UTM

UNIVERSITI TEKNOLOGI MALAYSIA

ASSIGNMENT 4

GROUP 3

SECTION 03 – 2024/2025

SECI1013 (DISCRETE STRUCTURE)

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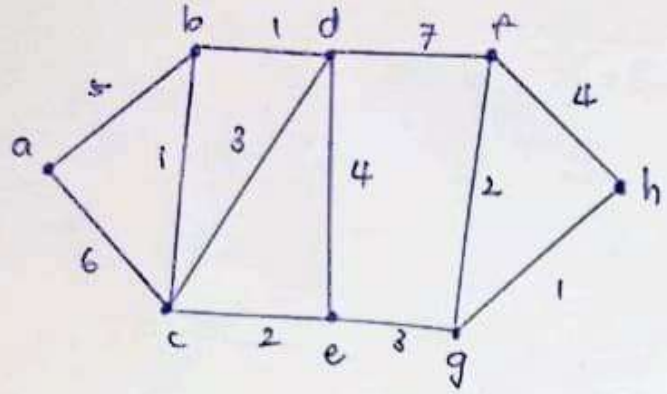
4.7 : Shortest Path

1.



Iteration	S	N	L(a)	L(b)	L(c)	L(d)	L(e)	L(f)	L(g)	L(h)
0	{}	{a,b,c,d,e,f,g,h}	0	∞	∞	∞	∞	∞	∞	∞
1	{a}	{b,c,d,e,f,g,h}	0	5	6	∞	∞	∞	∞	∞
2	{a,b}	{c,d,e,f,g,h}	0	5	6	6	∞	∞	∞	∞
3	{a,b,c}	{d,e,f,g,h}	0	5	6	6	8	∞	∞	∞
4	{a,b,c,d}	{e,f,g,h}	0	5	6	6	8	13	∞	∞
5	{a,b,c,d,e}	{f,g,h}	0	5	6	6	8	13	11	∞
6	{a,b,c,d,e,g}	{f,h}	0	5	6	6	8	13	11	12
7	{a,b,c,d,e,g,h}	{f}	0	5	6	6	8	13	11	12

∴ Shortest path is $a \rightarrow c \rightarrow e \rightarrow g \rightarrow h$

Chapter 4 (4.7) Question 2

i)

Iteration	S	N	L(I)	L(A)	L(K)	L(P)	L(J)	L(S)	L(M)
0	{}	{I, A, K, P, J, S, M}	∞	∞	∞	∞	∞	∞	∞
1	{I}	{A, K, P, J, S, M}	0	1768	2987	3899	∞	∞	∞
2	{I, A}	{K, P, J, S, M}	0	1768	2987	3899	5024	∞	∞
3	{I, A, K}	{P, J, S, M}	0	1768	2987	3899	5024	∞	∞
4	{I, A, K, P}	{J, S, M}	0	1768	2987	3899	5024	5253	∞
5	{I, A, K, P, J}	{S, M}	0	1768	2987	3899	5024	5253	∞
6	{I, A, K, P, J, S}	{M}	0	1768	2987	3899	5024	5253	6479
7	{I, A, K, P, J, S, M}	{}	0	1768	2987	3899	5024	5253	6479

Shortest Path: Ipoh → Putrajaya → Seremban → Melaka

Shortest route: 6479

ii)

Iteration	S	N	L(A)	L(I)	L(J)	L(K)	L(P)	L(S)	L(M)
0	{}	{A, I, J, K, P, S, M}	∞	∞	∞	∞	∞	∞	∞
1	{A}	{I, J, K, P, S, M}	0	1768	3256	∞	∞	∞	∞
2	{A, I}	{J, K, P, S, M}	0	1768	3256	4755	5667	∞	∞
3	{A, I, J}	{K, P, S, M}	0	1768	3256	4755	5667	5257	∞
4	{A, I, J, K}	{P, S, M}	0	1768	3256	4755	5667	5257	∞
5	{A, I, J, K, S}	{P, M}	0	1768	3256	4755	5667	5257	6483
6	{A, I, J, K, S, M}	{P}	0	1768	3256	4755	5667	5257	6483

Shortest path: Mor Setar → Johor Baharu → Seremban → Melaka

Shortest Route: 6483

b) i) Ipoh → Melaka

Ipoh → Putrajaya → Seremban → Melaka

1500	500	500
1.5 Hour	20 min	20 min

Time taken = 2 Hour 10 Minutes

Cost : 1500 + 500 + 500

= 2500

= RM2500

ii) Alor Setar → Melaka

Alor Setar → Johor Baharu → Seremban → Melaka

1400	2000	500
1.25 Hour	2H10 M	20 min

Time taken : 2 Hour 55 Minutes

Cost : 1400 + 2000 + 500

= RM3900

c) i) Ipoh → Melaka

Ipoh → Putrajaya → Seremban → Melaka

4H 30M	2H 30M	2H
700	100	100

Time Taken = 9 Hours

Cost = 700 + 100 + 100

= 900

= RM900

ii) Alor Setar → Melaka

Alor Setar → Johor Baharu → Seremban → Melaka

5H	6H 20M	2H
700	1000	100

Time Taken = 13H 20urs 20 Minutes

Cost = 700 + 1000 + 100

= 1800 = RM1800

Chapter 4.8

Question 1

1a. n, o, p

1b. s, m, i, d, b, a

1c. r, s, t

1d. 11 leaves

1e. h, i, j, k, l

1f. m = 4

1g. the height of the tree is 5

1h. h, q, r, s, t, m, i, d, e, b, n, o, p, j, f, k, l, g, c, a

1i. a, b, d, h, i, m, q, r, s, t, e, c, f, j, n, o, p, g, k, l

1j. h, d, q, m, r, s, t, i, b, e, a, n, j, o, p, f, c, k, g, l

Chapter 4.8

Question 28

a. $m = 5$

$i = 20000$

$l = (m-1)i + 1$

$l = (5-1)(20000) + 1$

$l = 80001$

$n = l + i$

$n = 80001 + 20000$

$n = 100001$

total people who received the letters = 100001 people

b. $m = 5$

$i = 20000$

$l = (m-1)i + 1$

$l = (5-1)(20000) + 1$

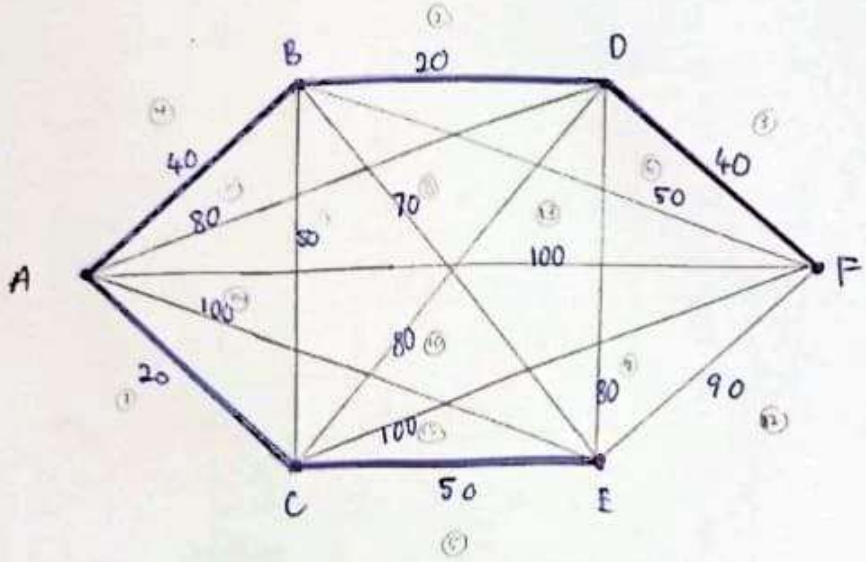
$l = 80001$

there were 80001 people who did not sent out the letters.

4.8

Question 3

- Find MST using Kruskal's Algorithm
- Provide the overall weight of MST
- Show all the procedures
- Give reasons behind the path you choose



List ~~Select~~ the edges in order of size:

AC 20	AC 20
BD 20	BD 20
DF 40	AB 40
AB 40	DF 40
CE 50	BC 50
BF 50	BF 50
BC 50	CE 50
~~170~~ ⇒	BE 70
BE 70	AD 80
DE 80	CD 80
CD 80	DE 80
AD 80	EF 90
EF 90	AE 100
AF 100	AF 100
AE 100	CF 100
CF 100	

Select the shortest edge in the network:

AC 20

Select the next shortest edge which does not create a cycle:

AC 20
BD 20
AB 40
DF 40
~~BC 50~~ } forms a cycle
~~BF 50~~
CE 50
~~BE 70~~ } forms a cycle
~~AD 80~~
~~CD 80~~
~~DE 80~~
~~EF 90~~
~~AE 100~~
~~AF 100~~
~~CF 100~~

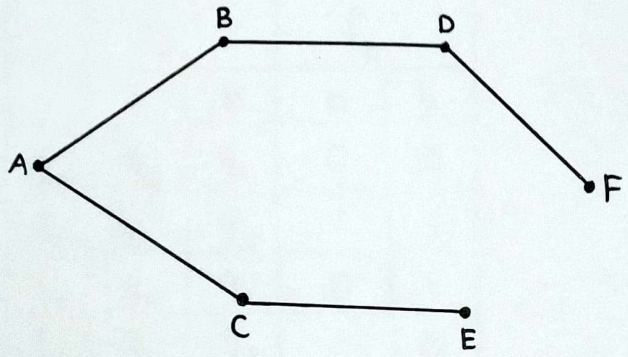
Overall weight of MST is

AC + BD + AB + DF + CE

= 20 + 20 + 40 + 40 + 50

= 170

Minimum Spanning Tree :



Chapter 5

Question 1

$M = \{S, I, q_0, f_s, F\}$

S:

q_0 – initial state (0 coin)

q_1 – 50 cents

q_2 – 100 cents

q_3 – 150 cents

q_4 – $\geq$ 200 cents

$I = \{50, 100\}$

$f_s(q_0, 50) = q_1$

$f_s(q_0, 100) = q_2$

$f_s(q_1, 50) = q_2$

$f_s(q_1, 100) = q_3$

$f_s(q_2, 50) = q_3$

$f_s(q_2, 100) = q_4$

$f_s(q_3, 50) = q_4$

$f_s(q_3, 100) = q_4$

$f_s(q_4, 50) = q_4$

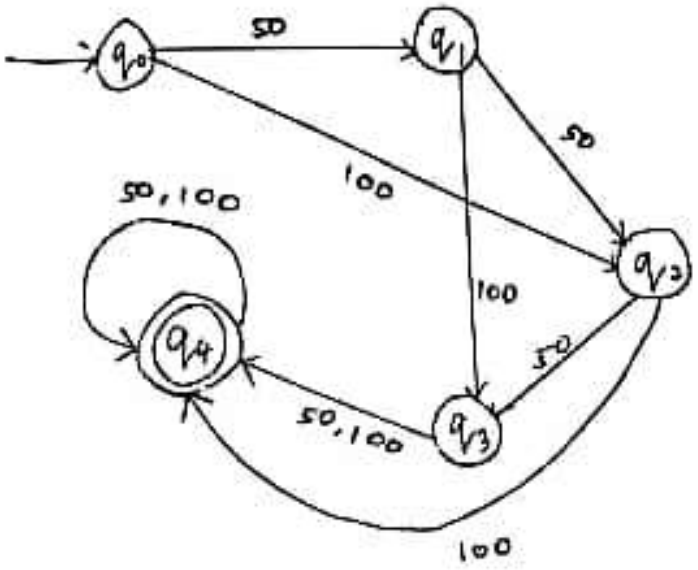
$f_s(q_4, 100) = q_4$

$M = \{\{q_0, q_1, q_2, q_3, q_4\}, \{50, 100\}, q_0, f_s, \{q_4\}\}$

Transition Table

f_s	I	
	50	100
q_0	q_1	q_2
q_1	q_2	q_3
q_2	q_3	q_4
q_3	q_4	q_4
q_4	q_4	q_4

Transition Diagram



Question 2

2i.

	f_s		f_o	
	a	b	a	b
q_0	q_2	q_1	0	0
q_1	q_2	q_3	1	1
q_2	q_0	q_1	0	1
q_3	q_2	q_3	1	0

$f_o = \{0, 1\}$

ii.a. abbaaab

$$q_0 \xrightarrow[0]{a} q_0 \xrightarrow[0]{b} q_1 \xrightarrow[1]{b} q_3 \xrightarrow[1]{a} q_2 \xrightarrow[0]{a} q_0 \xrightarrow[0]{a} q_0 \xrightarrow[0]{b} q_1$$

output string = 0011000

output = 0

No, the input string is not accepted by the machine

ii.b. bbbaababb

$$q_0 \xrightarrow[0]{b} q_1 \xrightarrow[1]{b} q_3 \xrightarrow[0]{b} q_3 \xrightarrow[1]{a} q_2 \xrightarrow[0]{a} q_0 \xrightarrow[0]{b} q_1 \xrightarrow[1]{a} q_2 \xrightarrow[1]{b} q_1 \xrightarrow[1]{b} q_3$$

output string = 010100111

output = 1

Yes, the input string is accepted by the machine.

Question 3

i. Element of M:

$S = \{q_0, q_1, q_2\}$

$I = \{a\}$

q_0

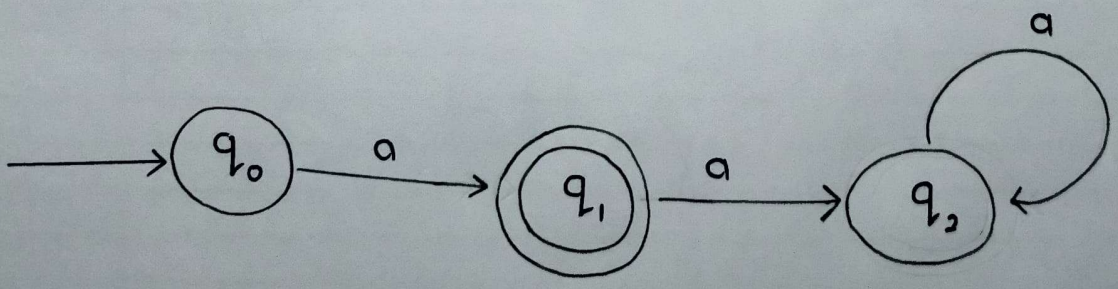
f_s

$F = \{q_1\}$

ii.

	f_s
	a
q_0	q_1
q_1	q_2
q_2	q_2

iii.

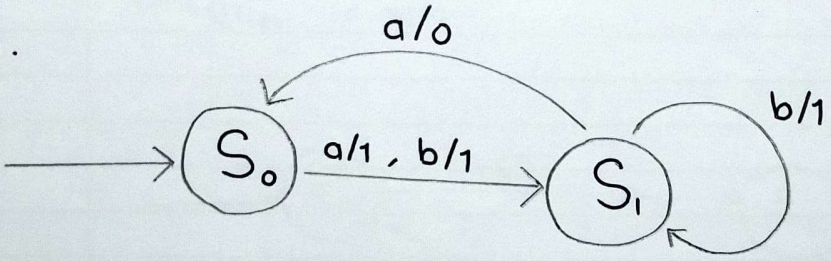


Question 5

i.

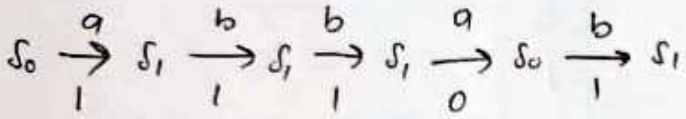
	f_s		f_o	
	a	b	a	b
S_0	S_1	S_1	1	1
S_1	S_0	S_1	0	1

ii.



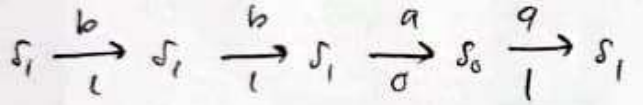
5 iii. - Shows output sequence
- Determine whether accepted or not.

a. abbab



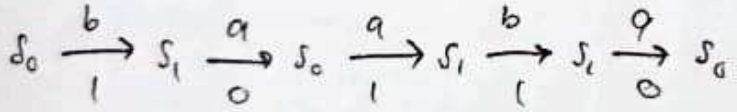
output string : 1 1 1 0 1
output : 1
accepted

b. bbaa



output string : 1 1 0 1
output : 1
accepted

c. baaba



output string : 1 0 1 1 0
output : 0
rejected

Question 6