3.1 $A : 1, 12, B : 2, 11, C : 3, 10, D : 13, 18, E : 5, 6, F : 4, 9, G : 14, 17, H : 15, 16, I : 7, 8,$ $A - B$ tree, $B - C$ tree, $B - E$ back, $C - F$ tree, $E - F$ tree, $F - I$ tree, $D - G$ tree, $G - H$ tree $D - H$ back.

3.2 (a) $A : 1, 16, B :, 2, 15, C : 3, 14, D : 4, 13, E : 8, 9, F : 7, 10, G : 6, 11, H : 5, 12,$ $A- > B$ tree, $A- > F$ forward, $B- > C$ tree, $B- > E$ forward, $C- > D$ tree, $D- > H$ tree, $G- > F$ tree, $F- > G$ backward, $F - E$ tree, $E- > G$ backwards.

(b) $A : 1, 16, B : 2, 11, C : 4, 5, D : 6, 9, E : 7, 8, F : 3, 10, G : 13, 14, H : 12, 15,$ $A- > B$ t, $A- > H$ t, $B- > F$ t, $C- > B$ b, $D- > C$ c, $F- > E$ f, $F- > D$ t, $F- > C$ t, $G- > F$ c, $G- > B$ c, $G- > A$ b, $H- > G$ t.

3.3 (a) $A : 1, 14, B : 15, 16, C : 2, 13, D : 3, 10, E : 11, 12, F : 4, 9, G : 5, 6, H : 7, 8$

(b) the sources are A, B and the sinks are G, H

(c) B A C E D F H G

(d) Since $\{A, B\}, \{D, E\}, \{G, H\}$ are all antichains, then their order can be swapped to produce a valid topological ordering. Since we have 3 binary choices to make, then that implies that we have 2^3 possibilities, thus there are 8 topological orderings.

3.5 To reverse a graph, we're going to implement a form of DFS, where in the explore routine one takes in the edge (u, v), then inserts (v, u) into the adjacency list E^R. Note that explore will be ran once per node, thus we will find all edges and flip them.

3.9 To compute twodegree, one first iterates through the linked list by counting the degree by just counting the number of elements in the linked list per node. Let these numbers be put into an array denoted as $degrees[]$. Then one iterates through the nodes again, where instead one goes through the adjacency list, and for each node u in the adjacency list for v, add $degrees[u]$ to the total $twodegree[v]$.