

Short Answer (3 pts each)

1. Write down a recursive definition for the height of a tree.
2. What data structure implements LIFO behavior?
3. List two methods of handling collisions in a hash table.
4. What are the two components of a hash function?
5. What is an efficient algorithm for determining strong connectivity in a directed graph?
6. Order the following algorithms from best to worst in terms of their worst-case complexity (use $<$ if the complexity is lower and \leq if they are the same): selection sort, quicksort, heap-sort.

Longer Answer

1. (8 pts) On a separate sheet of paper show the tree of calls for the quick-sort algorithm using the final element as a pivot on the array 42395861.
2. (8 pts) Show the result of the following sequence of operations in an array of size 10 below. The hash function is simply $n \bmod 10$. Perform this for a) when linear probing is used to handle collisions and b) when chaining is used.

Add 3 2 5 1 16 25

Remove 5

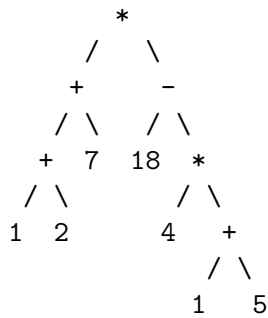
Add 10

Add 13

Remove 1

Remove 13

3. (9 pts) What is the result of a) a preorder traversal, b) an in-order traversal, and c) a postorder traversal on the following expression tree?

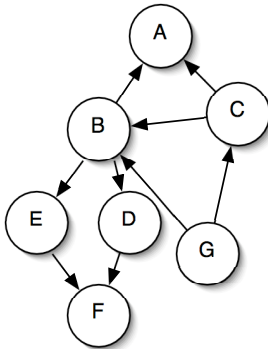


a)

b)

c)

4. (7 pts) What is a topological ordering of the following graph?



5. Show the steps in the in-place heap sort of 47213: a) show the steps in heap construction and b) show the steps as the sort proceeds.