UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SECI 1013 - DISCRETE STRUCTURE

SECTION 02

SEM I 2023/2024

ASSIGNMENT 4

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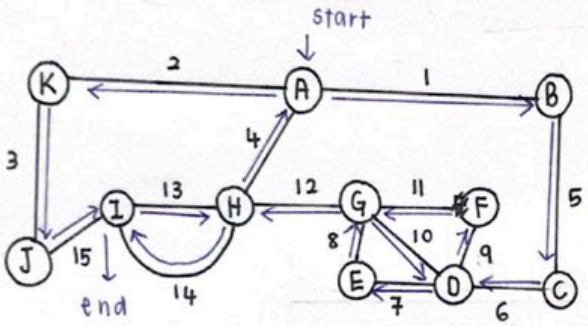
1. not same edge more than once

a) construct the route for the security guard to patrol the entire neighbourhood starting from the guard house, labelled A



~~A,1,B,5,C,6,D,9,F,11,G,10,D,7,E,8,G,12,H,4,A,2,K,3,J,15,~~

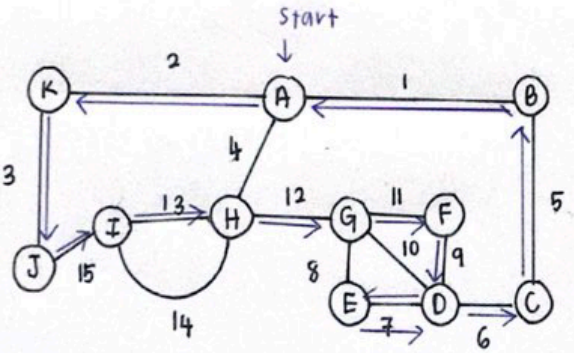
(A,1,B,5,C,6,D,9,F,11,G,10,D,7,E,8,G,12,H,14,I,13,H,4,A,2,K,3,J,15,I)

No, the guard will not go back to the guard house A because :

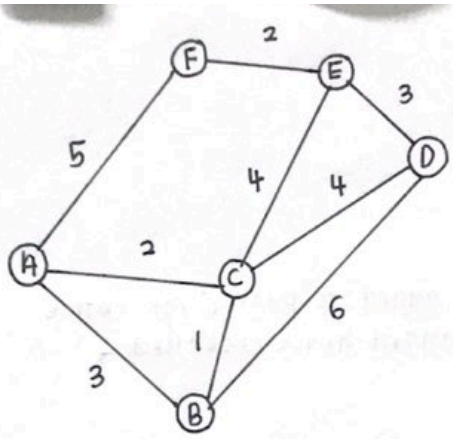
- it is Euler trail (it start with A but end with I)
- there is odd degree on vertex I

b) It is not possible because :

- Vertex D is visited twice
- (A,2,K,3,J,15,I,13,H,12,G,11,F,9,D,7,E,7,D,6,C,5,B,1,A)



2.



A : Mumbai
B : Bengaluru
C : Hyderbad
D : Kolkata
E : Lucknow
F : New Delhi.

~~Bengaluru~~

a)

S	N	L(B)	L(A)	L(C)	L(D)	L(E)	L(F)
$\{\phi\}$	$\{B,A,C,D,E,F\}$	ϕ	∞	∞	∞	∞	∞
$\{\phi,B\}$	$\{A,C,D,E,F\}$		3	~~4~~	6	∞	∞
$\{\phi,B,C\}$	$\{A,D,E,F\}$		~~3~~		5	5	∞
$\{\phi,B,C,A\}$	$\{D,E,F\}$				~~5~~	5	8
$\{\phi,B,C,A,D\}$	$\{E,F\}$					~~5~~	8
$\{\phi,B,C,A,D,E\}$	$\{F\}$						~~8~~
$\{\phi,B,C,A,D,E,F\}$	$\{\phi\}$						7

b) shortest path

B ⟵ C ⟵ E ⟵ F

minimum hours ~~to~~ travel :

= 1 + 4 + 2

= 7 hours ✱

3. Consider the rooted tree T shown in Figure 3.

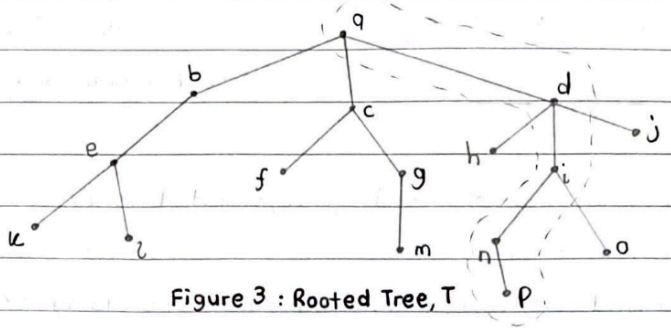


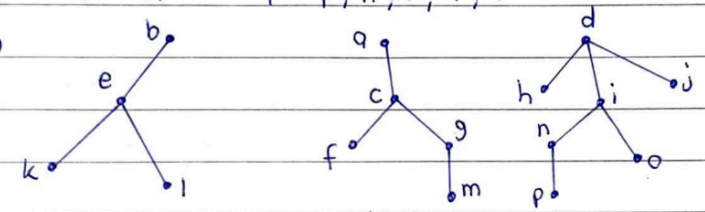
Figure 3 : Rooted Tree, T

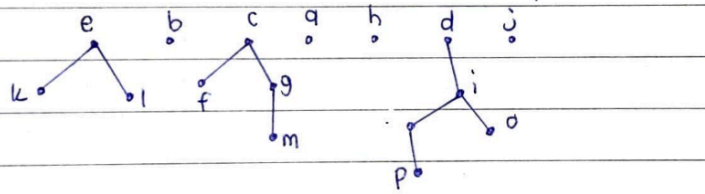
a) what are the ancestors of p?

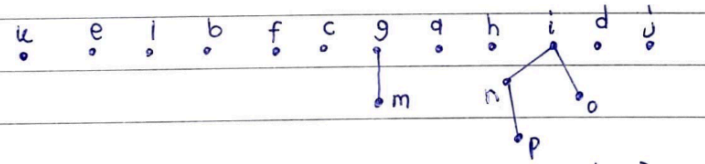
b) Perform inorder traversal. (left-root-right)

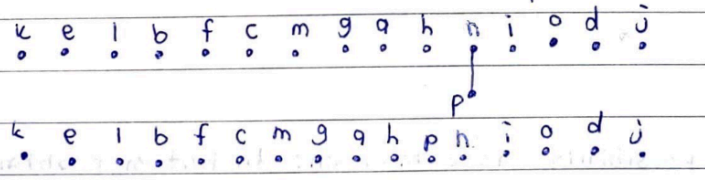
a) Ancestor of node p: p, n, i, d, a

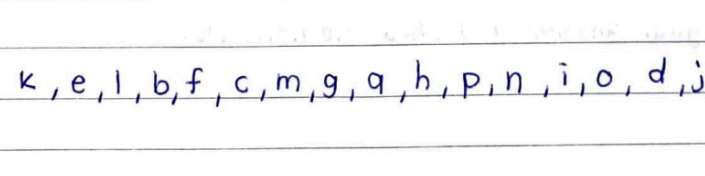
b)





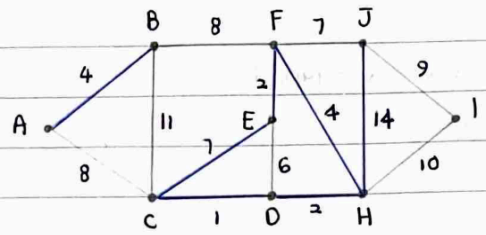






∴ k, e, l, b, f, c, m, g, a, h, p, n, i, o, d, j

4.



E = length of path in meters

Cost = RM100/meter

Find minimum network needed.

a) Explain why the staff's work which is highlighted is incorrect.

Because it formed a circuit and some path are not connected.

b) Help the staff to find the correct minimum network using Kruskal's algorithm and states its length and total cost.

Edge	Weight	Circuit	Select
CD	1	no	yes ✓
DH	2	no	yes ✓
FE	2	no	yes ✓
HF	4	no	yes ✓
AB	4	no	yes ✓
ED	6	yes	no
EC	7	yes	no
FJ	7	no	yes ✓
BF	8	yes	no
AC	8	no	yes ✓
JI	9	no	yes ✓
IH	10	yes	no
BC	11	yes	no
JH	14	yes	no

V = 9

E = 9-1 = 8

minimum network

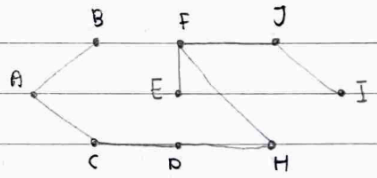
= 1 + 2 + 2 + 4 + 4 + 7 + 8 + 9

= 37

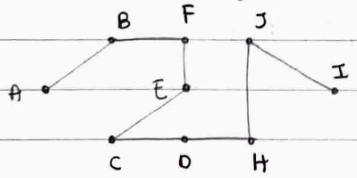
Total cost

= 100 x 37

= Rm 3700.00



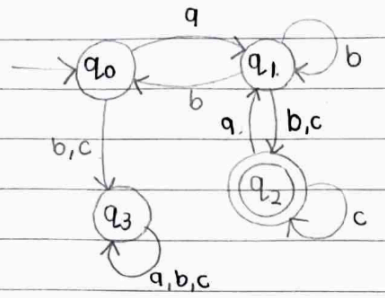
c) Is there any possibility, more than one distint MST obtained? If yes, justify your answer and show the network.



yes, but this is not the most minimum

5. Construct a state transition diagram of a DFA that accepts all strings over $\{a, b, c\}$ that begin with a, contain exactly two b's and end with c.

$\Sigma = \{a, b, c\}$



f_s	a	b	c
q_0	q_1	q_3	q_3
q_1	q_0	q_2	q_2
q_2	q_1	q_1	q_2
q_3	q_3	q_3	q_3

⑥ let $M = \{S, I, w, f_s, F\}$ be the DFA such that $F = \{x, z\}$ and f_s is defined as in

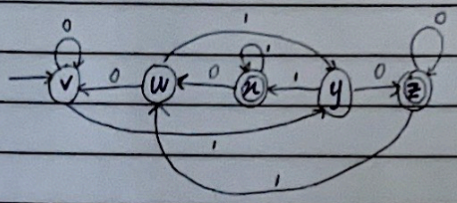
TABLE 1

STATE	f_s	
	0	1
v	v	y
w	v	y
x	w	x
y	z	x
z	z	w

a] write the set of states and initial state for DFA machine M.

set of states, $S = \{v, w, x, y, z\}$

initial state = v



b] determine an input string with length 4 and start with 0 that will be accepted by the machine. Show the sequence of transition of each state for the input string.

$v \xrightarrow{0} v \xrightarrow{1} y \xrightarrow{1} x \xrightarrow{0} x$

[0110]

end at x/z

start at v

⑦ there is a 3-story elevator that can go to ground floor, floor 1 and floor 2, and there are buttons for each floor. The initial state is the ground floor. The inputs to the elevator are the buttons for the ground, first, and second floor. If the elevator is on the floor 1 and the button for:

- floor 1 is pressed, nothing happens, and the elevator remains on floor 1.
- floor 2 is pressed, the elevator goes up until it has reached floor 2.
- ground floor is pressed, the elevator goes down until it has reached ground floor.

this situation also applies for elevator that is on floor 2 or ground floor. The FSM has 3 inputs which is for button ground floor is "0", button first is "1", and button second floor is "2". Design the FSM which controls the operation of an elevator in a 3-story building using the transition table.

	0	1	2	0	1	2
gf	gf	f1	f2	a	b	b
f1	gf	f1	f2	c	a	b
f2	gf	f1	f2	c	c	a

use $M = \{S, I, O, q_0, f_s, f_o\}$

$I = \{0, 1, 2\}$ — button

$S = \{gf, f1, f2\}$ — floor

$q_0 = gf$ — initial state

let a = remain, b = goes up } goes down = c,

$O = \{a, b, c\}$ — output