

DATA STRUCTURES & ALGORITHMS

17: SINGLE SOURCE SHORTEST PATH

(DIJKSTRA'S ALGORITHM)

Dr Ram Prasad Krishnamoorthy

Associate Professor
School of Computing and Data Science

ram.krish@saiuniversity.edu.in



DIJKSTRA'S ALGORITHM

Dijkstra's algorithm solves single source shortest path on weighted directed graph $G(V,E)$.

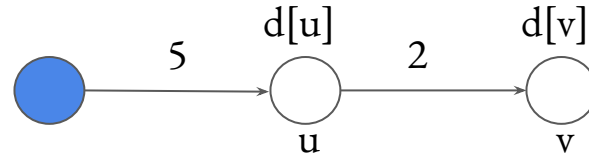
It is a generalization of Breadth First Search (BFS) on weighted graphs. The weights here are non-negative.

The source vertex **s** is explicitly provided.

Find shortest path from **s** to all remaining vertices.

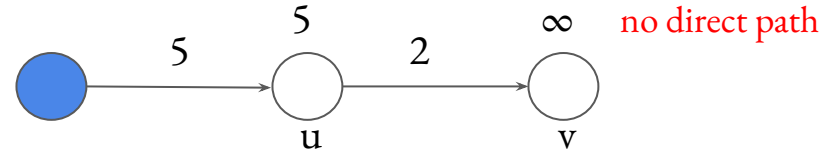
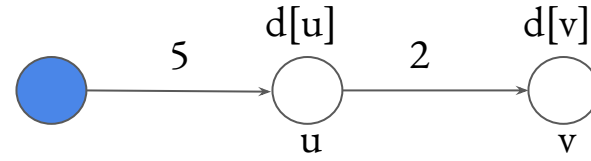
DIJKSTRA'S ALGORITHM

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if (d[u] + w(u,v) < d[v])  
    d[v] = d[u] + w(u,v)
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DIJKSTRA'S ALGORITHM

if ($d[u] + w(u,v) < d[v]$)
 $d[v] = d[u] + w(u,v)$

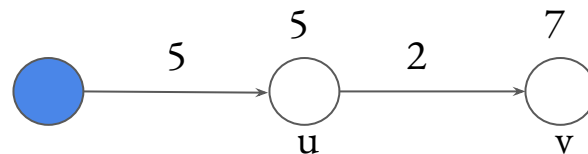
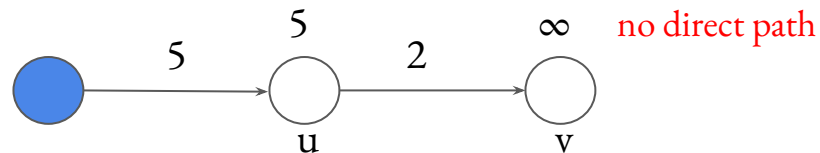
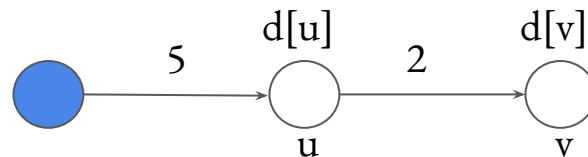


DIJKSTRA'S ALGORITHM

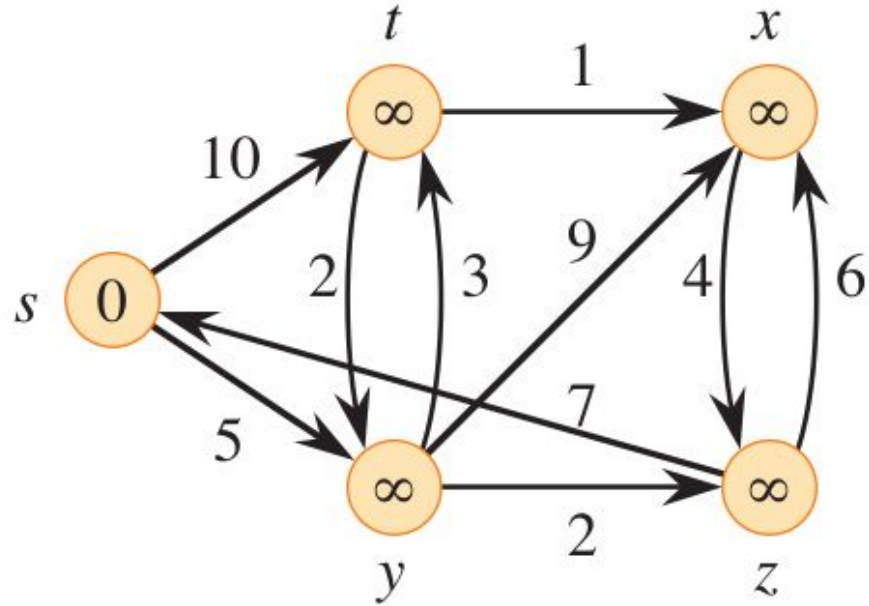
if ($d[u] + w(u,v) < d[v]$)
 $d[v] = d[u] + w(u,v)$

$d[u] = 5$
 $w(u,v) = 2$
 $d[v] = \infty$

$5 + 2 < \infty$ is true
 $d[v] = 5 + 2 = 7$

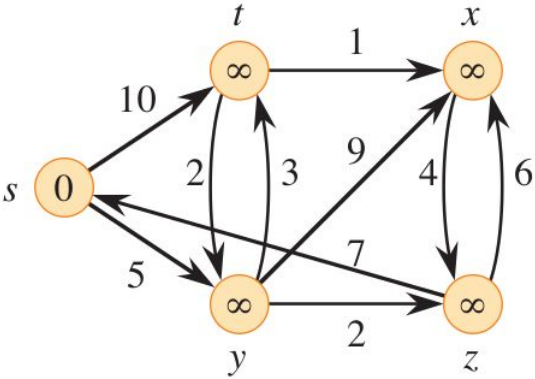


DIJKSTRA'S ALGORITHM



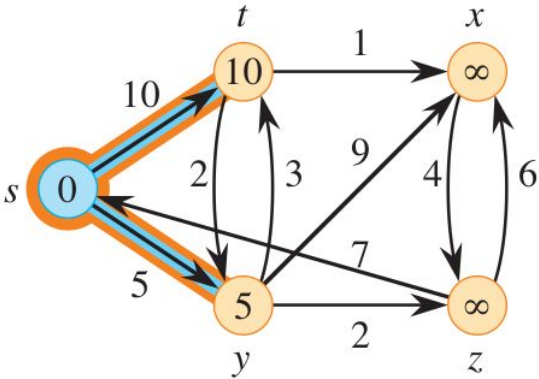
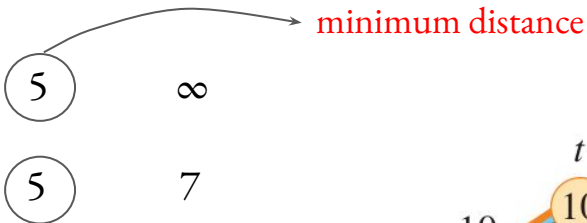
DIJKSTRA'S ALGORITHM

Selected vertex	Visited set	$d[t]$	$d[x]$	$d[y]$	$d[z]$
s	{s}	10	∞	5	∞



DIJKSTRA'S ALGORITHM

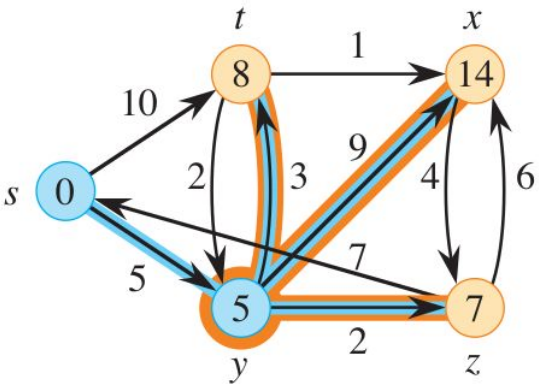
Selected vertex	Visited set	$d[t]$	$d[x]$	$d[y]$	$d[z]$
s	{s}	10	∞	5	∞
y	{s, y}	8	14	5	7



DIJKSTRA'S ALGORITHM

Selected vertex	Visited set	d[t]	d[x]	d[y]	d[z]
s	{s}	10	∞	5	∞
y	{s, y}	8	14	5	7
z	{s, y, z}	8	13	5	7

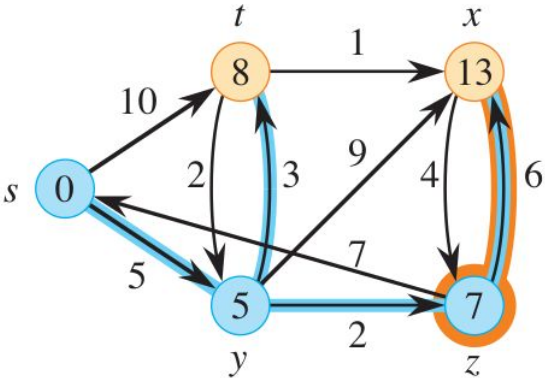
minimum distance



DIJKSTRA'S ALGORITHM

Selected vertex	Visited set	d[t]	d[x]	d[y]	d[z]
s	{s}	10	∞	5	∞
y	{s, y}	8	14	5	7
z	{s, y, z}	8	13	5	7
t	{s, y, z, t}	8	9	5	7

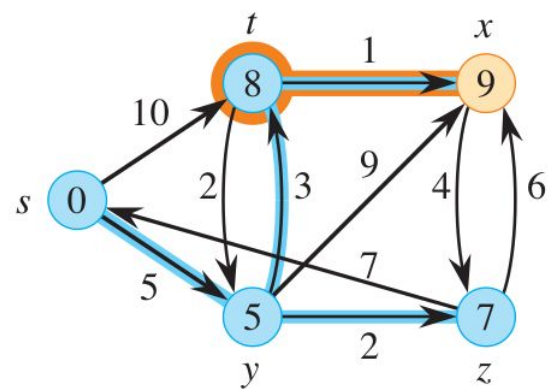
minimum distance



DIJKSTRA'S ALGORITHM

Selected vertex	Visited set	d[t]	d[x]	d[y]	d[z]
s	{s}	10	∞	(5)	∞
y	{s, y}	8	14	(5)	(7)
z	{s, y, z}	(8)	13	(5)	(7)
t	{s, y, z, t}	(8)	9	(5)	(7)

minimum distance



DIJKSTRA'S ALGORITHM

Selected vertex	Visited set	d[t]	d[x]	d[y]	d[z]
s	{s}	10	∞	5	∞
y	{s, y}	8	14	5	7
z	{s, y, z}	8	13	5	7
t	{s, y, z, t}	8	9	5	7
x	{s, y, z, t, x}	8	9	5	7

