

Algorithms and Datastructures assignment 1

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14. maj 2015

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1 Task 1

$$|N(c, i)| = \begin{cases} 0 & \text{if } c \leq 0 \\ 0 & \text{if } i = 0 \\ 1 + N(c, i - 1) & \text{if } p_i = c \\ N(c - p_i, i - 1) + N(c, i - 1) & \text{otherwise} \end{cases}$$

2 task 2

In order to prove the correctness of our formula, for calculating the amount of unique combinations of unique beers you can buy with a specified amount of money, we will have to check the three properties of a correct formula.

First we will first prove the correctness of the initialization of our formula.

This we have summarized into showing that for a given value of $1 \leq c$ and $1 \leq i$ that our base case holds true for the first iteration. For the example above, it is trivial to see that if $N(1, 1)$ then the base cases for the formula, won't be triggered. From this we can see that initialization will hold for any value of $1 \leq c$ and $1 \leq i$.

The second property that our formula must hold, is that if the invariant before an iteration is true, must remain true after the iteration. To show that our

To further prove the correctness of our formula, we have see if the formula holds true before and after an iteration.

3 Task 3

Bellow we have written the pseudo-code for MemoizedBeerComp using memoization DP

```
MemoizedBeerComp(c, i, beerList, array)
1 if c <= 0 or i==0
2   return 0
3 if array(c, i) > -1
```

```

4     return array(c, i)
5 if c - beerList[i] == 0
6     array(c,i) = 1 + MemoizedBeerComp(c, i - 1)
7     return array(c,i)
8 else
9     array(c,i) = MemoizedBeerComp(c, i - 1, beerList, array) +
                    MemoizedBeerComp(c - beerList[i], i - 1, beerLis, array)
10    return array(c, i)

```

4 Task 4