Please submit a pdf copy (at most 3 pages) of your own solutions to Problems 1–3, at SUCourse+ before March 24 (Monday), 23:30.

Problem 1 (25 points) Consider a variation of the randomized quicksort algorithm studied in class, where the pivot is picked randomly until the array is partitioned in such a way that both the lower subarray and the upper subarray contain at most 2/3 of the elements of the array. Please analyze the expected running time of this algorithm.

Problem 2 (25 points) To compute the black-height of a given node in a red-black tree (RBT) in constant time, consider augmenting the black-heights of nodes as additional attributes in the nodes of the RBT. Please explain why this augmentation does not increase the asymptotic time complexity of inserting a node into an RBT in the worst case.

Problem 3 (25 points) To compute the depth of a given node in an RBT in constant time, consider augmenting the depths of nodes as additional attributes in the nodes of the RBT. Please explain by an example why this augmentation increases the asymptotic time complexity of inserting a node into an RBT in the worst case.