50.004 Introduction to Algorithms, Fall 2018
Singapore University of Technology and Design 25 Sep, 2018
Gemma Roig, Ioannis Panageas, Subhajit Datta Home Exercises - Week 3

Student Information

Name: _____ Student ID: _____
Due Date: 02 Oct 11:59pm.
Submit answers on eDimension in pdf format. Submission without student information will **NOT** be marked! Any questions regarding the homework can be directed to the TA through email (contact information on eDimension).

Week 3

Note: Please read and understand the Heap operations before doing the following questions.

1. The array [80, 77, 76, 50, 45, 70, 52, 30, 29, 22] forms a heap [True/False].
   Show explanation by drawing. ***Only half of the full marks will be awarded if answer is correct without explanation.***

2. We have a max heap of n elements and we want to insert m more elements to this heap. Assume that all the m elements are inserted at the same time and the end result must also be a max heap. The entire operation takes O(m + n) total time [True/False].
   Will the time complexity change if the m elements are inserted one by one to a max heap containing n elements? If it changes, what would be the time complexity? ***Only half of the full marks will be awarded if answer is correct without explanation.***

3. Consider the heap created from the array [80, 77, 76, 50, 45, 70, 52, 30, 29, 22]. If the node with value 29 has its value increased to 79, how many swaps must occur to convert the heap into a max heap? Provide answer and show explanation by drawing. ***Only half of the full marks will be awarded if answer is correct without explanation.***

4. In the worst case scenario, what is the time complexity of finding the smallest item from a max heap?

   A. O(1)

   B. O(n)

   C. O(log n)

D. O(n log n)

5. What is the number of swaps needed to construct a max heap from the array [9, 19, 50, 7, 8, 10, 25, 2, 5, 17, 12, 8]?

   A. 6 swaps

   B. 3 swaps

   C. 1 swap

   D. 4 swaps