

## Dijkstra's Algorithm Examples

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## Dijkstra's Algorithm: Pseudocode

Initialize the cost of each node to  $\infty$

Initialize the cost of the source to 0

While there are **unknown** nodes left in the graph

  Select an **unknown** node  $b$  with the lowest cost

  Mark  $b$  as **known**

  For each node  $a$  adjacent to  $b$

    if  $b$ 's cost + cost of  $(b, a) < a$ 's old cost

$a$ 's cost =  $b$ 's cost + cost of  $(b, a)$

$a$ 's prev path node =  $b$

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## Important Features

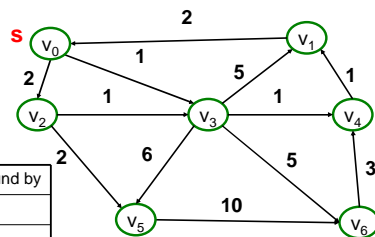
- Once a vertex is made **known**, the cost of the shortest path to that node is known
- While a vertex is still not **known**, another shorter path to it might still be found
- The shortest path itself can be found by following the backward pointers stored in **node.path**

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## Notes on these examples

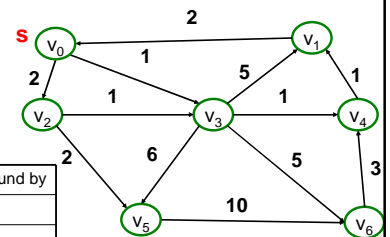
- These examples use:
  - ?? instead of **infinity**.
  - Visited? instead of **Known**
  - Found By instead of **Path**

## Dijkstra's Example



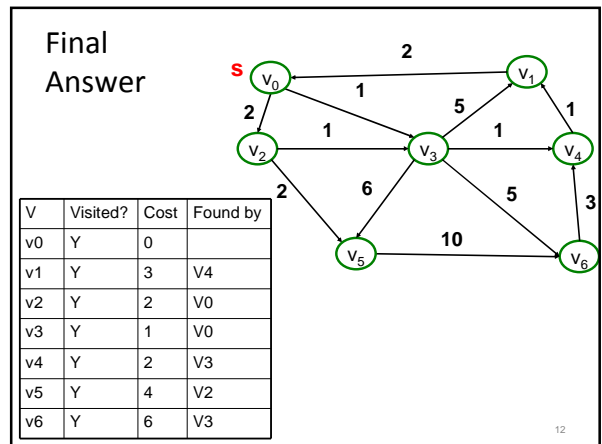
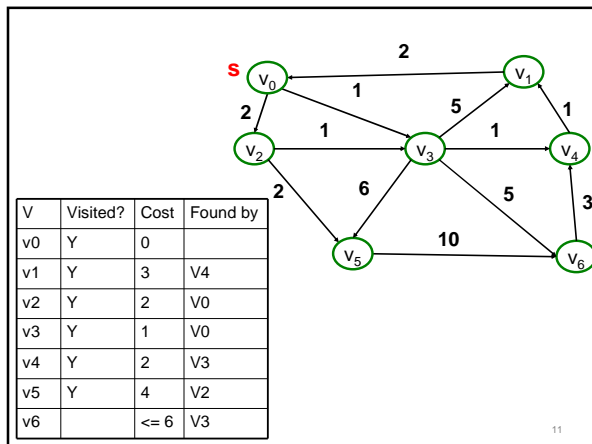
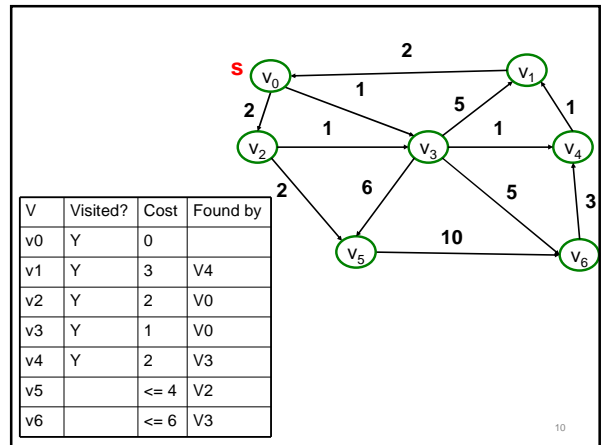
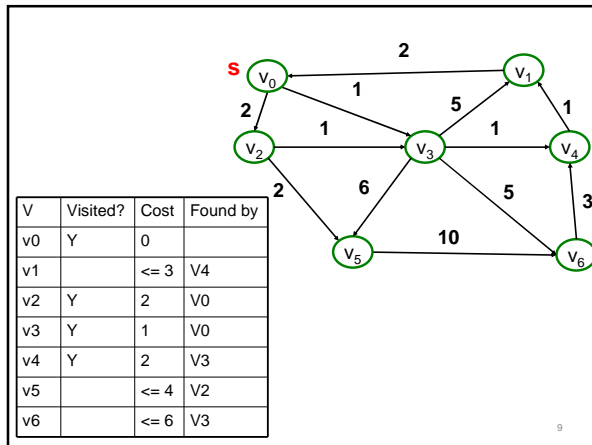
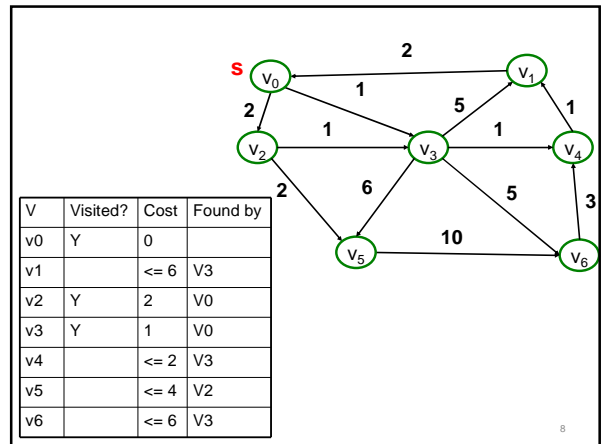
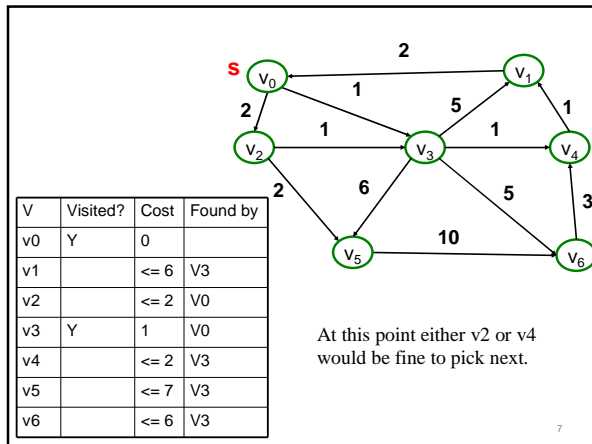
V	Visited?	Cost	Found by
v0			
v1			
v2			
v3			
v4			
v5			
v6			

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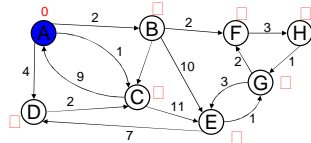


V	Visited?	Cost	Found by
v0	Y	0	
v1		??	
v2		$\leq 2$	v0
v3		$\leq 1$	v0
v4		??	
v5		??	
v6		??	

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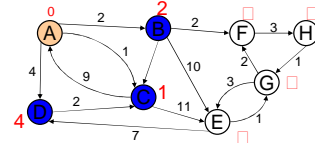


### Dijkstra's Algorithm in action



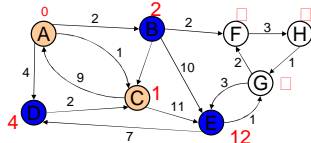
Vertex	Visited?	Cost	Found by
A		0	
B	??		
C	??		
D	??		
E	??		
F	??		
G	??		
H	??		

### Dijkstra's Algorithm in action



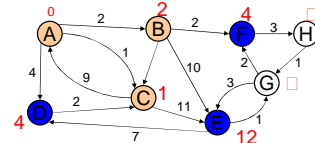
Vertex	Visited?	Cost	Found by
A	Y	0	
B		$\leq 2$	A
C		$\leq 1$	A
D		$\leq 4$	A
E		??	
F		??	
G		??	
H		??	

### Dijkstra's Algorithm in action



Vertex	Visited?	Cost	Found by
A	Y	0	
B		$\leq 2$	A
C	Y	1	A
D		$\leq 4$	A
E		$\leq 12$	C
F		??	
G		??	
H		??	

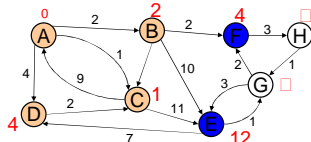
### Dijkstra's Algorithm in action



Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D		$\leq 4$	A
E		$\leq 12$	C
F		$\leq 4$	B
G		??	
H		??	

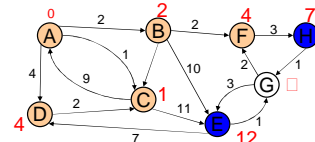
At this point either D or F would be fine to pick next.

### Dijkstra's Algorithm in action



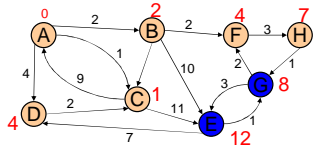
Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D	Y	4	A
E		$\leq 12$	C
F		$\leq 4$	B
G		??	
H		??	

### Dijkstra's Algorithm in action



Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D	Y	4	A
E		$\leq 12$	C
F	Y	4	B
G		??	
H		$\leq 7$	F

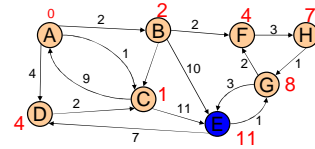
## Dijkstra's Algorithm in action



Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D	Y	4	A
E		<=12	C
F	Y	4	B
G		<=8	H
H	Y	7	F

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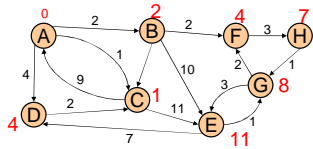
## Dijkstra's Algorithm in action



Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D	Y	4	A
E	Y	<=11	G
F	Y	4	B
G	Y	8	H
H	Y	7	F

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## Final Answer



Vertex	Visited?	Cost	Found by
A	Y	0	
B	Y	2	A
C	Y	1	A
D	Y	4	A
E	Y	11	G
F	Y	4	B
G	Y	8	H
H	Y	7	F

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