Name: Harris Spahic Date: 10/10/21

Pledge: "I pledge my honor I have abided by the Stevens Honor System."

1.

	1	2	3	4	5	6	7	8	9	10
1	0	1	0	1	0	0	0	0	0	0
2	0	0	0	0	1	0	0	0	0	0
3	0	0	0	0	1	0	0	0	0	0
4	0	1	0	0	0	0	0	0	0	0
5	0	0	0	1	0	0	0	0	1	0
6	0	0	0	0	0	1	0	1	0	0
7	0	0	0	0	1	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	1	0	0	1
10	0	0	1	0	1	0	0	0	0	0

2.

1	2,4
2	5
3	5
4	2
5	4,9
6	6,8
7	5
8	
9	7,10
10	3,5

3. 1, 2, 4, 5, 9, 7, 10, 3, 6, 8

4. 1, 2, 5, 4, 9, 7, 10, 3, 6, 8

5. $\Theta(V^2)$ where V is # vertices
b. $\Theta(V+E)$ where E is # of edges

6. $\Theta(V^2)$
b. $\Theta(V+E)$

7. When we use an adjacency matrix, we need to encode every possible transition for our graph. This costs memory, & requires a search of the entire row (V checks) to find all outgoing transitions from a node. However we can find any particular node in linear time.

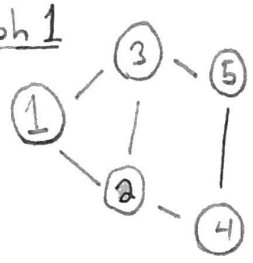
This is faster for small or very dense graphs. But the adjacency list is better whenever we have a large or sparse graph (small out degree).

8. When following breadth-first, if we end up popping a vertex on the queue that has already been visited, and is not the "previous vertex" that adds it, our undirected graph has a cycle. This is because the vertex has been revisited by a vertex not directly adjacent to it. → We can revisit said vertex along this path infinitely. → Cycle.

We adjust BFS to not add transitions to the parent on the queue

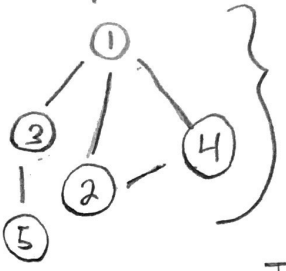
9. No,

Graph 1



In this case BFS branches from 1 to 2 & 3, then finds the directed cycle after checking 2.
DFS finds the outer cycle first, which takes 5 traversals.
Thus BFS faster.

Graph 2



In this case BFS goes from both 2 & 3, then finds 4.
While DFS directly finds the 1, 2, 4 cycle immediately.
Thus DFS is faster.

10. Notice

V	E
2,	5
5,	4
4,	2

Creates a cycle in our directed graph.
→ We can't use topological sort.

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

#3)* $S \to A\#B\#|C\#D\#$

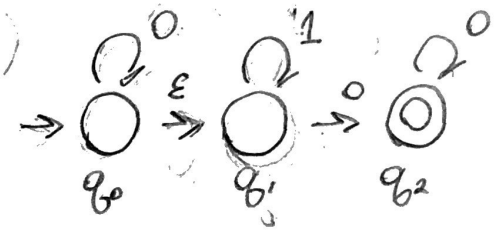
$A \to 0A|0C$

$B \to B0|B0$

$C \to 1C|1A$

$D \to D1|D1$

5)* $0^*1^*0^+$



4b)* Start $, Then given

$\delta(q_0, 0) = \{q_0, q_1\}$

$\delta(q_0, \varepsilon) = \{q_1\}$

$\delta(q_1, 1) = \{q_1\}$

$\delta(q_1, 0) = \{q_2\}$

$\delta(q_2, 1) = \{\phi\}$

$\delta(q_2, 0) = \{q_2\}$