CENG 218 – Analysis and Design of Algorithms
Homework 3

27 May 2020

Due Date: 9 June 2020
Contents: There are 2 questions on 2 pages.

Exercise 1 Red-Black Trees

We want to store the keys H, R, S, L, D, N in a data structure sorted in the alphabetical order.

a. Insert the keys above into a Binary Search Tree (BST) in the given order (insert H as the first and N as the last element). Draw the resulting tree.

b. Delete the key R from the BST and draw the resulting tree structure.

c. Insert the keys H, R, S, L, D, N into a Red-Black Tree. Draw the resulting tree **after each insertion** (Draw red links as dashed or double lines (- - - or ===) and black links as solid lines (—).

Exercise 2 Undirected Graphs and Search with Adjacency Matrices

Download and extract contents of
`ceng218_05_Graph_Representation_and_Traversal.tar.gz`

a. Compile and run the executable `graph-search` by running `cmake` and `make`. Inspect the output and the code to understand the implementation of graph search using adjacency lists in C++.

b. Write a new class `GraphAdjMat` that has the same API as the existing class `GraphAdjList` but that represents the graph internally using an adjacency matrix instead of an adjacency list.

c. Replace the references to `GraphAdjList` by `GraphAdjMat` in the file `src/graph_search_main.cc`. Compile and run the executable `graph-search`. Make sure the output is exactly the same as before.