a) Answer the following questions for the tree.



(i) Find the ancestors of *k*. (1 mark)

(ii) Find the children of *d*. (1 mark)

(iii) Find the descendents of *c*. (1 mark)

(iv) Find the siblings of *j*. (1 mark)

(v) What is the height of this rooted tree? (1 mark)

(b) Use the laws of logic to classify the following expression as tautology or contradiction.
$[s \longrightarrow (r \rightarrow s)] \vee (s \wedge \neg r)$ (5 marks)

(c) Given p = T, q = T and r = F, find the truth value of the proposition given below.
$(p \wedge q \wedge r) \vee (\neg r) \leftrightarrow (q \rightarrow \neg p)$ (4 marks)

(d) Represent the following statements using logical connectives:

(i) If it is cold then I will wear the sweater. (2 marks)

(ii) Wages rise if and only if productivity increases. (2 marks)

(e) Prove that $2 + 6 + 18 + \cdots + 2(3)^{n-1} = 3^n - 1$ whenever n is a nonnegative integer by using Mathematical Induction method.

(7 marks)

Question 4

(a) Let A = {1,2,5,6} , B = {2,5,7}, C={1,3,5,7,9} and the universal set is U={1,2,3,.....8,9} . Find

(i) $|A|$ (cardinality of A) and $|B|$ (cardinality of B) (2 marks)

(ii) $A \cup B$, $B \cup C$ (2 marks)

(iii) $A \cap B$, $A \cap C$ (2 marks)

(iv) $A - B$, $A - C$ (2 marks)

(v) $A \oplus B$ (2 marks)

(b) Let A={1,2,3,4}, B={a,b,c}, C={x,y,z}. Consider the relation R from A to B and relation S from B to C as follows:

R= {(1,b), (3,a), (3,b), (4,c)}

S= {(a,y), (c,x), (a,z)}

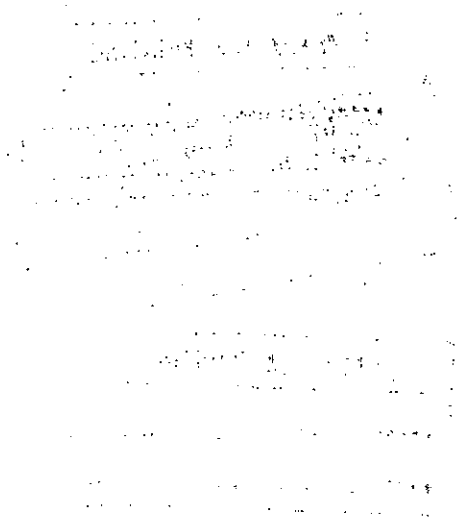
(i) Find the matrix of each relation R and S. (4 marks)

(ii) Write R^{-1} and $R \circ S$ as sets of ordered pairs. (4 marks)

(c) Rewrite each of the terms of the following expression in binary and simplify the expression. Convert the final answer to octal and hexadecimal.

$$75.625 + 100111.001_2 - 43.2_8 - 3C.4_{16}$$

(7 marks)



Question 5

(a) 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* detect? (1 mark)

(b) Find the length of a shortest path between *a* and *z* in the given weighted graph in Figure Q5(b).

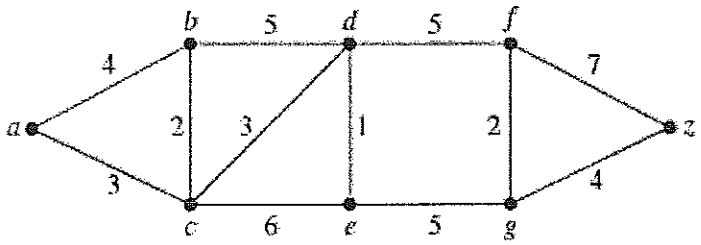


Figure Q5 (b)

(5 marks)

(c) Consider the following graph in Figure Q5(c), find:

(i) The number of vertices (1 mark)

(ii) The number of edges (1 mark)

(iii) The number of loops (1 mark)

(iv) The number of pendant vertices (1 mark)

(v) Names of vertices which have parallel edges (2 marks)

(vi) The degree of each vertex and verify the Handshaking Theorem. (4 marks)

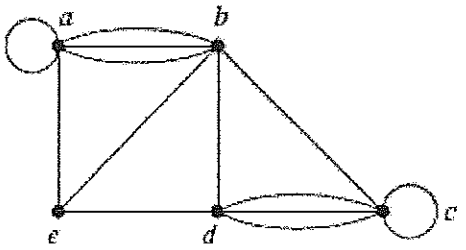


Figure Q5 (c)

(d) Draw a binary search tree for the given set of names in alphabetical order.
{Bobby, Annie , Sarah, Fred , Jafar, Kim, Hamid} (5 marks)

~ The End ~

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