

Recursion Problems: Group B

The following problems all involve recursion, memoization, or dynamic programming. Try to see if you can come up with the most efficient solutions possible!

1. Given a number n , generate all distinct ways to write n as the sum of positive integers. For example, with $n = 4$, the options are 4, $3 + 1$, $2 + 2$, $2 + 1 + 1$, and $1 + 1 + 1 + 1$.
2. In a binary tree, a *common value subtree* is a complete subtree where every node has the same value. (A complete subtree is a subtree consisting of a node and all its children). Determine the largest common value subtree in a nonempty binary tree.
3. Suppose you have a multiway tree where each node has an associated integer value. Find a set of nodes with the maximum possible sum, subject to the constraint that you cannot choose a node and any of its children at the same time.
4. Suppose that you have a group of people that you need to assign into different houses. For each house, you know the number of people that the house can hold. Additionally, you know that some people *insist* that they not be put into the same house as some other people. Given the list of pairs of people that can't be put into houses and the house capacities, determine how to distribute the people into the houses, or report that it's impossible.