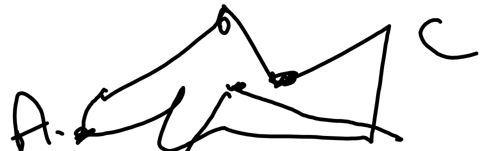


DIJKSTRA'S ALGORITHM

Steps: Find shortest path from "s" to "t"

1) Given a connected, weighted graph G with n vertices. If G is not simple make it simple be removing self loops and parallel edge be keeping minimum weighted edge amoung parallel edges.

2) We start with origin (starting vertex) by assiging "0" as permanent label, remaining (n-1) vertices are labelled as ∞ and treat as temporary labels.

3) In each iteration another vertex gets a permanent label, according to the following rules.

3a) Every vertex vj that is not yet permanently labelled get a new temporary label by the formula

Lable(vj)=min(Permanent Label, Temperary label (vj)+wt(vj to x))

Here wt(vj to x) means weight of the edge between vj to x vertex

3b) If the vertex vi and vj are not adjacent by any edge then take the weight as ∞.

3c)

s	v_1	v_2	—	—	—	v_n	t
0	∞	∞	—	—		∞	∞
$\boxed{0}$	0	0				0	0

3c) The smallest value among all the temporary label is found and this becomes the permanent lable of the corresponding vertex.
If two or more smallest value, choose any one of them.

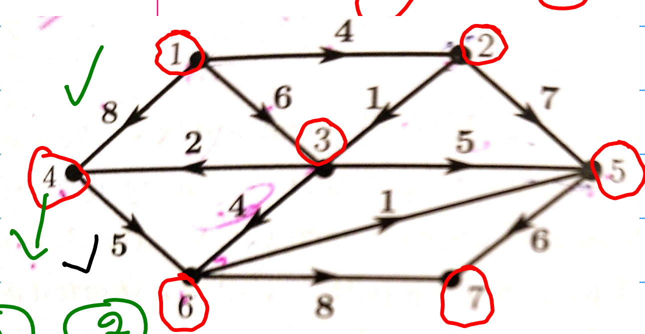
3d) We repeat step 3 till destination vertex gets permanent label.

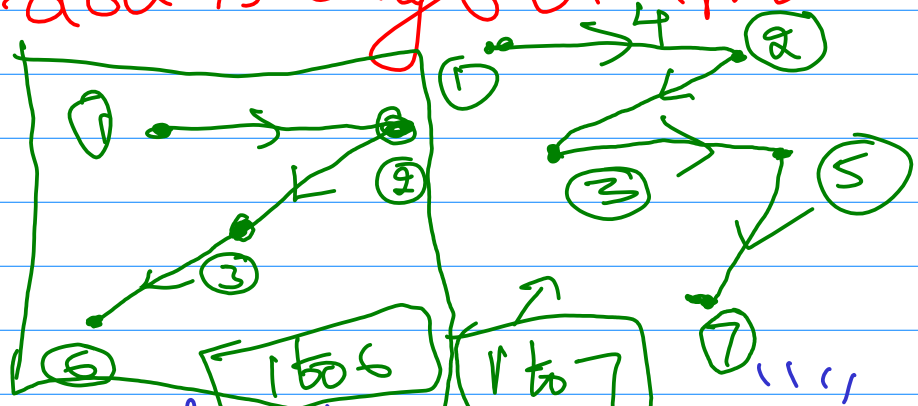
5) This algorithm gives shortest distance but not path. To find path we impliment backward procedure from terminal vertex such where each vertex gets

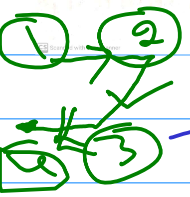
permanent label.

11) Problem

Find shortest path from '1' to all other using Dijkstra's algorithm.







1) Start with vertex 1, assigning 0 as Per Label.

1	2	3	4	5	6	7
$\boxed{0}$	∞	∞	∞	∞	∞	∞

$\text{Label}(2) = \min\{\infty, 0+4\}$ edge(1 to 2)

$= 4$

$\text{Label}(3) = \min\{\infty, 0+6\} = 6$

$\text{Label}(4) = \min\{\infty, 0+8\} = 8$

$\text{Label}(5) = \min(\infty, 0+\infty\} = \infty$

$\text{Label}(6) = \min(\infty, 0+\infty\} = \infty$

$\text{Label}(7) = \min(\infty, 0+\infty\} = \infty$

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	6	8	∞	∞	∞

now 2 is having Permanent label.

Label(3) = min{6, 4 + 1} } edge from 2 to vertex
= 5

Label(4) = min{8, 4 + ∞} = 8
Label(5) = min{∞, 4 + 7} = 11
For 6, min{∞, 4 + ∞} = ∞
For 7, min{∞, 4 + ∞} = ∞

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	$\boxed{5}$	8	11	∞	∞

Now vertex 3 is having per. Label.

For 4, min{8, 5 + 2} = 7
For 5, min{11, 5 + 5} = 10
For 6, min{∞, 5 + 4} = 9
For 7, min{∞, 5 + ∞} = ∞

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	$\boxed{5}$	$\boxed{7}$	10	9	∞

Now 4 is having Per. Label and its value is "7"

For 5, min{10, 7 + ∞} = 10
For 6, min{9, 7 + 5} = 9
For 7, min{∞, 7 + ∞} = ∞

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	$\boxed{5}$	$\boxed{7}$	10	$\boxed{9}$	∞

Now 6 is having per. label. and its value "9".

For 5, $\min\{10, 9+1\} = 10$

For 7, $\min\{\infty, 9+8\} = 17$

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	$\boxed{5}$	$\boxed{7}$	$\boxed{10}$	$\boxed{9}$	17

Now 5 is having Per. Label.

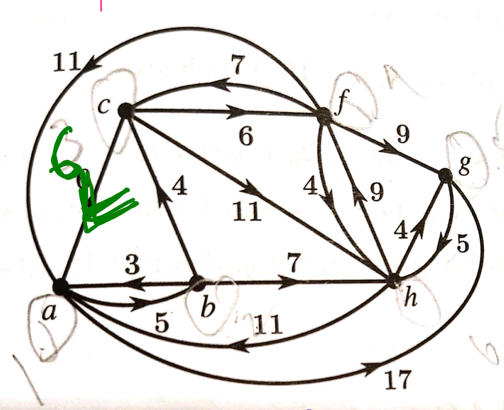
For 7, $\min\{17, 10+6\} = 16$

1	2	3	4	5	6	7
$\boxed{0}$	$\boxed{4}$	$\boxed{5}$	$\boxed{7}$	$\boxed{10}$	$\boxed{9}$	$\boxed{16}$

shortest distance from 1

To 2 is 4
To 3 is 5
To 4 is 7
To 5 is 10
To 6 is 9
To 7 is 16

2) Find shortest path from c to all other

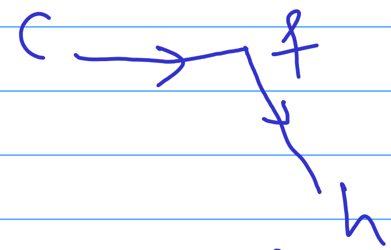


a	b	c	f	g	h
∞	∞	$\boxed{0}$	∞	∞	∞
6	∞	$\boxed{0}$	$\boxed{6}$	∞	11
$\boxed{6}$	∞	$\boxed{0}$	$\boxed{6}$	15	10
$\boxed{6}$	11	$\boxed{0}$	$\boxed{6}$	15	$\boxed{10}$

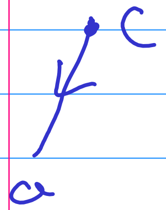
$\min\{$Tem. Label, Per.L + edg$\}$

6	11	0	6	14	10
6	11	0	6	14	10

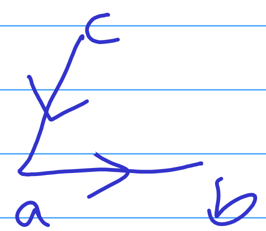
Shortest path from c to h



c to a

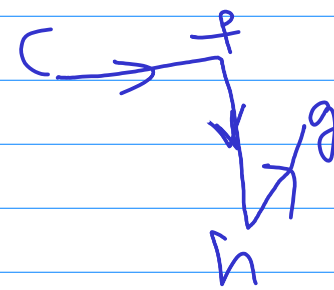


c-b

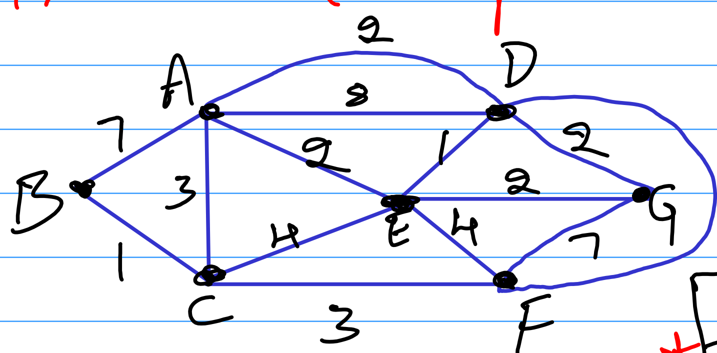


c-f

c-g



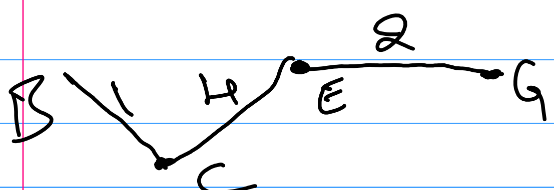
3) Find shortest path from B to G



$\min\{T.L,\ P.L + wt(e)\}$

$\infty,\ 1+4$

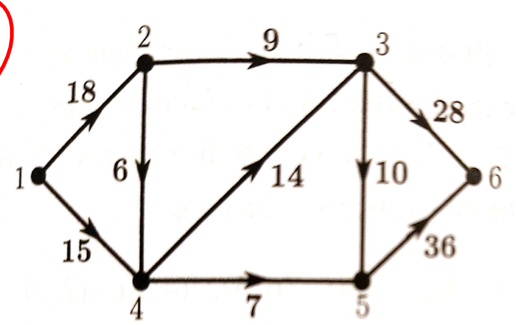
	A	B	C	D	E	F	G
1st	∞	0	∞	∞	∞	∞	∞
2nd	7	0	1	∞	∞	∞	∞
3rd	4	0	1	∞	5	4	∞
	4	0	1	14	5	4	11
	4	0	1	6	5	4	11
	4	0	1	6	5	4	7
	4	0	1	6	5	4	7



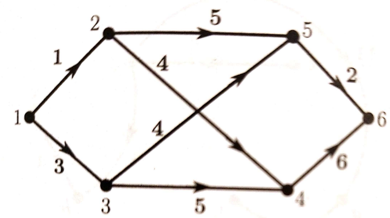
B – C – E – G

This is required shortest path and its length "7"

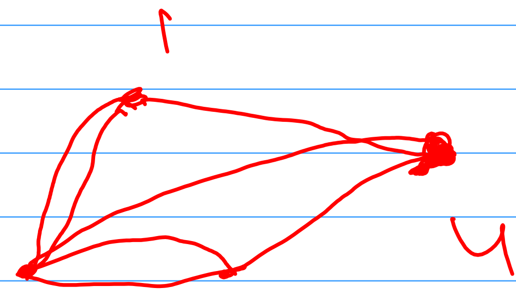
1)



2)



Example for Konigsberg bridge



There is no Euler circuit

1 – 2 – 3 – 2 – 1 – 4 – 3