

# Lecture 9.2

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## Greedy Algorithms: Dijkstra's Algorithm

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1

## Single-source shortest path

- Problem: Given a graph  $G = \langle E, V \rangle$ , find the shortest path from a given source vertex  $s \in V$  to every vertex  $v \in V$
- A greedy algorithm to solve the above problem is the Dijkstra's Algorithm for Single-Source Shortest Path
- Dijkstra's algorithm is similar to Prim's algorithm for the Minimum Spanning Tree.

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2

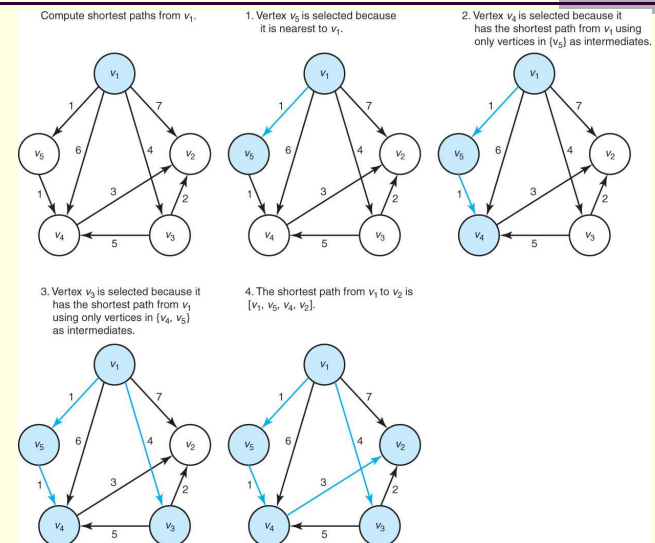
## Dijkstra's Algorithm

```
Y = {v1};  
F = ∅;  
while (the instance is not solved){  
    select a vertex v from V - Y, that has a // selection  
    shortest path from v1, using only vertices // procedure and  
    in Y as intermediates; // feasibility check  
    add the new vertex v to Y;  
    add the edge (on the shortest path) that touches v to F;  
    if (Y == V)  
        the instance is solved; // solution check  
}
```

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3

## Example



4

## How to solve?

- Make Adjacency matrix

	1	2	3	4	5
1	0	7	4	6	1
2	$\infty$	0	$\infty$	$\infty$	$\infty$
3	$\infty$	2	0	5	$\infty$
4	$\infty$	3	$\infty$	0	$\infty$
5	$\infty$	$\infty$	$\infty$	1	0

6

## Cont.

- Pick min in each row

	1	2	3	4	5
1	—	7 <sup>1</sup>	4 <sup>1</sup>	6 <sup>1</sup>	(1) <sup>1</sup>
5	—	$\infty, 7$ 7 <sup>1</sup>	4 <sup>1</sup>	(1+1) (2) <sup>5</sup>	—
4	—	3+2 = 5 <sup>4</sup>	(4) <sup>1</sup>	—	—
3	—	2+4 <sup>x</sup> (5) <sup>4</sup>	—	—	—
2	—	—	—	—	—

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7