Assignment 6: Trees and Graphs

CS 301

April 5, 2018

For our last programming assignment, we will look at two very useful data structures that are generalizations of the linked lists that we looked at earlier.

- **Trees** are just like linked lists, but each node can have more than one child. Just as in a linked list, the children of a node are always new nodes—we never have links pointing back to other nodes higher in the tree.
- **Directed graphs** are just like trees, but now nodes are allowed to point at any other node, even themselves, and we therefore no longer have a special node that we think of as being first. In a graph, we refer to nodes as **vertices**, and the links between them as **directed edges**.
- **Graphs** are just directed graphs with the property that if there is a directed edge from v_1 to v_2, then there is also a directed edge back from v_2 to v_1. Another way of thinking about this is that in a graph, the direction of the edges doesn't matter.

1. Create a python Tree class.
2. Create a python DirectedGraph class.
3. For each of these classes, implement a search method. (For the graph class, it may be helpful to add some additional attributes to the class to help with the search.)
4. What is the running time of each of your search algorithms?