Divide-and-Conquer Worksheet

Name: _____

For each of the following you are to design and analyze algorithms. Your goal is to find an algorithm that is as efficient as possible. The best possible complexity for each is not given since it is important to develop an intuition for what is and is not possible in a given amount of time. For each of these, describe your algorithm, give the complexity class to which it belongs (best and worst case; average if possible), and state whether or not you think it is the best possible (asymptotically) and why.

1. The *median* element of a sorted list is the value of the middle element. If a list has an even number of elements, the median is the average of the two middle elements. Describe an efficient algorithm to find the *median* of an *unsorted* array.

2. Describe an efficient algorithm to find all elements in a sorted array that are between two values L and U, inclusive, with $L \leq U$.

3. Describe an efficient algorithm that will determine if the values in an array satisfy the heap property.

4. Let S_1 and S_2 be sets with $|S_1| = n$ and $|S_2| = m$, with $n \leq m$. For a given number x, describe an efficient algorithm for finding whether there exists a pair of elements, $s_1 \in S_1$ and $s_2 \in S_2$ such that $x = s_1 + s_2$.[1]

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[1] This is essentially problem 4-6 from ADM.