SULIT

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Faculty of Computing

UNIVERSITI TEKNOLOGI MALAYSIA
FINAL EXAMINATION SEMESTER I , 2016 / 2017

SUBJECT CODE	:	**SCSI 1013**
SUBJECT NAME	:	**DISCRETE STRUCTURE**
SECTION	:	**ALL**
TIME	:	**9. 00 AM – 12. 00 NOON**
DATE/DAY	:	**2 / 1 / 2017 (MONDAY)**
VENUES	:	**DEWAN SERBAGUNA KTDI**

INSTRUCTIONS :

1. Read instructions given for each question carefully.
2. Answer **ALL** questions in the **ANSWERING BOOKLET** given.

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

Name	HAIFA AQILAH BINTI DAUD
I/C No.	970716-04-5114
Year / Course	1-SCSV
Section	05
Lecturer Name	DR. NORHAIZAN

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

QUESTION 1 [30 MARKS]

a) A shuttle bus travels through eight residential colleges (C1, C2, C3, C4, C5, C6, C7, C8) to pick up students. The location of the colleges determines the bus route. There are two routes connecting C1 and C2. From C2, the shuttle can go to C3 through two routes, one route to C4 and one route to C5. There is only one route that connects C5, C6, and C7. In order to get to C7, the shuttle bus needs to pass through C6. C8 can only be access by a route through C7. During semester break; a shortcut route that connects C1, C4 and C7 can be used to shorten the journey.

i) Draw a graph that represents the route that connects the residential colleges.

(4 marks)

ii) Decide whether the graph in a(i) is a simple graph? Justify your answer.

(2 marks)

iii) List the degrees for each vertex of graph in a(i). (4 marks)

b) Write adjacency matrix for the graph shown in Figure 1.

(4 marks)

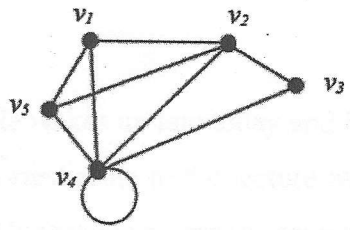
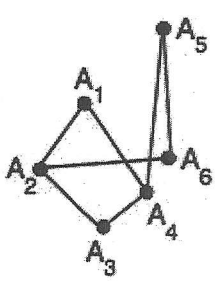
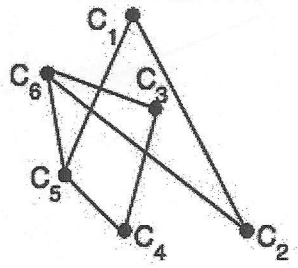


Figure 1

c) Show whether the graphs in Figure 2 (G and H) are isomorphic. (6 marks)



G



H

Figure 2

d) A tourist plans to visit seven places of attractions in a country, namely A, B, C, D, E, F, and G. These places are connected with inter city railway links. The route across these places is as shown in Figure 3.

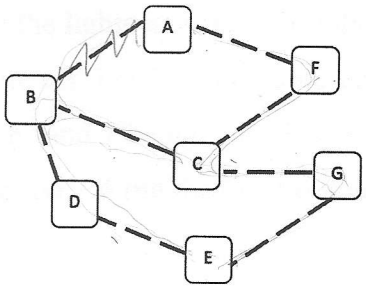


Figure 3

i) Trace the journey of the tourist if he wanted to visit every place of attractions (A, B, C, D, E, F, G, H) exactly once starting and ending at E. (4 marks)

ii) Determine whether the tourist's journey in d(i) is an Euler circuit or Hamiltonian circuit. (2 marks)

iii) If the inter city railway link from A to B is close due to maintenance work, plan the tourist's journey starting from A so he/she can still visit all the place of attractions and ends at any of the places following the Euler trail rules. (4 marks)

QUESTION 2 [10 MARKS]

Ahmad cycles to lecture every day. He wakes up late today and have only 15 minutes left before the lecture start. Help him to find the shortest route to the lecture hall if Ahmad college is located at **A** and the lecture hall is located at **F.** All possible routes to reach the lecture hall from the college and the time in minute for each path are illustrated in Figure 4. (10 marks)

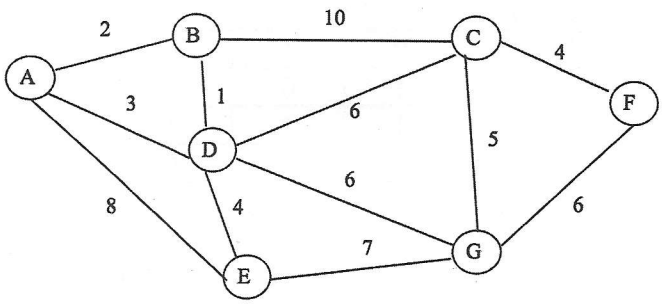


Figure 4

QUESTION 3 [20 MARKS]

a) The lights in a classroom are controlled by two switches; one at the back and one at the front of the room. Moving either switch to the opposite position turns the lights off if they are on and on if they are off. Assume the lights have been installed so that when both switches are in the down position, the lights are off. Let P and Q represent the position of the switches in the classroom, with 0 being "down" and 1 being "up". Let R represent the condition of the light, with 0 being "off" and 1 being "on". Write the input/output table with the design of the circuit to control the switches. (5 marks)

b) Write the Boolean expression for the circuit shown at Figure 5.

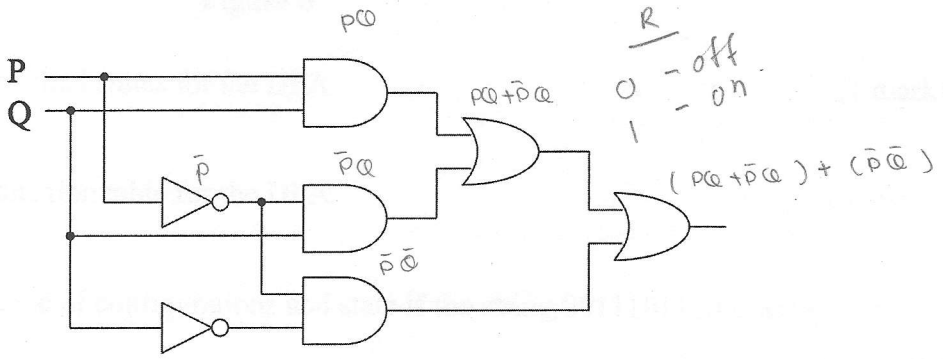


Figure 5

(5 marks)

c) Using the truth table for the following function F (see Table 1),

Table 1: Truth table function F

x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	0
1	0	0	1
1	1	0	1
1	0	1	0
0	1	1	1
1	1	1	0

i) Find the sum-of-product. (4 marks)

ii) Find the minimum expression using Karnaugh Map. (6 marks)

QUESTION 4 [10 MARKS]

a) Given a deterministic finite automaton (DFA) as in Figure 6.

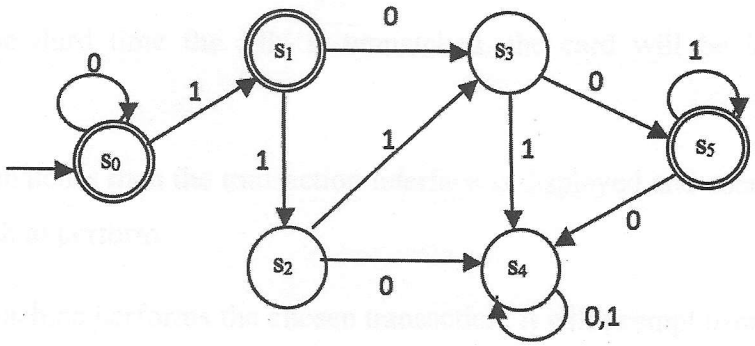


Figure 6

i) Write the set of final states for the DFA. (1 mark)

ii) Construct a transition table for the DFA. (3 marks)

iii) Find the sequence of configurations and state if the string 0011101100 is accepted by the DFA? (2 marks)

b) Construct a deterministic finite automaton (DFA) that accepts the set of all bit strings that contain three consecutive 1s. (4 marks)

QUESTION 5 [10 MARKS]

ATM is a computerized machine that provides bank customers to gain access to their accounts using magnetic encoded plastic card and code number. It enables the customer to perform online transactions without involving cashier, clerk and bank teller. The customer make cash withdrawal, check account balances, transfer money as well as purchase prepaid mobile phone credit by using ATM card. Typical PIN based ATM has following processes:

• Insert ATM card to establish interface. The card will be validated to ensure the correct ATM card is inserted. If the card is unsuccessfully validated, the card is ejected and ATM session is terminated.

• For valid ATM card, user is asked to enter the PIN and press the execution key for the system to match the PIN, if PIN does not matches, then user access is denied to the next stage and he or she is requested to repeat the operation with the correct PIN for a fixed two retries.

• If after the third time the PIN is unmatched, the card will be locked and ATM session is terminated.

• If the PIN matches then the transaction interface is displayed and user has to select the transaction that they wish to perform.

• After the machine performs the chosen transaction, it will prompt user if a new transaction is to be performed. If the response is 'Yes', the transaction interface is again displayed and if 'No' the transaction is terminated and card ejected and ATM session is terminated.

Based on the above description, the states, inputs and outputs are as follow:

States:

S_1: Welcome screen
S_2: Validating card
S_3: 1st PIN entering screen
S_4: 2nd PIN entering screen
S_5: 3rd PIN entering screen
S_6: Choosing transaction screen
S_7: Performing transaction
S_8: Asking for other transaction screen
S_9: Terminate ATM session

Inputs:

A: Insert ATM card
B: Valid ATM card
C: Invalid ATM card
D: Correct PIN
E: Incorrect PIN
F: Transaction is selected
G: Complete transaction
H: Yes for other transaction
I: No for other transaction screen

~~States:~~ Output

0: Nothing happened
1: Eject ATM card
2: Lock ATM card

Redraw the transition diagram (Figure 7) for the above system in your answer booklet and complete it.

(10 marks)

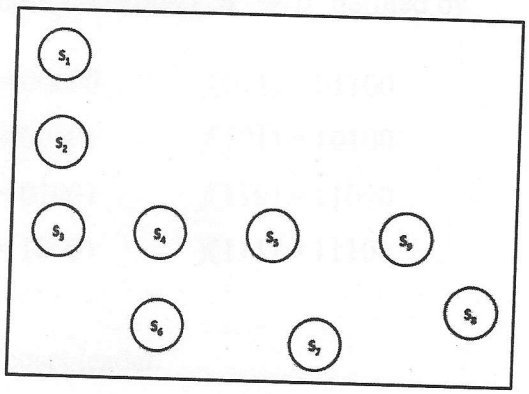


Figure 7

QUESTION 6 [10 MARKS]

a) Consider the (4,5) parity check code. Could the following bit strings have been received correctly?

i) 10011 (1 mark)

ii) 01010 (1 mark)

b) Let f be the (2,8) encoding function defined by

$f(00) = 00000000$ $f(01) = 01010100$ $f(10) = 10101111$ $f(11) = 11111000$

i) Find the Hamming Distance between each of pairs of the group code. (2 marks)

ii) How many errors can f detect? (2 marks)

d) Let $H = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ be parity check matrix.

Determine the group code function f_H: $B^2 \rightarrow B^6$. (4 marks)

QUESTION 7 [10 MARKS]

Consider the (3,5) group encoding function f: $B^3 \rightarrow B^5$ defined by

$f(000) = 00000$	$f(011) = 01100$
$f(001) = 00101$	$f(101) = 10100$
$f(010) = 01001$	$f(110) = 11000$
$f(100) = 10001$	$f(111) = 11101$

a) Determine the number of coset leader. (1 mark)

b) Contruct a table of left cosets in B^5 for $N = f(B^3)$. Place the coset leader at the beginning of each row. (5 marks)

c) Decode the following words relative to the maximum likelihood decoding function.

i) 00111 (2 marks)

ii) 11011 (2 marks)

11011

0000

00011 / 00101 / 00110

00011 / 01001 / 01010

00011 / 10001 / 10010

00011 / 01100 / 01111

00011 / 10100 / 10111

00011 / 11000 / 11011

00011 / 11101 / 11110

** End of Questions **
Good Luck!