CS 3310 Homework 6
Mason Fernandez

Part 1
1. Visit the graph in different orders...
(a) BFS 1,2,4,3,5,7,6,8,9

(b) DFS 1,2,3,6,5,4,7,8,9

(c) BFS with a stack 1,4,2,5,3,6,9,8,7

2.
(a) Prove G has a unique topological order if and only if there exists a directed path that visits each vertex only once.

A directed acyclic grapth that visits or leaves a vertex more than once creates multiple valid topological orders because going to each incoming or outgoing edge along the graph in different orders can create multiple valid orders. Therefore, any graph that visits and leaves each node only once, has no alternative orders and must be unique for that graph.

(b) Describe an algorithm to check in linear time to see whether or not G has such a path.

```
HasUniquePath(G):
   For v in graph G
      if v has >1 incoming edges:
         return false
   return true
```

This algorithm assumes the graph is a DAG. It loops over each vertex and checks to see if there are more than one edges to it. If there are for any vertex, the graph doesn't have a unique path and returns false. If there are no vertexes with more than one edge, it returns true. The algorithm runs in O(n) time.

Part 2
(see hw6.py)

```
PS C:\Users\Mason\OneDrive\Desktop\UVU\03-Spring-2025\331
Challenge:  [79, 29, 27, 63, 89, 85, 98, 55, 99, 28]
Test 5:  [5, 2, 3, 4, 1]
test 10:  [10, 5, 7, 2, 3, 1, 6, 9, 8, 4]
```