

Labwork 11

December 13, 2019

Exercises related to binary heaps

1. Suppose A is the array with elements

$$A[0] = 27, A[1] = 17, A[2] = 3, A[3] = 16, A[4] = 13, A[5] = 10, A[6] = 1, \\ A[7] = 5, A[8] = 7, A[9] = 12, A[10] = 4, A[11] = 8, A[12] = 9, A[13] = 0.$$

- (a) Draw the binary tree representation of this array, as defined for binary heaps.
- (b) Is this array a binary heap? Motivate your answer.
- (c) Indicate the index $0 \leq i \leq 13$ for which $\text{HEAPIFY}(A, i)$ must be called to produce a binary heap, and the element values of A produced by this call.

2. Suppose A is the array with elements

$$A[0] = 15, A[1] = 13, A[2] = 9, A[3] = 5, A[4] = 12, A[5] = 8, A[6] = 7, \\ A[7] = 4, A[8] = 0, A[9] = 6, A[10] = 2, A[11] = 1.$$

- (a) Is this array a binary heap? Motivate your answer.
(SUGGESTION: draw the binary tree representation of this array, as defined for binary heaps, and check that it fulfils the binary heap property.)
- (b) Indicate the content of A after the operation $\text{INSERT}(A, 3)$.
- (c) Indicate the content of A after the operation $\text{EXTRACTMAX}(A)$ on the initial content of A .

3. What is the running time of HEAPSORT on an array A with n elements that is already sorted in increasing order? What about decreasing order?