

Exercises (Heaps)

Directions: Submit your solutions on *Canvas*. You may use either a *txt* file or a *pdf* file.

EX04. d -rithmetic (20 points)

In this problem, you will figure out how the arithmetic works for d -heaps. Feel free to look at Section 6.5 of Weiss for more information on d -heaps.

- (a) [5 Points] We will begin with considering a 3-heap (a heap where each node has at most 3 children) stored as an array. You should place the root of the tree at index 0, do NOT start at index 1. What are the indices of the parent and children of index k ?
Hint: The solution should be very concise. If it is becoming complicated, you might want to rethink your approach.
- (b) [5 Points] Generalize your solution from (a) to work for d -heaps in general. If a d -heap is stored as an array, what are the indices of the parent and children of index k ? As in part a, we want you to do calculations as if the root is at index 0.
- (c) [5 Points] If a d -heap has height h , what is the maximum number of nodes that it can contain? What is the minimum? Give exact expressions (not something in big-O or theta etc.) and **show** how you came up with your answers.
- (d) [5 Points] If a d -heap has n nodes, what will its height be? Give an exact expression (not something in big-O or theta etc.) and **show** how you came up with your answers.