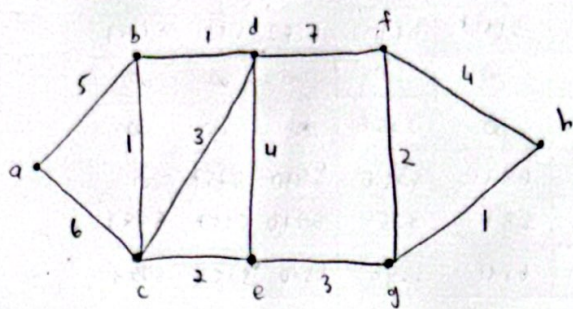


ASSIGNMENT 4 (MAP 4 (4-7))

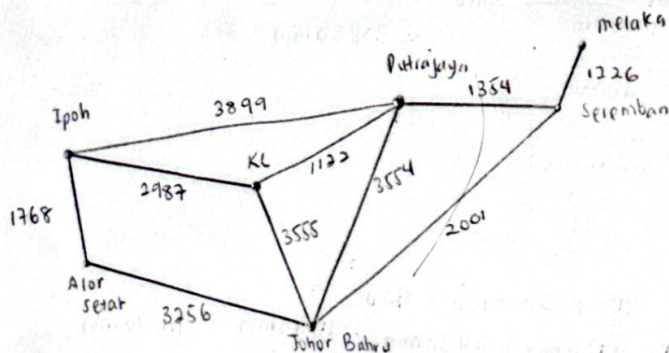
1.



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 : $a \rightarrow c \rightarrow e \rightarrow g \rightarrow h = 12$

2.



a) i. Ipoh to Melaka

Iteration	S	N	L(I)	L(AS)	L(KL)	L(JB)	L(P)	L(S)	L(M)
0	{}	{I, AS, KL, JB, P, S, M}	0	∞	∞	∞	∞	∞	∞
1	{I}	{AS, KL, JB, P, S, M}	0	1768	2987	∞	3899	∞	∞
2	{I, AS}	{KL, JB, P, S, M}	0	1768	2987	3256	3899	∞	∞
3	{I, AS, KL}	{JB, P, S, M}	0	1768	2987	3256	3899	∞	∞
4	{I, AS, KL, JB}	{P, S, M}	0	1768	2987	3256	3899	5257	∞
5	{I, AS, KL, JB, P}	{S, M}	0	1768	2987	3256	3899	5253	∞
6	{I, AS, KL, JB, P, S}	{M}	0	1768	2987	3256	3899	5253	6479
7	{I, AS, KL, JB, P, S, M}	{}	0	1768	2987	3256	3899	5253	6479

Shortest distance : $I \rightarrow P \rightarrow S \rightarrow M = 6479$

2. a) ii) Alor Setar to Melaka

Iteration	S	N	L(AS)	L(KL)	L(JB)	L(P)	L(S)	L(M)
0	{ }	{ AS, KL, JB, P, S, M }	0	∞	∞	∞	∞	∞
1	{ AS }	{ KL, JB, P, S, M }	0	∞	3256	∞	∞	∞
2	{ AS, JB }	{ KL, P, S, M }	0	6811	3256	6810	5257	∞
3	{ AS, JB, S }	{ KL, P, M }	0	6811	3256	6810	5257	6483
4	{ AS, JB, S, M }	{ KL, P }	0	6811	3256	6810	5257	6483

shortest distance : AS \rightarrow JB \rightarrow S \rightarrow M : 6483

b) i. Ipoh to Melaka

shortest distance : I \rightarrow P \rightarrow S \rightarrow M

destination	Aeroplane	
	cost	time
Ipoh \rightarrow Putrajaya	1500	1H30 min
Putrajaya \rightarrow Seremban	500	0H20 min
Seremban \rightarrow Melaka	500	0H20 min

cost : 1500 + 500 + 500 = 2500

time : 90 + 20 + 20 = 130 min
= 2H10 min

ii. Alor Setar to Melaka

shortest distance : AS \rightarrow JB \rightarrow S \rightarrow M :

destination	aeroplane	
	cost	time
Alor Setar \rightarrow Johor Bahru	1400	1H00 min
Johor Bahru \rightarrow Seremban	2000	2H10 min
Seremban \rightarrow Melaka	500	0H20 min

cost : 1400 + 2000 + 500 = 3900

time : 1H + 2H10 min + 0H20 min
= 3H30 min

c) i) Ipoh to Melaka

destination	car	
	cost	time
Ipoh \rightarrow Putrajaya	700	4H30 min
Putrajaya \rightarrow Seremban	100	2H30 min
Seremban \rightarrow Melaka	100	2H00 min

cost : 700 + 100 + 100 = 900

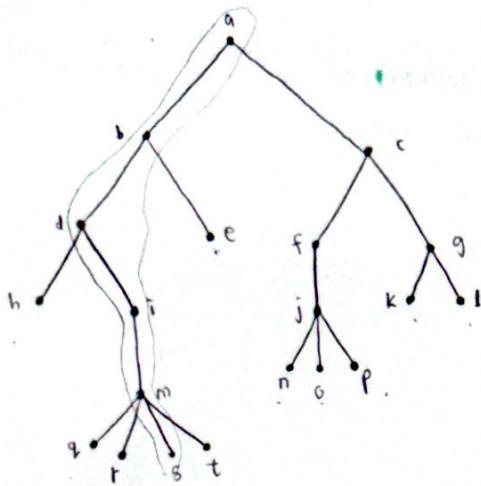
time : 4H30 min + 2H30 min + 2H00 min = 9H00 min

ii) Alor Setar to Melaka

destination	car	
	cost	time
Alor Setar \rightarrow Johor Bahru	700	5H00 min
Johor Bahru \rightarrow Seremban	1000	6H20 min
Seremban \rightarrow Melaka	100	2H00 min

cost : 700 + 1000 + 100 = 1800

time : 5H00 min + 6H20 min + 2H00 min = 13H20 min



a) children of vertex j



n, o, p are children of j

b) ancestors of vertex s



a, b, d, i, m are ancestors of s

c) siblings of vertex q



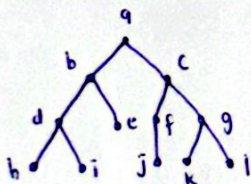
r, s, t are siblings of q

d) number of leaves : 11

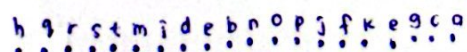
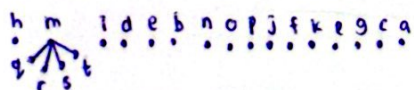
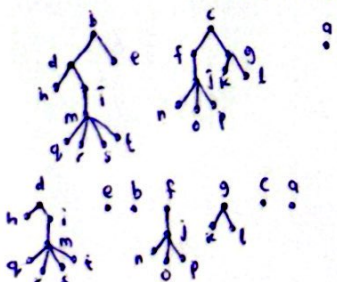
e) list all level 3 vertices

f) m = 4

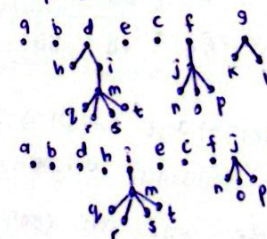
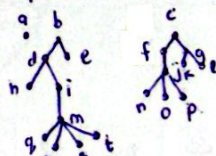
g) height = 5



h) post-order (left, right, root)

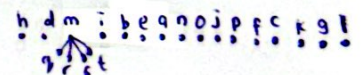
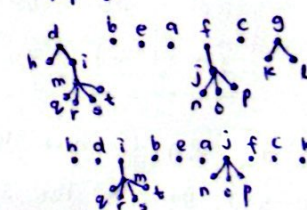


i) preorder (root, left, right)



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

j) inorder (left, root, right)



h d m i b e a n o j p f c k g l

2. a chain letter starts when a person sends a letter to 5 people. $m=5$

Each person sends the letter to 5 other people who have never received it or did not send it to anyone.

Suppose that 20 000 people send out the letter before the chain ends $i=20\ 000$
and that no one receives more than one letter.

How many people receive the letter? $n=?$

How many people do not send it out? $l=?$

using 5-ary tree. $m=5$

$$n = mi + 1$$

$$= 5(20\ 000) + 1$$

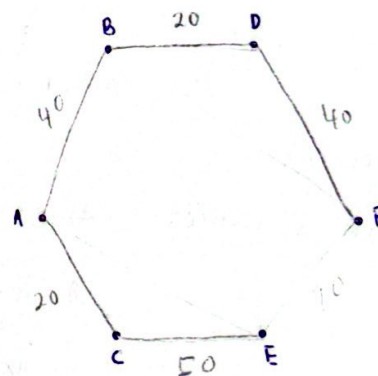
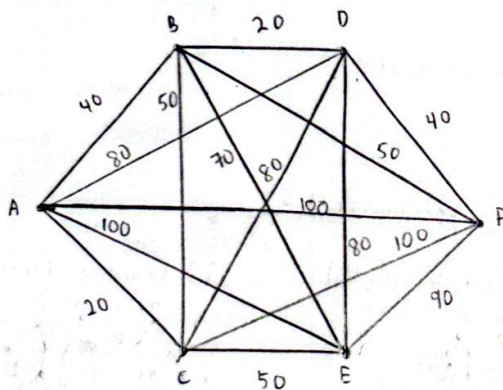
$$= 100\ 001 \text{ people receive the letter}$$

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

$$= (5-1)(20\ 000) + 1$$

$$= 80\ 001 \text{ do not send it out}$$

3.



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

AC and BD → has the least weightage which is 20

AD and DF → the next least weightage which is 30

CE → BC and BF create a cycle when its connected

overall weight of the MST = $50 + 20 + 40 + 20 + 40 = 170$

(S-1 and S-2)

$$I = \{50, 100\}$$

q_0 = no coin is put into the vending machine (2.00)

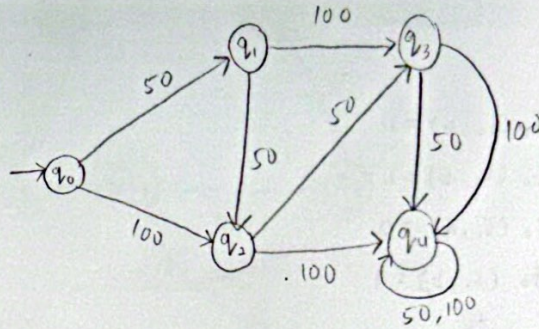
q_1 = accepts 50 cents (1.50)

q_2 = accepts 100 cents (1.00)

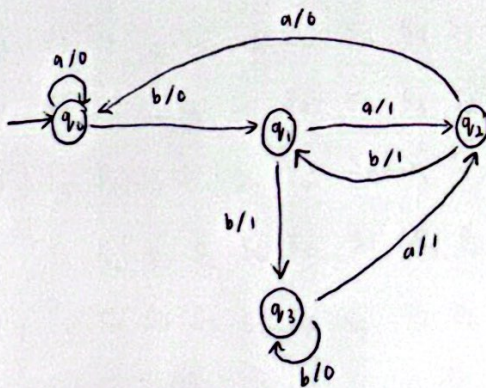
q_3 = accepts 150 cents (0.50)

q_4 = accepts 200 cents (0.00)

f_s	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



2)



i)

	f_s	f_0
	a b	a b
q_0	q_0 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

$$Q = \{S, I, O, q_0, f_s, f_0\}$$

$$S = \{q_0, q_1, q_2, q_3\}$$

$$I = \{a, b\}$$

$$O = \{0, 1\}$$

q_0 = Initial state

ii) a) abbaaab

$$q_0 \xrightarrow{a} q_0 \xrightarrow{b} q_1 \xrightarrow{b} q_3 \xrightarrow{a} q_2 \xrightarrow{a} q_0 \xrightarrow{a} q_0 \xrightarrow{b} q_1 = \text{not accepted by machine}$$

Output = 0

b) bbbababb

$$q_0 \xrightarrow{b} q_1 \xrightarrow{b} q_3 \xrightarrow{b} q_3 \xrightarrow{a} q_2 \xrightarrow{a} q_0 \xrightarrow{b} q_1 \xrightarrow{a} q_2 \xrightarrow{b} q_1 \xrightarrow{b} q_3$$

= accepted by machine

Output = 1

3) $M = \{ \{q_0, q_1, q_2\}, \{a\}, q_0, f_s, \{q_1\} \}$

$f_s(q_0, a) = q_1$

$f_s(q_1, a) = q_2$

$f_s(q_2, a) = q_2$

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

$I = \{a\}$

$q_0 = q_0$

$f_s = f_s$

$F = q_1$

ii.

f_s	a
q_0	q_1
q_1	q_2
q_2	q_2

iii.



4) $f_s(S_0, a) = S_1$ $f_0(S_0, a) = 1$

$f_s(S_0, b) = S_1$ $f_0(S_0, b) = 1$

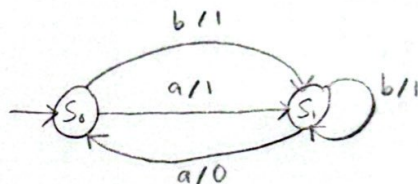
$f_s(S_1, a) = S_0$ $f_0(S_1, a) = 0$

$f_s(S_1, b) = S_1$ $f_0(S_1, b) = 1$

i.

	f_s			f_0	
	a	b		a	b
S_0	S_1	S_1		1	1
S_1	S_0	S_1		0	1

ii.



iii- a) abbab

$S_0 \xrightarrow[a]{a} S_1 \xrightarrow[b]{b} S_1 \xrightarrow[b]{b} S_1 \xrightarrow[a]{a} S_0 \xrightarrow[b]{b} S_1$

output : 1

\therefore accepted by machine M

b) bbba

$S_0 \xrightarrow[b]{b} S_1 \xrightarrow[b]{b} S_1 \xrightarrow[a]{a} S_0 \xrightarrow[a]{a} S_1$

Output : 1

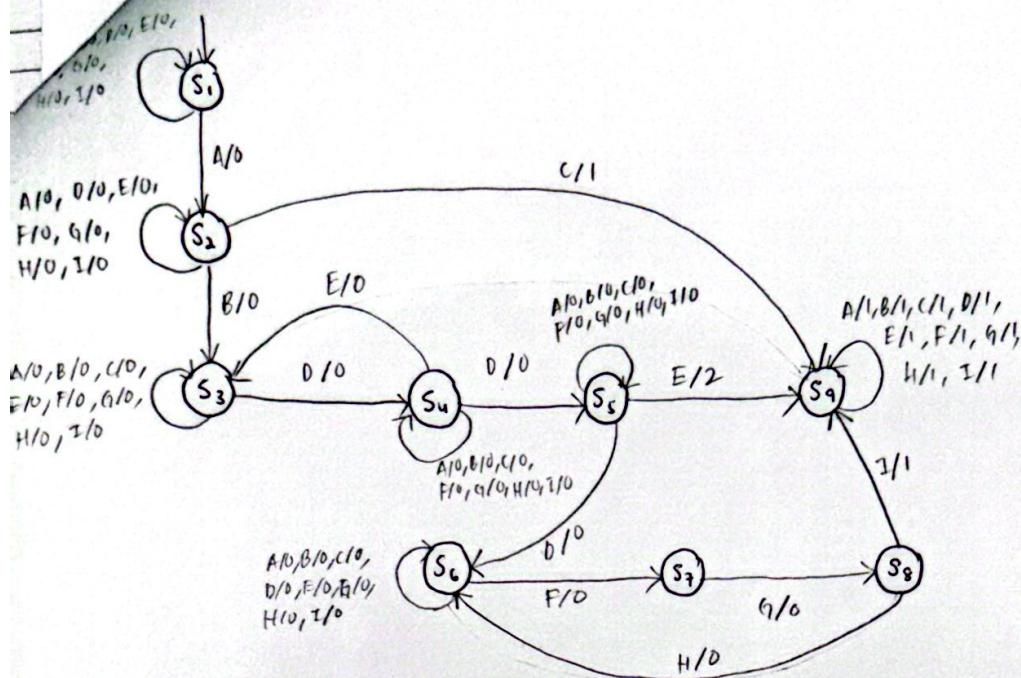
\therefore accepted by machine M

c) baaba

$S_0 \xrightarrow[b]{b} S_1 \xrightarrow[a]{a} S_0 \xrightarrow[a]{a} S_1 \xrightarrow[b]{b} S_1 \xrightarrow[a]{a} S_0$

output : 0

\therefore not accepted by machine M



	fs										fo								
	A	B	C	D	E	F	G	H	I		A	B	C	D	E	F	G	H	I
S1	S2	S1	S1	S1	S1	S1	S1	S1	S1		0	0	0	0	0	0	0	0	0
S2	S2	S3	S9	S2	S2	S2	S2	S2	S2		0	0	1	0	0	0	0	0	0
S3	S3	S3	S3	S4	S3	S3	S3	S3	S3		0	0	0	0	0	0	0	0	0
S4	S4	S4	S4	S5	S3	S4	S4	S4	S4		0	0	0	0	0	0	0	0	0
S5	S5	S5	S5	S6	S9	S5	S5	S5	S5		0	0	0	0	2	0	0	0	0
S6	S6	S6	S6	S6	S6	S7	S6	S6	S6		0	0	0	0	0	0	0	0	0
S7	S7	S7	S7	S7	S7	S7	S8	S7	S7		0	0	0	0	0	0	0	0	0
S8	S8	S8	S8	S8	S8	S8	S8	S6	S9		0	0	0	0	0	0	0	0	1
S9	S9	S9	S9	S9	S9	S9	S9	S9	S9		1	1	1	1	1	1	1	1	1