

Assignment No. 2: Analysis & Comparison of Bottom-up and Top-down Build Heap Approaches

Allocated time: 2 hours

Implementation

You are required to implement **correctly** and **efficiently** two methods for building a heap, namely the *bottom-up* and the *top-down* strategies.

You may find any necessary information and pseudo-code in your course notes, or in the book¹:

- *Bottom-up*: section 6.3 (Building a heap)
- *Top-down*: section 6.5 (Priority queues) and problem 6-1 (Building a heap using insertion)

Evaluation

! Before you start to work on the algorithms evaluation code, make sure you have a correct algorithm! You will have to prove your algorithm(s) work on a small-sized input: print the output of each build heap strategy using a pretty-print type procedure – i.e. display the heap as a tree, not as a vector. Do the two methods build the same heap?

1. You are required to compare the two build heap procedures in the **average** case. Remember that for the **average** case you have to repeat the measurements m times ($m=5$) and report their average; also for the **average** case, make sure you always use the **same** input sequence for the two methods – to make the comparison fair.
2. This is how the analysis should be performed:
 - vary the dimension of the input array (n) between [100...10000], with an increment of maximum 500 (we suggest 100).
 - for each dimension, generate the appropriate input sequence for the method; run the method, counting the operations (assignments and comparisons, may be counted together for this assignment).
 - ! Only the assignments and comparisons performed on the input structure and its corresponding auxiliary variables matter.
3. Generate a chart which compares the two methods under the total number of operations, in the **average** case. If one of the curves cannot be visualized correctly because the other has a larger growth rate, place that curve on a separate chart as well. Name your chart and the curves on it appropriately.

¹ Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein. *Introduction to Algorithms*

4. Interpret the chart and write your observations in the header (block comments) section at the beginning of your main .cpp file.
5. (*extra – for extra credit*) Try to compare the two build heap procedures in the **worst** case. What do you observe?