CSCI 3310 Homework: Heaps

Problem 1. (Based on Book Exercise 6.2) Show the min heap that results from inserting the following sequence of elements: 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4. Show the heap as both a tree and an array.

Problem 2. (Based on Book Exercise 6.3) Show the step-by-step result of calling pop() three times from the min heap resulting from Problem 1. Show the heap as both a tree and an array.

Problem 3. Suppose we wanted to implement a heap via a ternary approach (each node has up to three children).

- For a node at index $p$ in the array, what indices should contain $p$’s children?
- For a node at index $c$ in the array, what index should contain $c$’s parent?

Problem 4. (Based on Book Exercise 6.1) Consider implementing a min priority queue (not necessarily using a heap). Ignoring any time spent to allocate memory, is it possible to implement a min priority queue that has the following worst-case running times:

- $O(1)$ for push(), front(), and pop()?
- $O(1)$ for pop() and front()?
- $O(1)$ for push() and front()?
- $O(1)$ for push() and pop()?

For each answer, either describe why not or give a rough idea for an implementation.