INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**JANUARY 2018**
Programme	:	Diploma In Information And Communication Technology (DICTN)
Course	:	**MAT1104: Discrete Mathematics**
Date of Examination	:	9 March, 2018 (Friday)
Time	:	8:00 am – 10:00 am 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**
Moderator	:	Mr. Cheng Siak Peng

*This paper consists of **8** printed pages, including the cover page*

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY
PROGRAMME (DICTN)
MAT1104: DISCRETE MATHEMATICS
FINAL EXAMINATION: JAN 2018 SESSION

Instruction: Answer any **FOUR (4)** out of **(FIVE) 5** structured-type questions.

Question 1

(a) Rewrite each of the term of the expression

$$6312.56_8 - BA8.23_{16} + 157.25$$

into binary and simplify the expression. Present the final answer in hexadecimal. (6 marks)

(b) Given p and q are true and r and s are false, find the truth value of the following expression:

$$[\neg(p \wedge q) \vee \neg r)] \vee [((\neg p \wedge q) \vee \neg r) \wedge s]$$

(4 marks)

(c) Calculate 1539 + 877 using 8-4-2-1 BCD. (5 marks)

(d) Complete the following truth table, (copy the table in your answer booklet) and determine if $p \wedge (\neg p \wedge q)$ is a tautology or contradiction.

p	q	$\neg p$	$\neg p \wedge q$	$p \wedge (\neg p \wedge q)$
F	F			
F	T			
T	F			
T	T			

(4 marks)

(e) Store decimal 0.546875 in 10 bits word using sign modulus format. (3 marks)
(Show your working clearly)

(f) Convert $E91.5_{16}$ into the following base system. Show all the working clearly.

(i) Binary (1 mark)

(ii) Denary (2 marks)

Question 2

(a) A biology teacher instructed his 28 students to collect some hibiscus, sunflower and orchid. On the next day, the students brought the plants to the class. Here are the summary:

13 of them brought hibiscus
18 of them brought sunflower
13 of them brought orchid
5 of them brought hibiscus and orchid
6 of them brought hibiscus and sunflower
9 of them brought orchid and sunflower

(i) Assume that there are x of them brought all the three plants. There are y of them brought orchid and sunflower but not hibiscus. Draw a Venn diagram to illustrate the above information. (4 marks)

(ii) Find x and y. (3 marks)

(iii) Find the number of students brought only one type of flowers to the class. (1 mark)

(b) Let A be the set $A=\{1,3,5\}$ and R is a relation on set A, where $R = \{(1, 1), (1, 3), (1, 5), (3, 1), (3, 3), (3, 5), (5, 5)\}$.

(i) Determine if R is a reflexive and symmetric and transitive relation on A. (3 marks)

(ii) Draw a digraph of the relation. (2 marks)

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

(c) Simplify the following expression using the Karnaugh Map. Hence draw a logical network diagram for the simplified expression.

$$xyzt + x\bar{y}zt + x\bar{y}\,\bar{z}t + \bar{x}yzt + x\bar{y}\,\bar{z}\,\bar{t} + x\bar{y}zt + x\bar{y}\bar{z}t + \bar{x}y\bar{z}t$$

(10 marks)

Question 3

(a) Consider the matrix:

$$\begin{array}{c} \\ 1 \\ 2 \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix} \end{array}$$

(i) Write the relation R as a set of ordered pair. (2 marks)

(ii) Find the matrix of the inverse relation R. (2 marks)

(b) If numbers are held in 8 bit register in two's complement, show how 80 – 100 would be evaluated. Justify your answer.

(5 marks)

(c) Find the 24-bit computer representation of 24.828125, where 8 bits are used for the characteristic, and the exponent bias is $2^7 - 1$.

(6 marks)

(d) Use mathematical induction to prove that the following statement is true for all positives integers k.

$$1^3 + 2^3 + 3^3 + \ldots + n^3 = \frac{n^2 (n+1)^2}{4}$$

(5 marks)

(e) Consider the (2, 8) encoding function e,

$e(00) = 00000000$
$e(01) = 10110100$
$e(10) = 01100010$
$e(11) = 11010111$

(i) Find the minimum distance of the encoding function. (3.5 marks)

(ii) How many errors will the encoding function detect? (1.5 marks)

Question 4

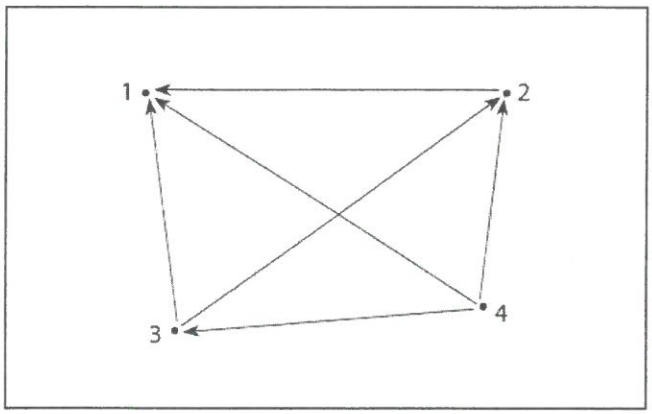
(a) Let R_1 and R_2 be the relations on {1, 2, 3, 4} given by

$$R_1 = \{(1,1),(1,2),(3,4),(4,2)\}$$
$$R_2 = \{(1,1),(2,1),(3,1),(4,4),(2,2)\}.$$

(i) List the elements of $R_1 \cap R_2$ and $R_1 \cup R_2$. (2 marks)

(ii) Represent R_1 and R_2 in a form of zero-one matrix, labeled as M_{R_1} and M_{R_2}. (2 marks)

(b) Given a digraph with the vertex represents set P={1,2,3,4}and the directed edge represent a relation, R.



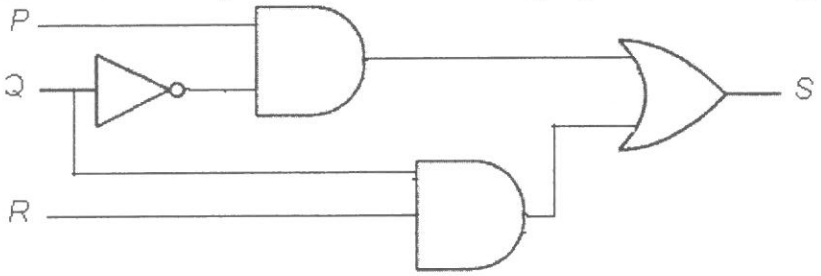
List the relation, R based on the given digraph. (3 marks)

(c) Prove using Boolean Algebra and De Morgan's Law that

$$\overline{A\overline{B}\cdot(A+C)} + \overline{A}B \cdot \overline{A+\overline{B}+\overline{C}} = \overline{A}+B$$ (4 marks)

(d) Given Boolean expression as $[(A+\overline{B})(B+C)]B$. Construct a truth table for the expression above. (4 marks)

(e) Obtain an boolean expression for the following logical network diagram.



Hence find the truth value of S when P=1, Q=1 and R=0. (4 marks)

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

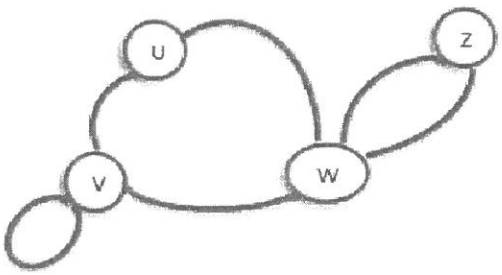
10110101 (2 marks)

(g) Draw a binary search tree for the given number.

{15, 7, 24, 11, 27, 13, 18, 19, 9 } (4 marks)

Question 5

(a) Consider the following graph. Find



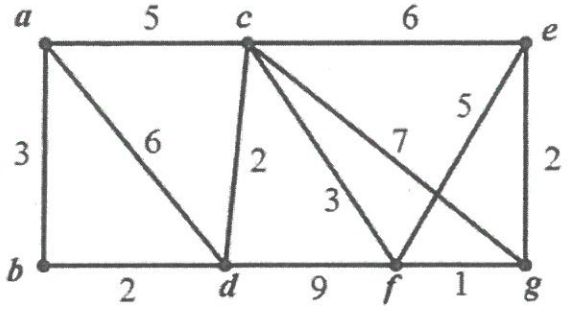
(i) the number of vertices. (1 mark)

(ii) the number of edges. (1 mark)

(iii) the degree of each vertex and verify the Handshaking Theorem. (3 marks)

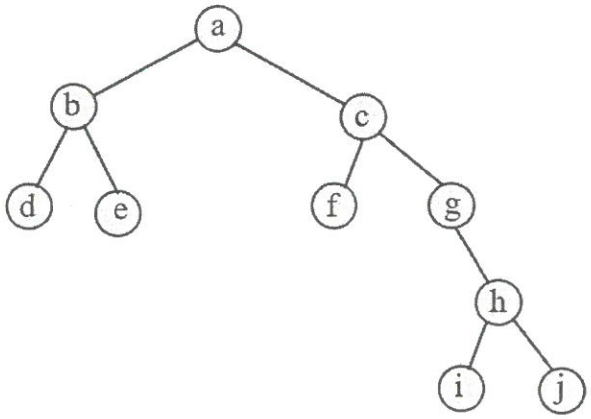
(iv) the number of loops. (1 mark)

(b) Use the Dijkstra's algorithm to find the shortest path between the nodes ***a*** and ***g*** in the diagram shown below:



(5 marks)

(c) Answer the following questions for the tree.



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

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

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

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

(v) Draw the subtree rooted at *c*. (1 mark)

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

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

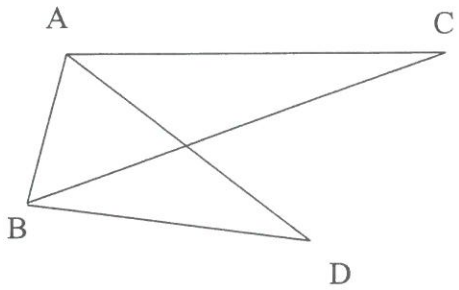
$$f: R \to R, f(x) = 2x - 6$$
$$g: R \to R, g(x) = 3x + 2$$

Find,

(i) $f \circ g$ (2 marks)

(ii) $g \circ f$ (2 marks)

(e) Determine the Eulerian path and Hamiltonian circuit of figure below, assuming that you start from vertex A.



(4 marks)

~THE END~

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