

# Algorithms and Programming

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## Problem Set 3

Third Test will be held on Friday, November 2, 2012 at 8.30 AM

1. Consider the following sorting methods: Bubble sort, Insertion Sort, Selection sort, Shell sort, Merge sort, Quick sort, and Heap sort. Sort the following keys using each of the above methods: 22, 36, 6, 79, 26, 45, 2, 13, 31, 62, 10, 79, 33, 11, 62, 26
2. Write down the worst case computational complexity in Big Oh notation in the space provided, assuming that a binary min-heap data structure is used :
  - Selecting the k-th smallest element given n random integers
  - Selecting the second smallest element given a heap with n elements
  - Finding the third smallest element given a heap with n elements
  - Finding the maximum element given a heap with n element
3. A d-ary min-heap is like a binary min-heap, but instead of two children, nodes have d children.
  - How would you represent a d-ary heap in an array?
  - What is the height of a d-ary heap of n elements in terms of n and d?
  - Create a 3-ary min-heap with the elements 22, 36, 6, 79, 26, 45, 2, 13, 31, 62, 10, 79, 33, 11, 62, 26
4. Suppose we have an array of n data records such that the key of each record has the value 0 or 1. Outline a worst case linear time algorithm to sort these records in place, using only an additional amount of storage equal to that of one record.
5. Suppose we have an array of n data records such that the key of each record has the value 0, 1, or 2. Outline a worst case linear time algorithm to sort these records in place, using only an additional amount of storage equal to that of one record.
6. Set up a recurrence relation to describe the worst case computational complexity of the bubblesort algorithm and solve the recurrence relation.