

CSC148 Lab#9, winter 2017

learning goals

In this lab, you will write methods that combine working with trees and working with linked lists. The main goal of this lab is to get you to spend a significant amount of time thinking before you code. Draw lots of pictures, write down high-level outlines of the methods you have to write, make sure you spend a lot of time discussing how to use recursion to accomplish your goals.

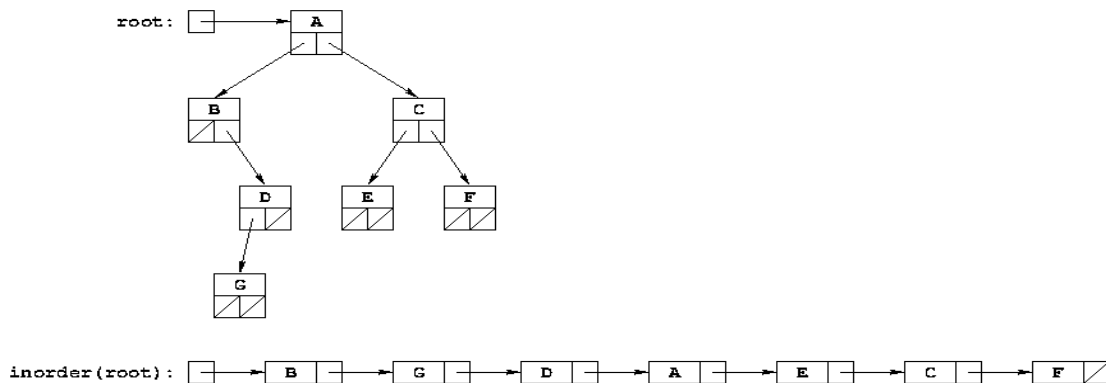
You should work on these on your own before Thursday, and you are encouraged to then go to your lab where you can get guidance and feedback from your TA . There will be a short quiz during the last 25 minutes of the lab, based on these exercises.

set-up

Open `ex8.py`, and save it under a new subdirectory called `lab9`. This file contains class definitions for `BinaryTree`, `LinkedListNode`, and `LinkedList`, as well as headers for methods that you need to complete.

inorder traversal

Complete the code for a method of `BinaryTree` named `inorder` that returns a linked list that contains every value from the binary tree, listed according to an inorder traversal. For example, if `root` is a reference to the root of the binary tree in the picture below, then your method should return a reference to the first node in the linked list pictured below the tree.



Note 1: Your method must create all of the nodes in the linked list and link them together in the right way. You must create and link each node as you traverse the tree; you are not allowed to use an intermediate Python list or other container class.

Note 2: You may find it much easier to write a recursive helper method and simply call it within the body of `inorder`. The reason for the helper method is that the information required at each step to build the linked list is different from what `inorder` receives in its argument list.

Think carefully about this helper method: when you're working on the root of some tree, what information would be most useful to get back from the recursive calls on the left and right sub-trees, to make it easy to put together the final answer? Write your code based on getting this information from each recursive call, and just make sure to return the same information back. Show your TA what information your helper method needs and returns.

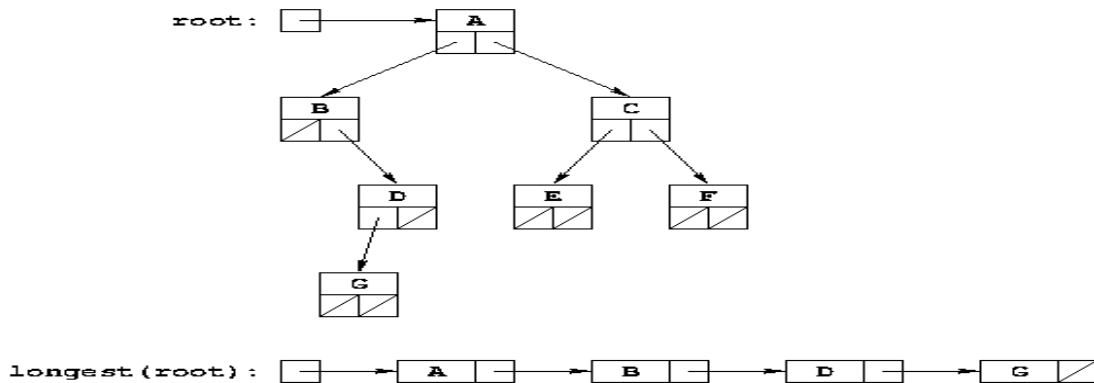
When you are done, you may want to take a few minutes to put together some testing code — several examples in your docstring combined with a good `_eq_` or `_repr_`, for example

When you're done, show your work to your TA.

longest path

Write code for a method named `longest` that returns a linked list that contains every value in a longest path from the root of the binary tree to one of its leaves.

For example, if `root` is a reference to the root of the binary tree in the picture below, then your method should return a reference to the linked list pictured below the tree.



Note 1: Your method must create all of the nodes in the linked list and link them together in the right way. You must create and link each node as you traverse the tree; you are not allowed to create an intermediate Python list or other container class.

Note 2: You may find it much easier to write a recursive helper method and simply call it within the body of `longest`. Think carefully about this helper method: when you're working on the root of some tree, what information would be most useful to get back from the recursive calls on the left and right sub-trees, to make it easy to put together the final answer? Write your code based on getting this information from each recursive call, and just make sure to return the same information.

Show your TA what information is needed/provided by each recursive call.

When you are done, you may want to take a few minutes to put together some testing code — consider a doctest example or two, similar to those for `inorder`. Show your work to your TA. Then, please stick around to help other students in your lab section!

finish up

Finish the remaining methods in `ex8.py` (`preorder` and `postorder`), and then submit it on [MarkUs](#).

During the last 25 minutes of the lab your TA will give you a short quiz. When you've finished, you should have an opportunity to discuss your answers and how you could improve them, then your TA will collect the papers.