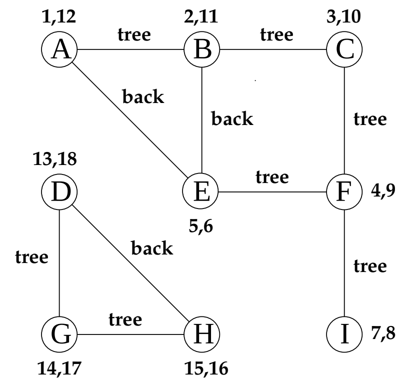
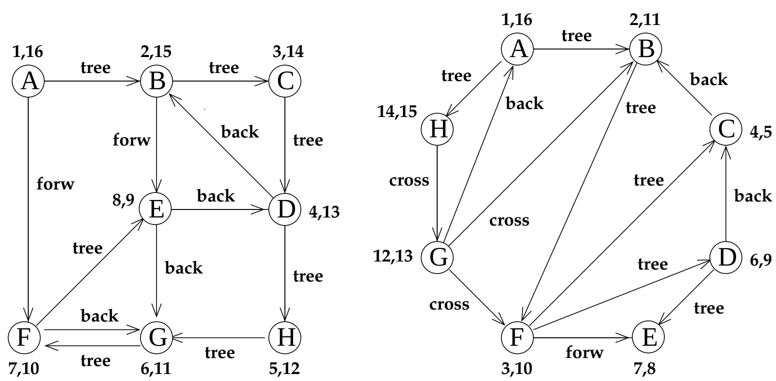
University of Nevada, Las Vegas Las Vegas Computer Science 477/677 Spring 2020

Answers to Assignment 4: Due Tuesday March 10, 2020

1. Problem 3.1 on page 95 of your textbook.

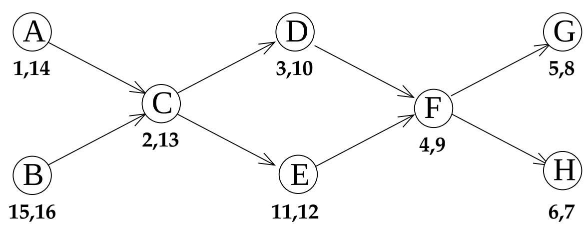


2. Problem 3.2 on page 95 of your textbook.



(a) (b)

3. Problem 3.3 on page 95 of your textbook.

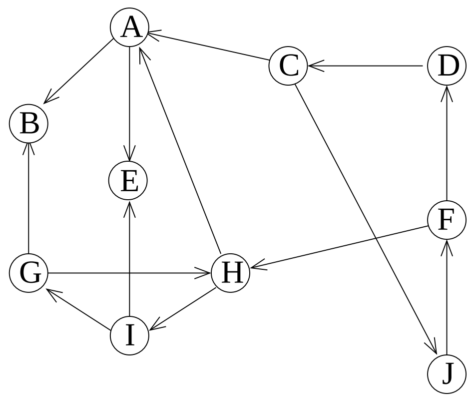


The topological order given by the algorithm is `B,A,C,E,D,F,G,H`.

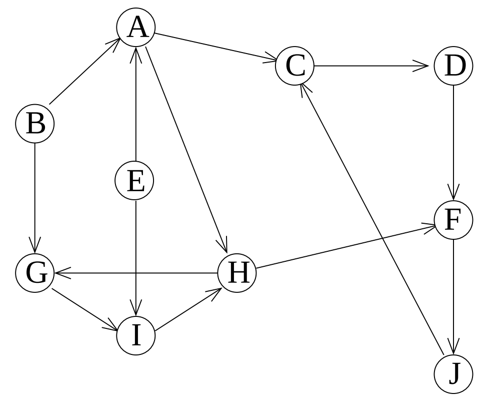
4. Problem 3.4 on page 96 of your textbook.

First run DFS on G^R, then run DFS on G, using the reverse order of the `post` numbers found during Phase 1. The vertices of each strong component are those visited between instances where the stack is empty during Phase 2.

(i) In Phase 1 we run DFS on G^R, and order the vertices by `post` number: `B,E,A,D,G,I,H,F,J,C`. In Phase 2, we run DFS on G. Whenever the stack is empty, the next vertex is the unvisited vertex of largest `post` number from Phase 1.



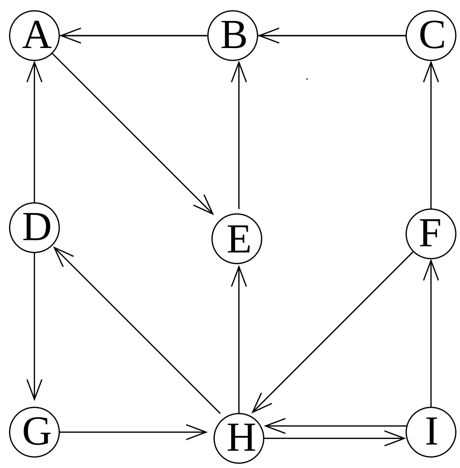
G^R



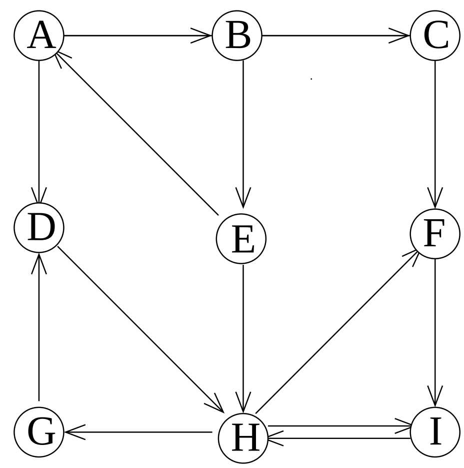
G

The strong components are {`C,D,F,J`}, {`G,H,I`}, {`A`}, {`B`}, and {`E`}.

(ii) The ordering of the vertices by Phase 1 `post` numbers is {`A,B,E,C,D,G,H,I,F`}. The strong components computed during Phase 2 are {`F,I,H,G,D`}, {`C`}, and {`E,A,B`}.



G^R



G

5. Work Problem 3.6(a) on page 96–97 of your textbook.

This problem is so easy that it's hard to come up with a proof, other than saying, "It's obvious." But, I'll try.

Proof: Place two credits on each edge. Since $|E|$ is the number of edges, there are $2|E|$ credits. For each edge $e = \{x, y\}$, move one of its credits to x and the other to y. Each vertex v will then have as many credits as it has incident edges, namely $d(v)$. The total number of credits is thus $\sum_{v \in V} d(v)$, which must then be equal to $2|E|$. ∎