

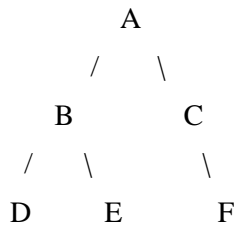
COMP 2230 – Data Structures and Algorithm Analysis

Assignment #7: Trees

Due Date: Oct. 31st Section 01 and Nov 1st Section 02

Chapter 19

1. Consider the following tree structure.



- Give the preorder traversal.
- Give the inorder traversal.
- Give the postorder traversal.
- Give the level-order traversal

Preorder: ABDECF
Inorder: DBEACF
Postorder: DEBFCA
Level-order: ABCDEF

2. What is a disadvantage of implementing a tree as an array using computed links?

With computed links space in the array is reserved for each element. So, if the tree is not complete, there could be wasted space in the array that is not holding anything but is taking up memory anyway. Computed links store elements on the left in $2n+1$ positions and on the right $2n+2$ positions and if there is no element in that specific position the address is reserved in memory should an element be added. This can cause unused memory and therefore wasted space.

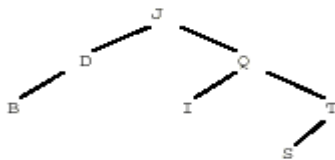
3. What might be the difference between a complete binary tree and a full binary tree

A binary tree is full if all leaf nodes are at the same level and every non-leaf node has exactly 2 children. A tree is complete if it is full or full to the $n-1$ level and the bottom level nodes are partially filled from left to right.

4. Explain how the tree below can be stored in the array then insert elements of this tree into array, using computed links.

The zero index is the root, and the children follow in a $2n+1$ index for the left nodes and a $2n+2$ index for the right nodes. If you read the elements starting at the front of the array they will be in level-order.

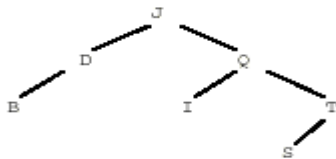
Index	0	1	2	3	4	5	6	7	8
Value	J	D	Q	B		I	T		
9	10	11	12	13	14				
				S					



5. Explain how the tree below can be stored in the array then insert elements of this tree into array, using simulated links.

The 0 index is the root, and the children follow in a first-come-first-served order. The array contains objects that hold references to the element and the children of that node. The references for the children are the index of its position in the array.

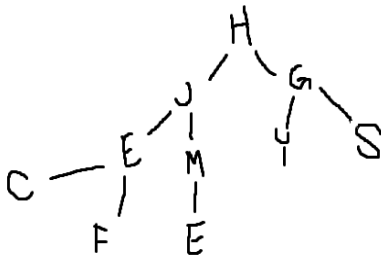
2	1	4	3	5		6							
J		Q		D		T		I		B		S	



6. Draw the tree represented by the following array.

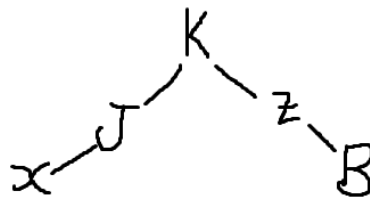
H J G E M Y S C F E

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]



7. Draw a graph (picture) of the **binary** tree of letters that has been implemented as an array of classes with a data item, left and right child indices as is shown below. Assume that **root** has index 0.

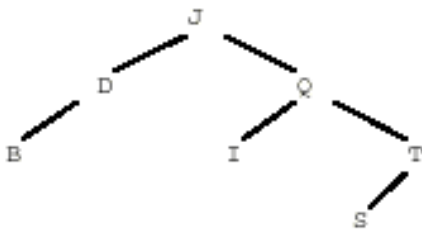
Index	Value	LChild	RChild
[0]	K	3	1
[1]	Z	-1	4
[2]	X	-1	-1
[3]	J	2	-1
[4]	B	-1	-1



8. A full binary tree of height N has how many leaves?

A full Binary tree contains 2^N leaf nodes

9. For the tree shown:



a) List the nodes that have Q as an ancestor.

Three nodes have Q as an ancestor: I, T, S.

b) List the children of J.

D and Q are children of J.

c) Determine the height of the tree.

The tree has a height of 3 because the length of the longest path from root to leaf is 3.

d) Determine the level of node I.

I is at level 2