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CSCI 303: Algorithms, HW 10

Due: 3:30 pm, Wednesday, 11/7

1. Problem 1

(a) Adjacency Matrix

0	0	0	1	1	0	1
0	0	1	0	1	1	0
0	0	0	1	1	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	1
0	0	0	0	0	0	1
0	0	0	0	0	0	0

(b) Adjacency List

v_1	v_4	v_5	v_7
v_2	v_3	v_5	v_6
v_3	v_4	v_5	
v_4	v_5		
v_5	v_6	v_7	
v_6	v_7		
v_7			

(c) The graph is a directed acyclic graph.

2. Problem 2

(14 points)(b) Is the topological ordering produced during your execution in problem 2a the unique topological ordering for this graph? If so, explain why. If not, explain why not (giving an alternative topological ordering suffices). (1 point) (c) Does the use of the adjacency list, augmented with a queue, enforce a consistent outcome for topological sort? If so, explain why. If not, explain why not. Again, think like a computer! (1 point)

(a) Topological sort

i.

Indegree	Adjacent node			
0	v_1	v_4	v_5	v_7
0	v_2	v_3	v_5	v_6
1	v_3	v_4	v_5	
2	v_4	v_5		
4	v_5	v_6	v_7	
2	v_6	v_7		
3	v_7			

Enqueue v_1 and v_2

Queue Start

v_1 v_2

ii. Dequeue v_1

Topological Order = v_1

Indegree	Adjacent node	
1	v_3	v_4 v_5
1	v_4	v_5
3	v_5	v_6 v_7
1	v_6	v_7
2	v_7	

Queue Start
v_2

iii. Dequeue v_2

Topological Order = v_1, v_2

Indegree	Adjacent node	
0	v_3	v_4 v_5
1	v_4	v_5
2	v_5	v_6 v_7
0	v_6	v_7
2	v_7	

Enqueue v_3, v_6

Queue Start
v_3, v_6

iv. Dequeue v_3

Topological Order = v_1, v_2, v_3

Indegree	Adjacent node	
0	v_4	v_5
1	v_5	v_6 v_7
2	v_7	

Enqueue v_4

Queue Start
v_6, v_4

v. Dequeue v_6

Topological Order = v_1, v_2, v_3, v_6

Indegree	Adjacent node	
1	v_5	v_6 v_7
1	v_7	

Queue Start
v_4

vi. Dequeue v_4

Topological Order = v_1, v_2, v_3, v_6, v_4

Indegree	Adjacent node	
0	v_5	v_6 v_7
1	v_7	

Enqueue v_5

Queue Start
v_5

vii. Dequeue v_5

Topological Order = v_1, v_2, v_3, v_6, v_4, v_5

Indegree	Adjacent node	
0	v_7	

Enqueue v_7

Queue Start
v_7

viii. Dequeue v_7
Topological Order = v_1, v_2, v_3, v_6, v_4, v_5, v_7

(b) Another possible topological order is v_2, v_1, v_3, v_6, v_4, v_5, v_7

(c) No it does not because if there are two items that are enqueued at the same time, whichever is enqueued first will affect how it is ordered.

3. Problem 3

(a)

v	*known*	d_v	p_v
v_1	F	0	0
v_2	F	∞	0
v_3	F	∞	0
v_4	F	∞	0
v_5	F	∞	0
v_6	F	∞	0
v_7	F	∞	0

(b)

v	*known*	d_v	p_v
v_1	T	0	0
v_2	F	∞	0
v_3	F	∞	0
v_4	F	6	v_1
v_5	F	1	v_1
v_6	F	∞	0
v_7	F	7	v_1