

CS 313E (Mitra)**Rod Cutting Problem**

You have rods that you sell in the following lengths and prices:

Length	1	2	3	4	5	6	7	8
Price	1	5	8	9	10	17	17	20

Assume that you have a rod of size 22. How will you cut the rod so that you maximize your profits? Use Dynamic Programming approach to fill the table. $C(i)$ is the price of the optimal cut of rod. $C(k)$ is the price of a cut of length k where k is between 1 and 8, the lengths of rods that are being sold. The relation that you want to solve is

$$C(i) = \max \{C(k) + C(i - k)\} \text{ where } 1 \leq k \leq i \text{ for } i \leq 8$$

$$1 \leq k \leq 8 \text{ for } i > 8$$

Length, i	Price for Optimal Cut $C[i]$	Cuts
0	0	0
1	1	no cuts
2	5	no cuts
3	8	no cuts
4	10	2, 2
5	13	2, 3
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

How many different ways to cut a rod of a given length?

	0	1	2	3	4	5	6	7	8
0	1	0	0	0	0	0			
1	1	1	1	1	1	1			
2	1	1	2	2	3	3			
3	1	1	2	3	4	5			
4	1	1	2	3	5	6			
5	1	1	2	3	5	7			
6									
7									
8									

1. First exclude the new length to cut and find the number of ways to cut from the row above.
2. Include the new length to cut and find the number of ways to cut.
3. Add the two numbers.

[If row number > column number, copy value from above row]

How many ways to cut a rod of length 5? [[1, 1, 1, 1, 1], [1, 1, 1, 2], [1, 1, 3], [1, 2, 2], [2, 3], [1, 4], [5]] = 7 ways