## CSCI 232: Data Structures and Algorithms

Dynamic Programming (Part 3)

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https://www.cs.montana.edu/pearsall/classes/spring2024/232/main.html



## WARM UP EXERCISE

## Finding 2<sup>nd</sup> smallest value in a BST



Announcements

# Program 3 due tonight at 11:59 PM → Make sure you read over the rubric

Lab 12 due **Sunday** at 11:59 PM

After this short lecture, I'll be in Barnard 254 helping people w/ program 3



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



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#### **Optimal Substructure**

Our solution for a rod length of n=8, has the optimal solution for rod length of n = 6, and n = 2



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

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

General Approach:

Compute all possible ways to cut the rod using dynamic programming, and return which one had the highest profit



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### **Overlapping subproblems**

We will compute the optimal way to cut a rod of length n=2 many times. We will use memoization to make sure we don't compute problems that we have already solved.





n = 8



Technically, out algorithm will consider making a cut of length 8 first, but we will skip over this part to avoid confusion index























n = 8





























cut Length 

Rod Length





cutlength 

Rod Length





dp[index][n] = 10

Rod Length

		1	2	3	4	5	6	7	8
cutleneth	1								
	2				10				
	3								
	4								
	5								
	6								
	7								
	8								





dp[index][n] = 10

Rod Length

		1	2	3	4	5	6	7	8
cut length	1								
	2				10				
	3								
	4								
	5								
	6								
	7								
	8								

Whenever we solve a subproblem, remember to place it inside of our memoization table











Only make the cut if its possible













