

# COMPSCI 2C03 – Week 13 Exercises

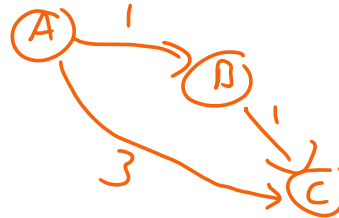
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Sample solutions and notes on sample solutions for this week's exercises.

## Lecture 1: Dijkstra's Algorithm

- Exercise 4.4.1: If you add a constant to every edge weight it does not change the solution to the single-source shortest paths problem. True or False?

False. Consider the path  $A \rightarrow B \rightarrow C$  vs.  $A \rightarrow C$ .  
Now add 2 to every weight.



- Draw the SPT for source A of the edge-weighted digraph shown in Figure 1 and give the parent-link representation of the Shortest path tree (SPT) using Dijkstra's algorithm.

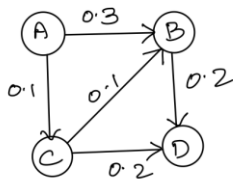
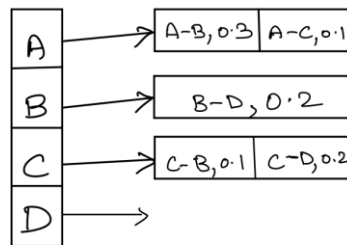


Figure 1



Start

	A	B	C	D
dist_to	0			
edge_to				
PQ	A(0)			

Dequeue A and Relax

	A	B	C	D
dist_to	0	<b>0.3</b>	<b>0.1</b>	
edge_to		<b>A</b>	<b>A</b>	
PQ	B(0.3), C(0.1)			

Dequeue C and relax

	A	B	C	D
dist_to	0	<b>0.2</b>	0.1	<b>0.3</b>
edge_to		<b>C</b>	A	<b>C</b>
PQ	B(0.2), D(0.3)			

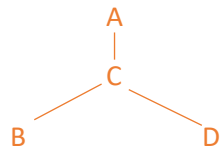
Dequeue B and relax

	A	B	C	D
dist_to	0	0.2	0.1	0.3
edge_to		C	A	C
PQ	D(0.3)			

Dequeue D and relax

	A	B	C	D
dist_to	0	0.2	0.1	0.3
edge_to		C	A	C
PQ				

Done.



- 
- Diagram illustrating a linked list structure with 8 nodes. Each node contains three values: an index, a value, and a pointer. The nodes are linked sequentially.
- | Index | Value | Pointer |
|-------|-------|---------|
| 0     | 2     | .26     |
| 1     | 3     | .29     |
| 2     | 7     | .34     |
| 3     | 6     | .52     |
| 4     | 7     | .37     |
| 5     | 1     | .32     |
| 6     | 7     | .28     |
| 7     | 3     | .39     |
- Arrows indicate the sequence of nodes: 0 → 1 → 2 → 3 → 4 → 5 → 6 → 7. An orange box highlights the first node (0, 2, .26) and an arrow points to the second node (1, 3, .29). A red arrow points to the third node (5, 4, .35).

[illegible][illegible][illegible]

## Deque 7

[illegible]

## Deque 5

[illegible]

## Deque 4

[illegible]

### Dequeue 3

[illegible]

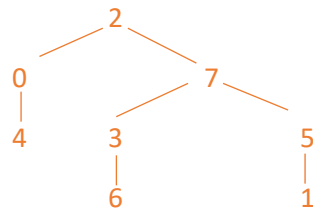
## Deque 1

[illegible]

## Deque 6

[illegible]

Done:



4. Draw the SPT for source 0 of the edge-weighted DAG shown in Figure 3, and give the parent-link representation of the Shortest path tree (SPT) using the topological sort shortest path algorithm described in the lecture.

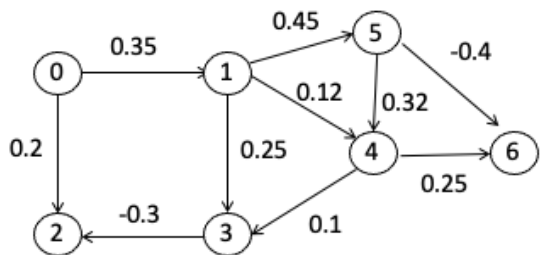
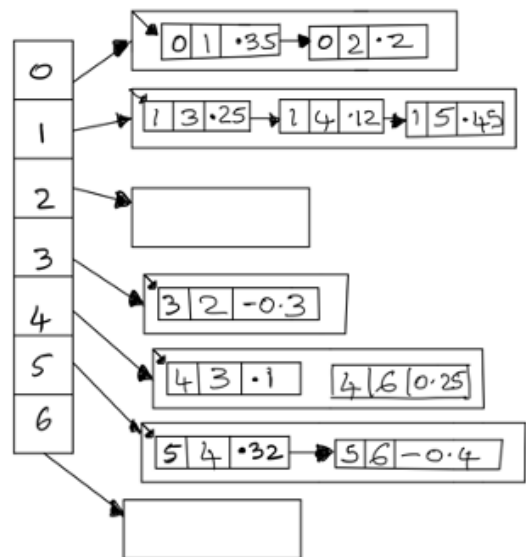
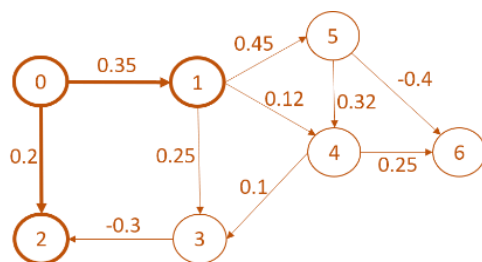


Figure 3

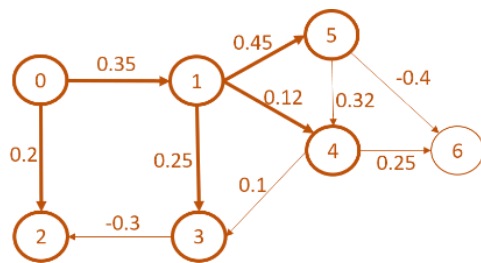


Topological sort using reverse post-order DFS is 0 1 5 4 6 3 2



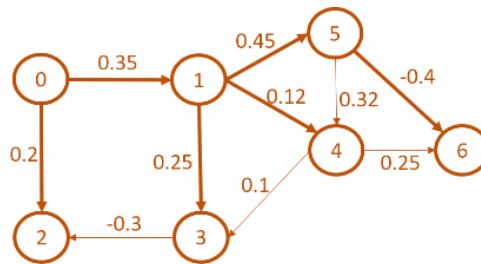
Topological sort: 0-1-5-4-6-3-2

Vertex	EdgeTo	DistTo
1	0	0.35
2	0	0.2
3		
4		
5		
6		



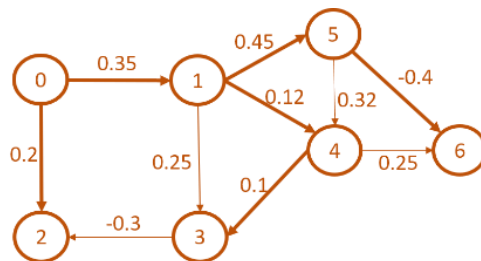
Topological sort: 0-1-5-4-6-3-2

Vertex	EdgeTo	DistTo
1	0	0.35
2	0	0.2
3	1	0.6
4	1	0.47
5	1	0.8
6		



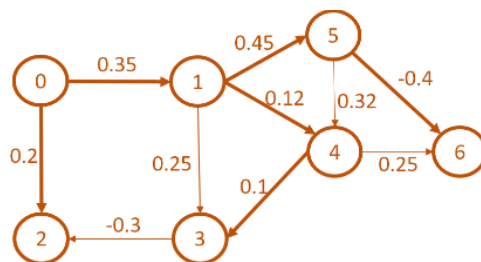
Topological sort: 0-1-5-4-6-3-2

Vertex	EdgeTo	DistTo
1	0	0.35
2	0	0.2
3	1	0.6
4	1	0.47
5	1	0.8
6	5	0.4



Topological sort: 0-1-5-4-6-3-2

Vertex	EdgeTo	DistTo
1	0	0.35
2	0	0.2
3	4	0.57
4	1	0.47
5	1	0.8
6	5	0.4



Topological sort: 0-1-5-4-6-3-2

Vertex	EdgeTo	DistTo
1	0	0.35
2	0	0.2
3	4	0.57
4	1	0.47
5	1	0.8
6	5	0.4