

Homework Assignment #4

Due: 2020/05/20 12:00

Assessment policy:

- Give full points when correct, $1/n$ for solving each n subproblems. 0 for totally wrong or none, -1 for each errors.
- There may be partial points for proofs if the direction is correct.

1. Understanding max-heap (6 pts)

Answer the following questions about max-heap, and explain your answer. (3 pts each)

(a) Is an array that is in sorted order a min-heap? Explain your answer.

(b) Is the array with values $\langle 23, 17, 14, 6, 13, 10, 1, 5, 7, 12 \rangle$ a max-heap? Explain why.

2. Applying for heapsort (12 pts)

For array $A = \langle 6, 18, 0, 10, 4, 16, 4, 1, 25, 16, 11, 8 \rangle$, illustrate each steps for heapsort. (3 pts each)

(a) Draw the binary tree of array A , using the model in the lecture.

(b) Illustrate the state of A for each calls in $\text{MAX-HEAPIFY}(A, 4)$.

(c) Illustrate the operation of BUILD-MAX-HEAP on array A .

(d) illustrate the operation of HEAPSORT on array A . Draw the result binary tree.

3. Applying for quicksort (13 pts)

For array $A = \langle 6, 18, 0, 10, 4, 16, 4, 1, 25, 16, 11, 8 \rangle$, illustrate each steps for quicksort.

(a) Illustrate the state of A for each calls in beginning of QUICKSORT. (3 pts)

(b) We will apply a different partition method using the median of 3. (10 pts) Instead of selecting the last element in the subarray as the pivot element, we select the median of the first, middle, and the last element as pivot (the middle element is computed as $\lfloor n/2 \rfloor$). Write pseudocode for MEDIAN-3-PARTITION, and illustrate the state of A for each calls using the partition method in quicksort. (10 pts)