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Recitation:	8

Problem 0

Points:

Acknowledgements

(a) I did not work in a group.

(b) I did not consult without anyone my group members.

(c) I did not consult any non-class materials.

Problem 1

Points:

DFS Basics

(a) $A \to B \to D \to E \to G \to F \to C \to H \to I$

(b)

A	$(1,12)$
B	$(2,11)$
C	$(13,18)$
D	$(3,6)$
E	$(4,5)$
F	$(8,9)$
G	$(7,10)$
H	$(14,17)$
I	$(15,16)$

(c)

Edge	**Type**
(A,B)	Tree
(A,E)	Forward
(B,D)	Tree
(D,E)	Tree
(E,D)	Back
(B,G)	Tree
(G,F)	Tree
(G,D)	Cross
(C,H)	Tree
(H,I)	Tree
(C,I)	Forward

Problem 2

Points:

Pre and Post Processing

(a) For our DFS algorithm, if $\text{post}(u) < \text{post}(v)$, then,

- Case 1 : $[\text{pre}(u), \text{post}(u)][\text{pre}(v), \text{post}(v)]$
- Case 2 : $[\text{pre}(v), [\text{pre}(u), \text{post}(u)]\text{post}(v)]$

These are the only 2 Cases for an undirected graph where $\text{post}(u) < \text{post}(v)$.

Since we know there is an edge between these 2 nodes, Case 1 can not happen because we must visit all the neighbors of a node before marking it as visited. That means, in Case 1, node u is marked visited before exploring edge v as it has $\text{post}(u) < \text{post}(v)$ which is violating the DFS rule of exploring all neighbor nodes before marking it visited. So, Case 2 is the only possible one, which yields v as the ancestor of u. The statement is True.

(b) First, Run Depth First Search Algorithm on the tree while also keeping the timestamps for the time when u is started to get explored (pre-number) and the time when u is finished getting explored (post-number). For every node u, $\text{pre}(u)$ denotes the time when we began exploring u and $\text{post}(u)$ denote the time when we finished it. This process will take linear time since the $Explore()$ function will never be called on a Node more than once.

Now, to check whether u an ancestor of v, we have to check whether:

$$\text{pre}(u) < \text{pre}(v) \text{ and } \text{post}(u) > \text{post}(v)$$

If the above condition becomes True, then u is the ancestor of v. This condition will itself take a constant time becuase it is just comparing two numbers.

Problem 3

Points:

Linearization Basics

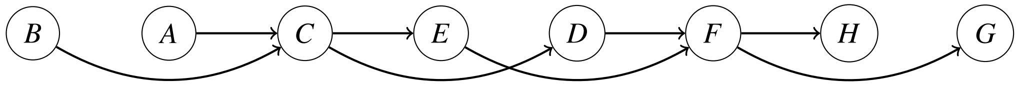
(a)

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) Sources : A, B (A, B are having most elevated post number)

Sinks : G, H (G, H are having least post number)

(c)



(d) We have three times where we can choose between two vertices on a path so $2^3 = 8$ lenearization.