CSC 225 SUMMER 2014
ALGORITHMS AND DATA STRUCTURES I
ASSIGNMENT 3
UNIVERSITY OF VICTORIA

1. Solve the following recurrence equation using repeated substitution to get a closed-formula for $T(n)$. Assume the n is a power of two.

$$\begin{aligned} T(n) &= 1 \text{ if } n = 1 \\ &= 4T\left(\frac{n}{2}\right) + n \log n \text{ if } n \geq 2 \end{aligned}$$

2. Solve the following recurrence equations using the Master Method (assuming that $T(n) = c$ for $n < d$, for constants $c > 0$ and $d \geq 1$).
   (a) $T(n) = 2T(n/2) + \log n$
   (b) $T(n) = 8T(n/2) + n^2$
   (c) $T(n) = 7T(n/3) + n$
   (d) $T(n) = 9T(n/3) + n^3 \log n$

3. Illustrate the performance of the heap-sort algorithm on the following input sequence: $(2, 5, 16, 4, 10, 23, 39, 18, 26, 15)$.

4. Prove that it is impossible to develop a comparison-based algorithm for Priority Queue ADT such that both *insert* and *deleteMin* operations only use $O(\log \log N)$ comparisons. Here, N denotes the size of the priority queue.

5. Suppose we are given a sequence S of n elements, each of which is an integer in the range $[0, n^2 - 1]$. Describe a simple method for sorting S in $O(n)$ time.