

RodCutting Problem

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1 Problem Statement

RodCutting Problem

Given a rod of length n inches and an array of prices that contains prices of all pieces of size smaller than n . Determine the maximum value obtainable by cutting up the rod and selling the pieces.



Figure 1: The core formula

2 Understanding the problem

“So we have the length of the rod and the prices which indicates all the values we can sell rod to the customers starting with 1 meter to n meters.

I think this problem can be made with a lot of variants, but the one that I came with is about dynamic programming and will be based on the Figure 2 formula and the final principal code will have a complexity of $O(n^2)$, while the second one will be less efficient and will not be able to solve for example a rod with length 200. ”

$$C(i) = \max_{1 \leq k \leq i} \{V_k + C(i-k)\}$$

Figure 2: The Rods we want to cut

3 The generator used

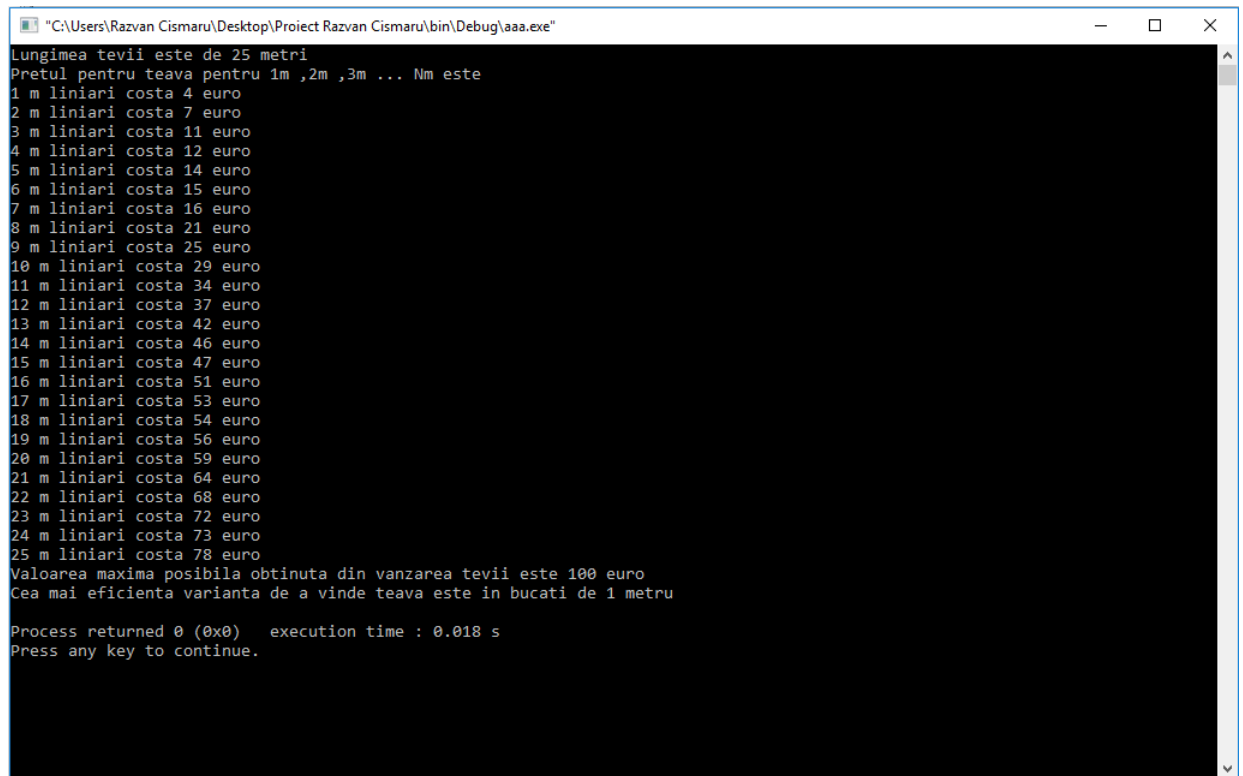
“For this problem, I needed to generate first a number and then n random numbers from 0 to infinity. As I thought that the price of a meter of rod (which is not made of gold) would not cost more than 5 euro, the generator will come first with a number between 1 and 5 and then generate the next ones adding to the previous one a value between 1 and 5

The generator uses `extension time.h` and then uses `srand` function `PROCENT` by `n + 1` to give random values between 1 and n ”

4 Application in real life

“As this problem is a pure example of dynamic programming and the prices in real life won't be bigger if we buy more, I consider that this program is just an example based on real life situation and can be continued and improved to become a functional program that may help us buy more efficient :)

5 Exemple of running the program



```
"C:\Users\Razvan Cismaru\Desktop\Proiect Razvan Cismaru\bin\Debug\aaa.exe"
Lungimea tevii este de 25 metri
Pretul pentru teava pentru 1m ,2m ,3m ... Nm este
1 m liniari costa 4 euro
2 m liniari costa 7 euro
3 m liniari costa 11 euro
4 m liniari costa 12 euro
5 m liniari costa 14 euro
6 m liniari costa 15 euro
7 m liniari costa 16 euro
8 m liniari costa 21 euro
9 m liniari costa 25 euro
10 m liniari costa 29 euro
11 m liniari costa 34 euro
12 m liniari costa 37 euro
13 m liniari costa 42 euro
14 m liniari costa 46 euro
15 m liniari costa 47 euro
16 m liniari costa 51 euro
17 m liniari costa 53 euro
18 m liniari costa 54 euro
19 m liniari costa 56 euro
20 m liniari costa 59 euro
21 m liniari costa 64 euro
22 m liniari costa 68 euro
23 m liniari costa 72 euro
24 m liniari costa 73 euro
25 m liniari costa 78 euro
Valoarea maxima posibila obtinuta din vanzarea tevii este 100 euro
Cea mai eficienta varianta de a vinde teava este in bucati de 1 metru

Process returned 0 (0x0)   execution time : 0.018 s
Press any key to continue.
```

Figure 3: Example

“As we can see, the program works and has some extras witch says if the most efficient way of selling the rod is by selling meter by meter or if it is the situation that the most efficient way to sell it is by not cutting it at all”

6 Conclusion

“Working on this project was a really unique experience for me, since it was truly a challenge, both in terms of research and understanding of the topic, aswell as in the implementation part. I can say that i have learned some new things making this project and that it has started the interest of making a code that may help me do something easier or even my parents with their business.

7 The Code

“The lines of code are shown in Fig 4 ”

```
int n, i, j;
int PretMaxim;

int TaiTeava(int n, int PRET[]){
    int i,j;
    int result[30];
    result[0]=0;

    for(i=1;i<=n;i++){
        result[i]=0;
        for(j=0;j<i;j++){
            int k=PRET[j]+result[i-(j+1)];
            result[i]=max(result[i],k);
        }
    }

    return result[n];
}

int main(){
    int PRETPRE;
    int PRET[100];

    //generator valori;
    srand(time(NULL));
    n = (rand() % 30) +1;
    printf("Lungimea tevii este de %d metri \n", n); //generam valoarea tevii

    printf("Pretul pentru teava pentru 1m ,2m ,3m ... Nm este \n");
    PRETPRE=0;
    for(int i=0;i<n;i++){
        PRET[i]= PRETPRE + (rand()%5) +1; //generam valoarea fiecarui pret |
        printf("%d m liniari costa %d euro \n", i+1, PRET[i]);
        PRETPRE= PRET[i];
    }

    PretMaxim = TaiTeava(n,PRET);
    printf("Valoarea maxima posibila obtinuta din vanzarea tevii este %d euro \n", PretMaxim );

    if(PretMaxim == n*PRET[0])
        printf("Cea mai eficienta varianta de a vinde teava este in bucati de 1 metru \n");
    if(PretMaxim == PRET[n-1])
        printf("Putem obtine cei mai multi bani vanzand teava intreaga, fara a taia din ea! \n");

    return 0;
}
```

Figure 4: The Code