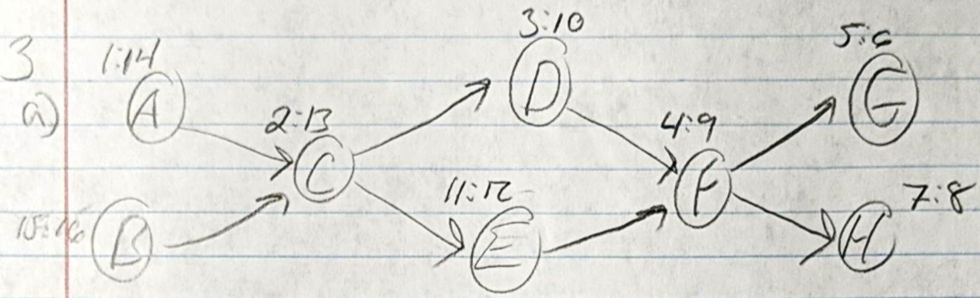
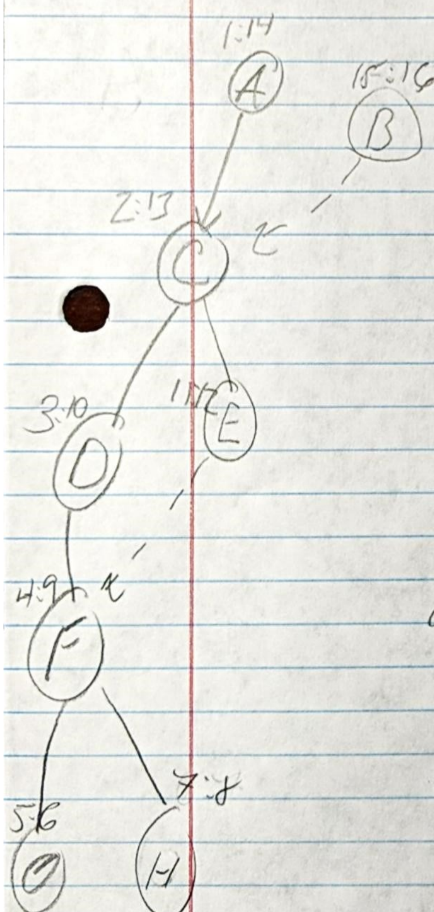
Jeffrey
Lansford

HW4

3.3

a)





b) Sink Nodes are G and H

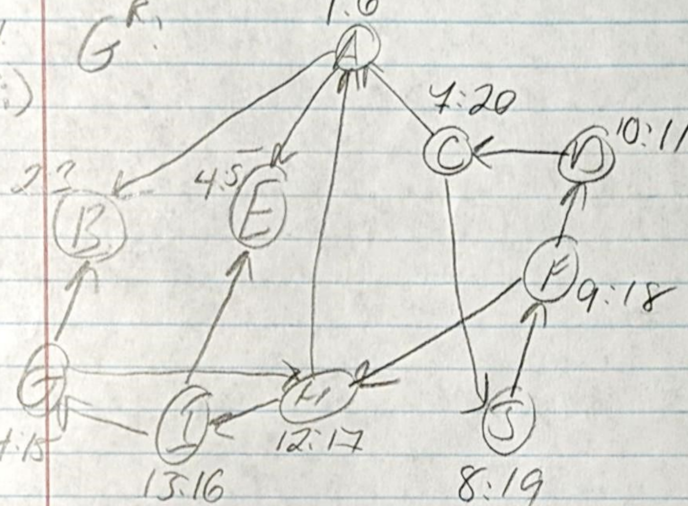
Source Nodes are A and B

c.) We can linearize the nodes by decreasing post numbers

(B, A, C, E, D, F, H, G)

d.) There are 8 possible topological orderings that the graph based on the 4 branching paths it has

34. (i) G^R:



(a) (C, J, F, H, I, G, D, A, E, B)

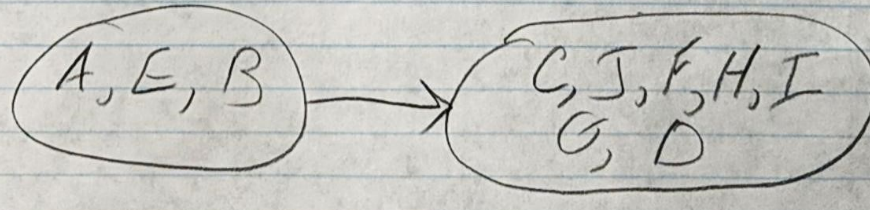
SCC 1: (C, J, F, H, I, G, D)

SCC 2: (A, E, B)

(b) SCC 1 is a sink SCC in G because it has the highest post, C, in G^R

SCC 2 is a source SCC in G as it has the lowest post, B, in G^R

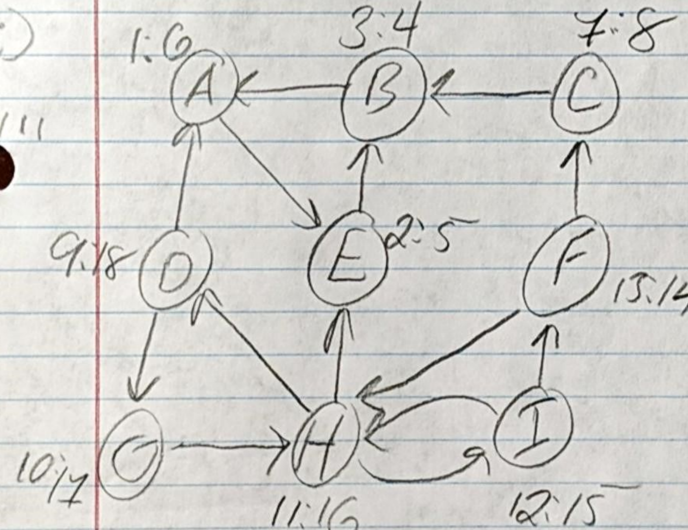
(c)



(d) Adding an edge from SCC1 to SCC2 would make the entire graph strongly connected by adding a cycle between the source and sink

(ii)

iii



(a) SCC1: (D, G, H, I, F)

SCC2: (C)

SCC3: (A, E, B)

(b) SCC1 has the highest post number, D, in G^R, so it is the sink in G.

SCC3 has the least post, B, in G^R, so it is the source in G.

(c)

$$\begin{tikzcd}
A, B, E \arrow[r] \arrow[dr] & C \arrow[d] \\
& D, F, G, H, I
\end{tikzcd}$$

(d) Again, we can add on an edge to the source node towards the sink, we make the entire graph strongly connected.

35 For each $e \in E$:

source $\xrightarrow{e}$ sink

temp = e.source

e.source = e.sink

e.sink = e.source

insert e into G^R

The result would by that every edge in E would have it values swap, the sink swichd with the source, reversing the edge. We stick each edge into G^R to result $G^R = (V, E^R)$. It is linear time because we go through the size of E exactly once and don't revist edges making it $O(n)$