15-211: Assignment 2 Theory Questions

Due May 29, 2009 in class

These questions count for 20% of the homework grade. Please hand in your answers, written or typeset, in lecture on Friday.

Question 1 (5 pts)

Is it possible to speed up this code using dynamic programming? If so, show how; if not, explain why not.

```
static int x = 0;

int foo(int n) {
   if (n <= 0) {
      x++;
      return x;
   }
   return n + foo(n-1) + foo(n-4);
}
```

Question 2 (5 pts)

Consider the knapsack problem with $W = 12$ and the following (weight, value) pairs of items: (6,25),(2,8),(5,19),(7,26),(3,10),(4,10),(1,1). Find the maximum achievable value of items. Show your work by drawing a DP table.

Question 3 (5 pts)

In class, we discussed the algorithm for finding the minimum number of coins needed to make change for a given amount, with a given set of coin denominations. Design a DP algorithm for finding the total number of ways of changing a given amount, with a given set of coin denominations.

Question 4 (5 pts)

In class, we also discussed a string reconstruction algorithm for inserting spaces into a space-less text file. Our solution only determines if there exists a valid break up of the given text. Extend the given DP algorithm to reconstruct the solution file.