
Algorithms and Programming

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Problem Set 3

Third Test will be held on Friday, November 11, 2011 at 12 Noon.

1. Consider the following sorting methods: Bubble sort, Insertion Sort, Selection sort, Shell sort, Merge sort, Quick sort, Tree 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. A d -ary min-heap is like a binary min-heap, but in stead 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
3. 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.
4. 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.
5. Solve the following instance of TSP using (a) nearest city heuristic (repeat with each city as starting city); (b) shortest edge heuristic (c) branch and bound technique. The graph has 5 vertices, call them A,B,C,D,E. Let the weight on edge A-B be denoted simply as AB, etc. The weights are: AB = 10; AC = 12; AD = 8; AE = 14; BC = 9; BD = 18; BE = 13; CD = 11; CE = 20; DE = 4.
6. Construct an example of a four city TSP such that the nearest city heuristic always gives an optimal solution whatever the starting city. The example should be different from the trivial one where all edge weights are the same.
7. Construct an example of a four city TSP such that the shortest edge heuristic gives an optimal solution. The example should be different from the trivial one where all edge weights are the same. Also, construct an example of a four city TSP such that the shortest edge heuristic does not give an optimal solution.