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Homework #4 (90pt), Due. 04-11-2017

Q1. [30pt] 2-3 Tree: Write a program that uses two node types to implement 2-3 search trees directly (not based on BST implementation). Provide three test inputs and a client program. Your test client takes your test inputs and builds a 2-3 tree internally. At the end of the day, your client needs to print out the resulting 2-3 tree based on the input data. You need to provide at least three test inputs. Each of which has a size 3, 5, and 10 respectively.

Q2. [30pt] Red-Black Tree: Implement a Left Leaning Red Black BST based on a BST implementation. For BST, you could use your own implementation from hw3 or exploit the partial codes available in the textbook (and lecture slides). Use the same test inputs as Q1 and see if your resulting tree is structurally the same as the tree implemented for Q1 above.

Q3. [30pt] Cost and Count Rotations: Instrument your Red Black BST implementation from Q2 to plot a) the cost* of each insert operation during the computation and b) the number of rotations and node splits that are used to build the trees. Generate your plots by insertion of n random keys, where $n \geq 10^6$, into an initially empty tree and report average value of 10 such trials.

*Note: you may want to define your cost before presenting the result.