

Algorithms and Programming
09 September 2016 – Theory Part (12 points)

1. (1 point)

Sort in ascending order with selection sort the following array of integers. Show relevant steps:

5 4 10 7 6 4 0 1 6 5 0 2 7 5 0 3 0 4 9

2. (1 point)

Visiting the corresponding binary tree, write the following arithmetic expression in prefix and postfix form:

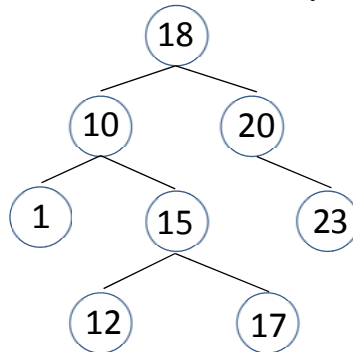
$$((A - B) / (C + (D * E))) * ((E - F) / (G * H))$$

3. (2 points)

Given the sequence of keys RAWFZIEV, where each character is identified by its index in the English alphabet (A=1, ..., Z=26), draw the final configuration of an initially empty hash table of size 17 where insertion of the previous sequence character by character occurs. Assume open addressing with quadratic probing with double hashing. Define functions h_1 e h_2 . Show relevant intermediate steps.

4. (1 point)

Insert in sequence into the BST leaves keys 11 and 4, then delete key 15, draw the tree at each step:

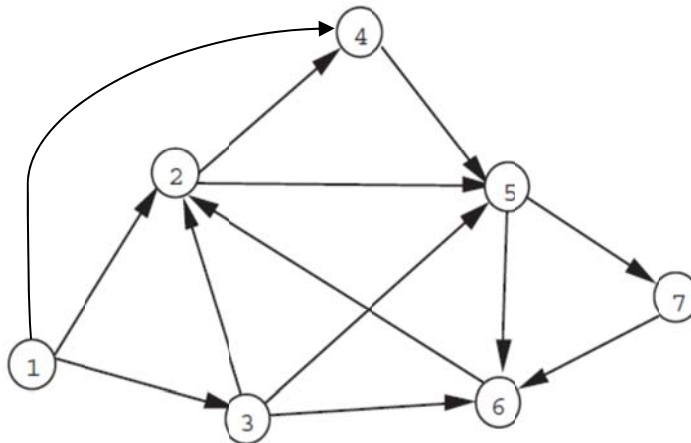


5. (0.5+0.5+0.5 points)

Visit in pre-order, in-order and post-order the binary tree of exercise n. 4.

6. (1.5 + 1.5 + 2.5 points)

Given the following directed graph:



- represent it as an adjacency list and as an adjacency matrix (1.5 points)
- perform BFS, 1 being the start vertex (1.5 points)
- find its SCCs using Kosaraju's algorithm (2.5 points).

If necessary, consider vertices in numerical order.