Assignment 2

For first 3 questions, consider a directed graph (with no multi-edges or self loops) having `n` vertices numbered `1,...,n`. You will be given adjacency list representation of graph as `vector<vector<int>> adj`.

1. Topological Sort

   Topologically sort given graph if possible.

   Return topologically sorted vector of vertices if possible to get topological ordering otherwise return empty vector.

   Complexity : O(V+E)

   Verify your code here.

2. Application of topological sort

   You will be given a DAG. You will also be given two vertices u and v. It guaranteed that v is reachable from u.

   1. length of shortest path from u to v
   2. length of longest path from u to v
   3. number of paths from u to v

   Express each of these as a function defined over vertices.

   Ex. $f(x)$ be number of paths from x to v then

   $$f(x) = \sum_{y \in adj[x]} f(y)$$

   Compute these functions by using topological ordering.

   Complexity : O(V+E)

   Verify your code here.

3. SCC decomposition

   Do SCC decomposition of graph. If there are `k` SCC in the graph, give each of then unique id from `1,...,k`. Return vector which maps each vertex to SCC it belongs to.

   Complexity : O(V+E)

   Verify your code here.

4. 2 SAT

   Solve this problem.