Instructions

- Upload (to google classroom) all answers in the same document, but in serial order.
- Name the file in the following format: RollNo.png (or jpeg).
- It is recommended to write your name and roll number in the answer sheet.

1. Call the sequence of edges from the root to a leaf of a binary search tree with all distinct keys, a *path*. Such a path partitions the nodes into three sets S_1, S_2 and S_3 : those to its left, those on the path itself and those to its right, respectively. Is the following statement true: "All the nodes in S_1 are less than all the nodes in S_2 and all the nodes in S_2 are less than the nodes in S_3. Prove with a succinct argument or disprove with a counterexample. (5 marks)
2. Insert the following keys into an initially empty AVL tree: 30 80 120 150 130 110 90 115 80 95. Show the rotations in a step by step manner, identifying what kind of rotation you are using. (10 marks)
3. Suppose the definition of the AVL tree is altered a bit to give more flexibility, in the following way: instead of the difference between the heights of the left and right subtrees at any node being at most 1, you are now allowed at most a constant c. Derive an upper bound on the height of such a tree in terms of the number of nodes n and c. (5 marks)
4. Write an algorithm (pseudo-code) for insertion into such a tree. Argue briefly that it works correctly. (10 marks)