1. Prove that an $n$ element binary heap has height $\lfloor \log_2 n \rfloor$.

2. Where in a max-heap might the smallest element reside, assuming that all elements are distinct?

3. Is an array in sorted order a min-heap? Why or why not?

4. Write an efficient MAX-HEAPIFY (in pseudocode) that uses iteration instead of recursion.

5. Why does the loop index in BUILD-MAX-HEAP need to decrease instead of increase?

6. What is the running time of Heapsort on an array that is already sorted? What is the running time on an array that is in reverse order?

7. Implement a heap class and heap sort. Plot the running time of heap sort for a variety of input sizes and compare this to the running time of the other sorting algorithms that you implemented last semester.