Tuesday

31/12/2013

SULIT

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of Computing

UNIVERSITI TEKNOLOGI MALAYSIA
FINAL EXAMINATION SEMESTER I, 2013/2014

SUBJECT CODE	:	**SCSI 1013 / SCI 1013**
SUBJECT NAME	:	**DISCRETE STRUCTURE**
SECTION	:	**ALL**
TIME	:	**9:00 AM – 12:00 NOON**
DATE/DAY	:	**31 / 12 / 2013 (TUESDAY)**
VENUES	:	**DK 7 (N 24)**

INSTRUCTIONS :

ANSWER ALL QUESTIONS IN THE GIVEN BOOKLET

(Please Write Your Lecture Name And Section In Your Answer Booklet)

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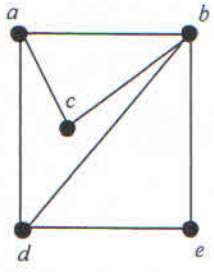
Year / Course	1 SCSV
Section	06
Lecturer Name	Pn. SUHAILA

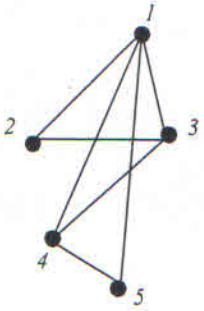
This questions paper consists of **SEVEN (7)** printed pages excluding this page.

Question 1 **[15 marks]**

a) Given the following graphs. Graph G and Graph H consist of the set of vertices, $V_G=\{a,b,c,d,e\}$ and $V_H=\{1,2,3,4,5\}$, respectively. Determine whether the following graphs are isomorphic? Validate your answer using adjacency matrices. (8 marks)

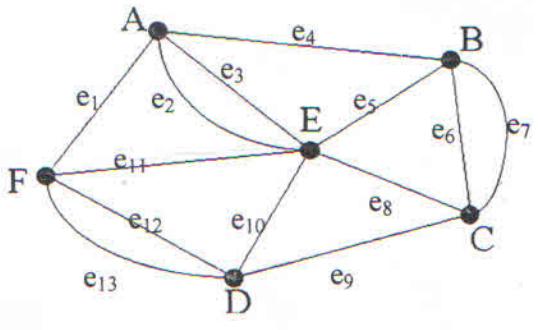


Graph G



Graph H

b) Consider the following graph D.



Graph D

i. Determine whether there exists Euler Cycle or Euler Path? If any, exhibit one. (4 marks)

ii. Check whether the graph has Hamiltonian Cycle? (3 marks)

Question 2 **[15 marks]**

Graph in Figure 1 shows the distance between computer centers in Taman Universiti. Find the shortest distance and its path from computer centre D to computer centre G using Djikstra's algorithm. (10 marks)

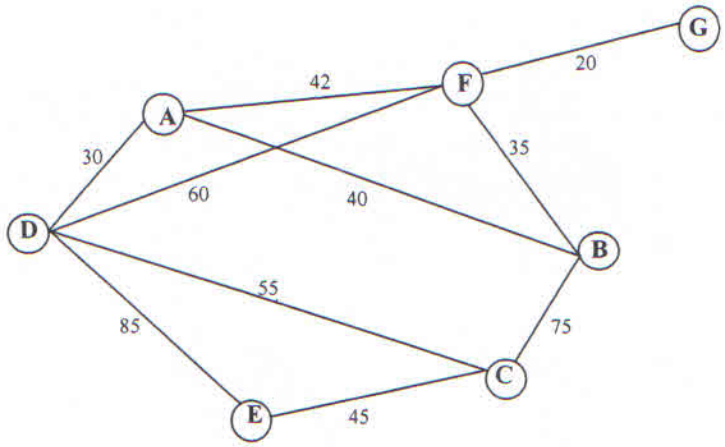


Figure 1

Question 3 **[25 marks]**

a) Given $\alpha(a,b,c) = (a + b' + c') \bullet (a + b' + c)$ and $\beta(a,b,c) = a + b' \bullet c$. Determine whether $\alpha \equiv \beta$ by using the truth table. (5 marks)

b) Find minterm for S_1 a combinational logic circuit that has the truth table outputs as in Table 1. (4 marks)

x	y	z	S_1
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Table 1

c) Design an electronic circuit comprising the combinations of logic gates to produce the output of the following Boolean algebra: (3 marks)

$$A + ((B' + C) \bullet (B + C'))$$

d) Use a Karnaugh map to minimize the following expression: (6 marks)

$$A'B'C + A'BC + AB'C' + ABC'$$

Question 4 **[25 marks]**

a) Let $M = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{a, b, c\}, q_0, f_s, \{q_1, q_3, q_5\})$ be the Deterministic Finite Automata (DFA) with state transition function, f_s defined as follows:

$$f(q_0, a) = q_1 \quad f(q_0, b) = q_0 \quad f(q_0, c) = q_0$$
$$f(q_1, a) = q_1 \quad f(q_1, b) = q_2 \quad f(q_1, c) = q_1$$
$$f(q_2, a) = q_2 \quad f(q_2, b) = q_3 \quad f(q_2, c) = q_4$$
$$f(q_3, a) = q_3 \quad f(q_3, b) = q_3 \quad f(q_3, c) = q_3$$
$$f(q_4, a) = q_4 \quad f(q_4, b) = q_5 \quad f(q_4, c) = q_4$$
$$f(q_5, a) = q_5 \quad f(q_5, b) = q_5 \quad f(q_5, c) = q_5$$

i. Draw the transition table for the above machine. (3 marks)

ii. Determine the final state for the input string *abcc*. (1 mark)

iii. Is the input string *abcb* accepted by the DFA? (1 mark)

b) Let $A = (S, I, O, Z, f, g)$ be a finite state machine (FSM) defined by the transition table shown in Table 2.

Table 2: Transition table of FSM *A*

	f			*g*		
Input / State	*A*	*b*	*c*	*a*	*b*	*c*
X	*Z*	*X*	*Y*	*1*	*0*	*1*
Y	*X*	*X*	*Z*	*0*	*1*	*0*
Z	*Y*	*X*	*Z*	*1*	*0*	*1*

i. Draw the transition diagram of the finite state machine *A*. (4 marks)

ii. Find the output string for the input string *babccaab*. (2 marks)

iii. Find the output generated from the input string *cabccba*. (2 marks)

iv. Determine whether the input string *abcbcbcabcc* is accepted. (2 marks)

Question 5 **[10 marks]**

A sliding barrier turnstile (shown in Figure 2), used to control access to subways, is an automated gate at waist height with a barrier across the entryway. Initially the barrier is locked, barring the entry, preventing passengers from passing through. Depositing a token in a slot on the turnstile unlocks the barrier, allowing a single customer to push through. After the customer passes through, the barrier is locked again until another coin is inserted.

Figure 2

Considered as a state machine, the turnstile has two states: ***Locked*** and ***Unlocked***. There are two inputs that affect its state: putting a token in the slot (***token***) and retract the barrier (***retract***). In the locked state, retracting the arm has no effect; no matter how many times the input ***retract*** is given, it stays in the locked state. Putting a ***token*** as an input, shift the state from ***Locked*** to ***Unlocked***. In the unlocked state, putting additional tokens does not change the state. However, a customer passing through the retracted barrier, giving a ***retract*** input, shifts the state back to ***Locked***.

q_0 –

Given :

State

L: Locked

U: Unlocked

Input

T: Token

R: Retract

Output

0: Nothing happened

1: Retract the barrier so passenger can pass through

2: Lock the barrier when passenger has passed through

(a) Complete the transition table below. (4 marks)

Table 3

State	Input, f_s		Output, f_o	
	T	R	T	R
L				
U				

(b) Draw the transition diagram for the turnstile system described above. (6 marks)

Question 6 **[15 marks]**

a) Let $f : B^m \rightarrow B^n$ be an (2,6) encoding function

$f(00) = 000000$
$f(10) = 101010$
$f(01) = 011110$
$f(11) = 111000$

i. Find minimum distance (6 marks)

ii. How many error will be detected (2 marks)

b) Suppose H is a parity check matrix. Let m=2 and n=5. Determine the group code $f_H : B^3 \rightarrow B^6$ for $B^3 = \{01, 11\}$. { 000, 001, 010, 100, 011, 101, 110, 111 } (7 marks)

$$H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Question 7 **[10 marks]**

Let an encoding function, $f : B^2 \rightarrow B^4$, with f given by,

$f(00) = 0000$
$f(01) = 0101$
$f(10) = 1010$
$f(11) = 1111$

Decode the word **1001** and **0111** using the maximum likelihood method. (10 marks)