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CS 385 Homework 3
Professor Borowski
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I pledge my honor that I have abided by the Stevens Honor System.

1.

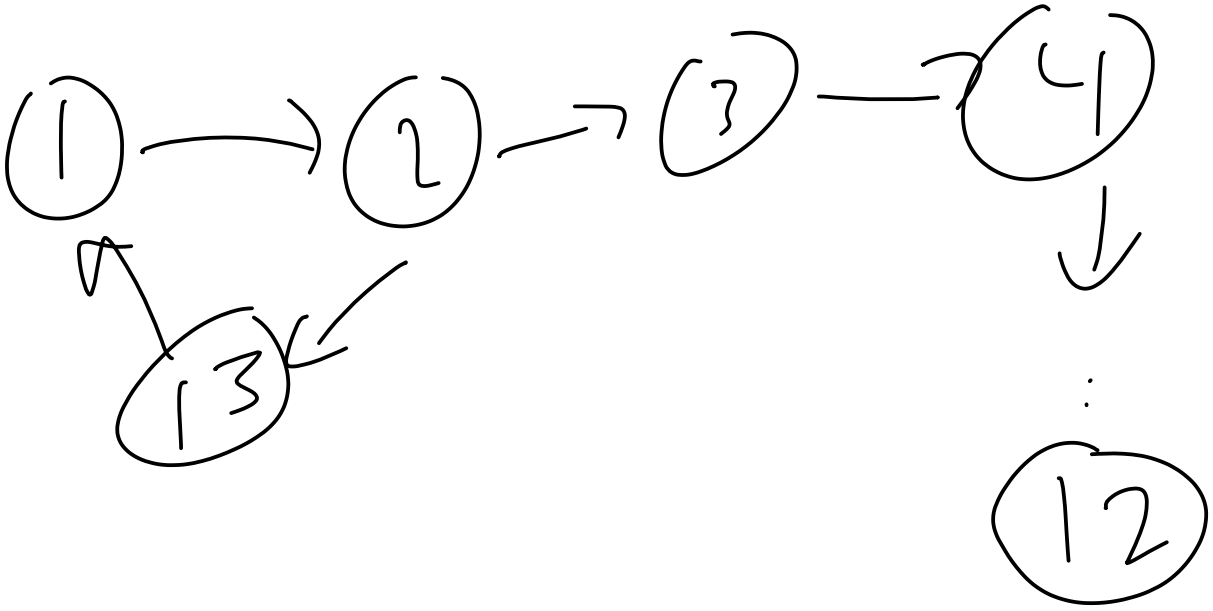
A ->	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	0	0	0	0	0	0	0	0	0	0
2	1	0	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	1
4	1	0	0	0	1	0	0	0	0	0
5	0	1	1	0	0	0	1	0	0	1
6	0	0	0	0	0	1	0	0	0	0
7	0	0	0	0	0	0	0	0	1	0
8	0	0	0	0	0	1	0	0	0	0
9	0	0	0	0	1	0	0	0	0	0
10	0	0	0	0	0	0	0	0	1	0

2.

```
[
   [2,4],
   [5],
   [5],
   [2],
   [4,9],
   [6,8],
   [5],
   [],
   [7,10],
   [3,5]
]
```

3. 1,2,4,5,9,7,10,3,6,8
4. 1,2,5,4,9,7,10,3,6,8
5a. $\theta(|V|^2)$
5b. $\theta(|V| + |E|)$
6a. $\theta(|V|^2)$
6b. $\theta(|V| + |E|)$
7. An adjacency list would be a clear winner in efficiency if there are very few edges in the graph. Thus, $|E|$ would be close to 0, or $|E| << |V|$, and the efficiency class would devolve to a comparison between $\theta(|V|)$ for adjacency lists and $\theta(|V|^2)$ for adjacency matrices for both a BFS and a DFS.
8. One can use an array of Booleans to store the visited vertices in the graph. Thus, if the search yields a value that has already been set to true in the visited vertices, then there exists a cycle in the graph.

9. Depth first is generally faster at finding cycles because it goes in a path down each node, i.e. it goes from vertex A to vertex B to vertex C, as opposed to breadth first search which goes from vertex A to vertex B, then vertex A to vertex C. Thus, it is better at finding cycles in the graph, as it takes a literal path, very close to the definition of a cycle. However, there exist graphs where a BFS will find the cycle faster, such as when a depth first search would go on a different path away from the cycle, as a BFS will stay close to the cycle at the beginning. In the graph below, a DFS would visit all nodes from 1-12 first, while a BFS will visit 1, 2, 3, 4, 13, and then find the cycle. In most cases, though, DFS is faster.



10. Topological sorts are not possible on graphs with a cycle. There is a cycle from 5 to 7 to 9, and a self-cycle from 6 to itself, among other cycles in the graph.

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