

# CSCI 303 Homework 4

**Problem 1 (6.1-1):**

What are the minimum and maximum numbers of elements in a heap of height  $h$ ?

**Problem 2 (6.1-6):**

Is the sequence  $\langle 23, 17, 14, 6, 13, 10, 1, 5, 7, 12 \rangle$  a max-heap?

**Problem 3 (6.2-1):**

Using Figure 6.2 as a model, illustrate the operation of  $\text{MAX-HEAPIFY}(A, 3)$  on the array  $A = \langle 27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 10 \rangle$ .

**Problem 4 (6.2-6):**

Show that the worst-case running time of  $\text{MAX-HEAPIFY}$  on a heap of size  $n$  is  $\Omega(\lg n)$ . (*Hint:* For a heap with  $n$  nodes, give node values that cause  $\text{MAX-HEAPIFY}$  to be called recursively at every node on a path from the root down to a leaf.)

**Problem 5 (6.3-1):**

Using Figure 6.3 as a model, illustrate the operation of  $\text{BUILD-MAX-HEAP}$  on the array  $A = \langle 5, 3, 17, 10, 84, 19, 6, 22, 9 \rangle$ .

**Problem 6 (6.4-4):**

Show that the worst-case running time of  $\text{HEAPSORT}$  is  $\Omega(n \lg n)$ .

**Problem 7 (6.5-7):**

The operation  $\text{HEAP-DELETE}(A, i)$  deletes the item in node  $i$  from heap  $A$ . Give an implementation of  $\text{HEAP-DELETE}$  that runs in  $O(\lg n)$  time for an  $n$ -element max-heap.