Home Exercise 2: Data Structures, Graph Theory

Algorithms and Complexity lecture
at Ecole Centrale Paris

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Abstract

Please send your solutions by email to Dimo Brockhoff (preferably in PDF format) with a clear indication of your full name until the submission deadline on September 30, 2019 (a Monday). Groups of up to 4 students are explicitly allowed and even encouraged. In the case of group submissions, please make sure that you submit maximally four times with the same partner!

1 Connected Components (5 points)

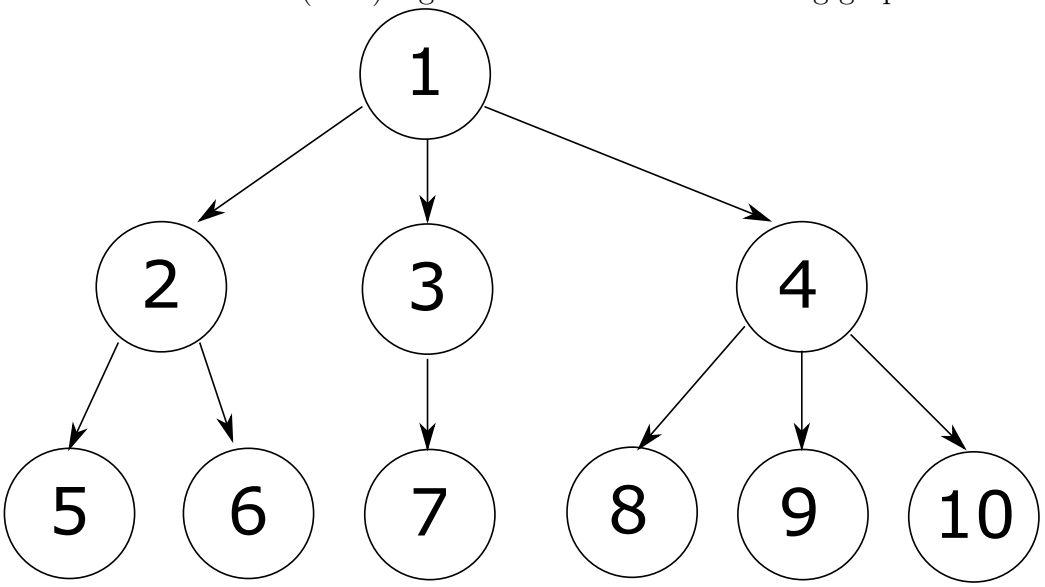
By how much (and why?) can the number of connected components of a graph $G = (V, E)$ change if an edge is added to E?

2 Binary Search Tree (5 points)

Insert the following integer numbers into an empty binary search tree: 8, 9, 2, 10, 6, 1, 3, 7, 5, 4. Afterwards, the numbers 10, 3, and 8 should be deleted. Draw for each of the 13 steps the resulting search tree.

3 DFS vs. BFS (5 points)

Give the order of nodes in which the Depth First Search (DFS) and the Breadth First Search (BFS) algorithm traverse the following graph:



If you need to make some assumptions on the algorithms, please write them down!

4 Inserting Into A Hash Table (5 points)

We consider a hash table with space for 19 data sets and the corresponding hash function $h(x) = x \mod 19$. Insert the following (key, value) pairs: (63, "one"), (388, "two"), (296, "three"), (68, "four"), (160, "five"), (264, "six"), (10, "seven"), (85, "eight"). In case of a collision, consider the next empty table cell (modulo 19).

Draw the content of the hash table after each insert.