Data Structures and Algorithms – (COMP SCI 2C03)
Winter 2021
Tutorial-3

January Feb 8, 2021

Question 1 Draw the recursion tree for the recursive function $T(n) = T(n/10) + T(9n/10) + \Theta(n)$. Based on the recursion tree explain that $T(n) \in \Theta(n \log_2 n)$. Answer on Cormen page 176.

Question 2 Show, in the style of the quicksort trace given in class, how quicksort sorts the array E A S Y Q U E S T I O N (for the purposes of this exercise, ignore the initial shuffle).

Question 3 Explain what happens when Quick.sort() is run on an array having items with just two distinct keys

Question 4 About how many compares will Quick.sort() make when sorting an array of N items that are all equal?

Question 5 Give the heap that results when the keys E A S Y Q U E S T I O N are inserted in that order into an initially empty max-oriented heap.

Question 6 Suppose that your application will have a huge number of insert operations, but only a few remove the maximum operations. Which priority-queue implementation do you think would be most effective: heap, unordered array, or ordered array?

Question 7 What is the minimum number of items that must be exchanged during a remove the maximum operation in a heap of size N with no duplicate keys? Give a heap of size 15 for which the minimum is achieved. Answer the same questions for two and three successive remove the maximum operations.

Question 8 The largest item in a heap must appear in position 1, and the second largest must be in position 2 or position 3. Give the list of positions in a heap of size 31 where the k-th largest (i) can appear, and (ii) cannot appear, for $k = 2, 3, 4$ (assuming the values to be distinct).