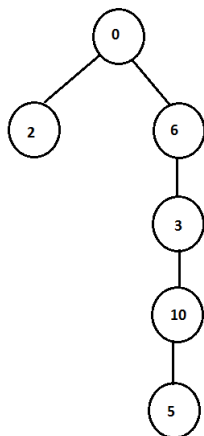


1. Given the following DFS result, draw the path tree with source 0

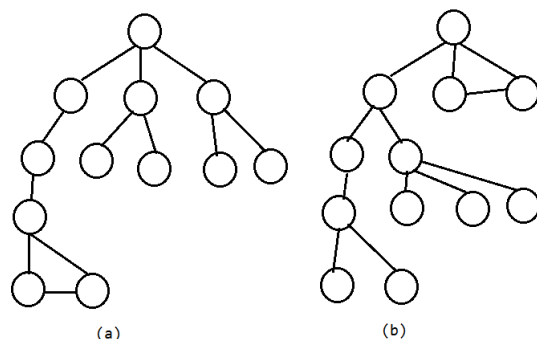
index	marked	edgeTo
0:	true	0
1:	false	0
2:	true	0
3:	true	6
4:	false	0
5:	true	10
6:	true	0
7:	false	0
8:	false	0
9:	false	0
10:	true	3
11:	false	0

Answer:



2. Does either of the two traversals, DFS or BFS, always find a cycle faster than the other? If your answer is yes, indicate which one is faster and explain why; if your answer is no, give two examples supporting your answer.

Answer: No. It depends on where the cycle is at. For the following graphs, DFS can detect the cycle in (a) faster while BFS can detect the cycle in (b) faster.



3. What is the maximum number of edges in a digraph with V vertices and no parallel nor self-loop edges?

Answer: $V * (V-1)$

4. What is the minimum number of edges in a digraph with V vertices, none of which are isolated?

Answer: $V-1$

5. Given the digraph on the right,
a) What is the indegree of vertex 6?
b) What is the outdegree of vertex 6?
c) Draw the adjacency lists for the digraph.

Answer:

a) 2

b) 1

c)

0: -> 6

1: -> 11

2: -> 0 -> 3

3: -> 10 -> 6

4: -> 1

5: -> 10 -> 2

6: -> 2

7: -> 8 -> 11

8: -> 1 -> 4

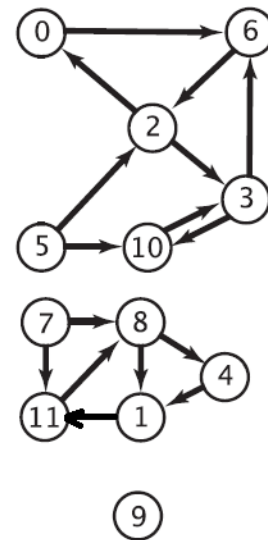
9:

10: -> 3

11: -> 8

tinyDGex2.txt

V → 12
E → 16
8 4
2 3
1 11
0 6
3 6
10 3
7 11
7 8
11 8
2 0
6 2
5 2
5 10
3 10
8 1
4 1



6. Find a topological order for the following digraph

13 vertices, 15 edges
adjacency lists:

0: 5 1 6

1:

2: 3 0

3: 5

4:

5: 4

6: 9 4

7: 6

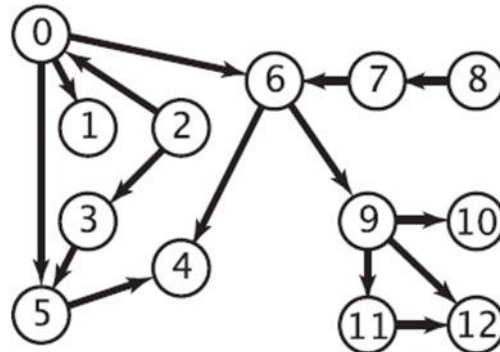
8: 7

9: 11 12 10

10:

11: 12

12:



Answer:

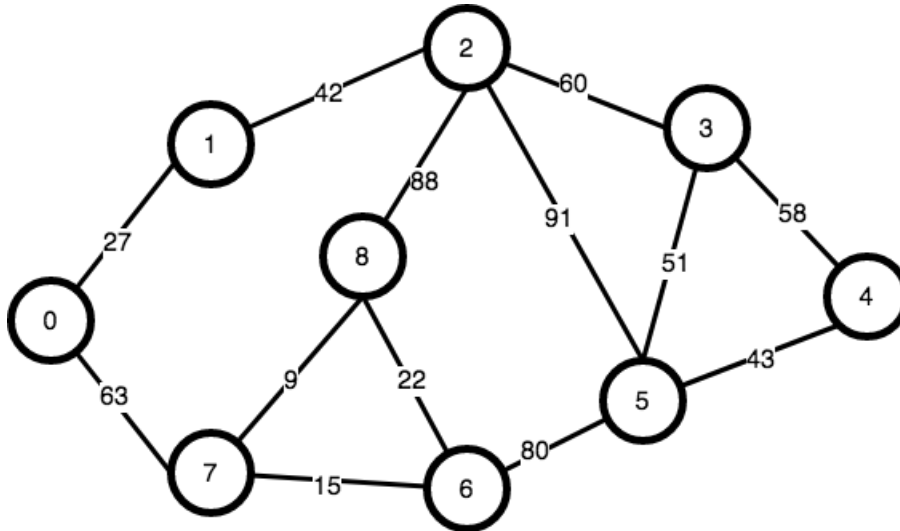
There are multiple topological orders and here is one of them

8, 7, 2, 3, 0, 6, 9, 10, 11, 12, 1, 5, 4

7. Find the MST for the following graph, list the edges in the order as they are added to MST and provide MST weight.

a) Use LazyPrimMST algorithm starting from vertex 0

b) Use Kruskal's MST algorithm



Answer:

	LazyPrimMST	Kruskal's MST
Edge List	0-1, 27 1-2, 42 2-3, 60 3-5, 51 5-4, 43 0-7, 63 7-8, 9 7-6, 15	7-8, 9 6-7, 15 0-1, 27 1-2, 42 5-4, 43 5-3, 51 2-3, 60 0-7, 63
MST weight	310	310

8. How would you find a maximum spanning tree of an edge-weighted graph?

Answer:

Change the minimum spanning tree algorithm (Prim's or Kruskal's algorithm) by replacing minPQ with maxPQ.