Sabancı University
Faculty of Engineering and Natural Sciences

CS301 – Algorithms

Homework 3

Due: 16-11-2021 @ 23:55

Notes

- No homework will be accepted if it is not submitted using SUCourse.
- Write your solutions on a piece of paper and then upload your solutions to SUCourse.
- The files you upload must be the scanned form of your papers (not photographs). You can use scanner apps available for phones.
- LATE SUBMISSION POLICY:
  Late submission is allowed subject to the following conditions:
  - Your homework grade will be decided by multiplying what your normal grade (i.e. what you get from your answers) by a "submission time factor (STF)".
  - If you submit on time (i.e. before the deadline), your STF is 1. So, you don't lose anything.
  - If you submit late, you will lose 0.01 of your STF for every 5 mins of delay.
  - We will not accept any homework later than 500 mins after the deadline.
  - SUCourse's timestamp will be used for STF computation.
  - If you submit multiple times, the last submission time will be used.

1. Consider an initially empty red-black tree. Insert the following numbers to the red-black tree independently. Show your work step by step for each insertion and rotation(if needed) with the colour of each node.
   (a) Insert 41.
   (b) Insert 38.
   (c) Insert 31.
   (d) Insert 12.
   (e) Insert 19.
   (f) Insert 8.
   (g) Insert 6.

2. Mark the following statements as true or false and give explanations for your answers. No explanation gets 0.
   (a) A red-black tree insertion requires O(1) rotations in the worst case.
   (b) A red-black tree insertion requires O(1) node recoloring in the worst case.
   (c) Walking a red-black tree with n nodes in pre-order takes $\Theta(n \log n)$.