

# CMSC 401 – Fall 2020

## Assignment 4 (due Sun, 12/6 – 11:59pm)

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CMSC 401- Algorithm Analysis with  
Advanced Data Structures



**VCU**

College of Engineering

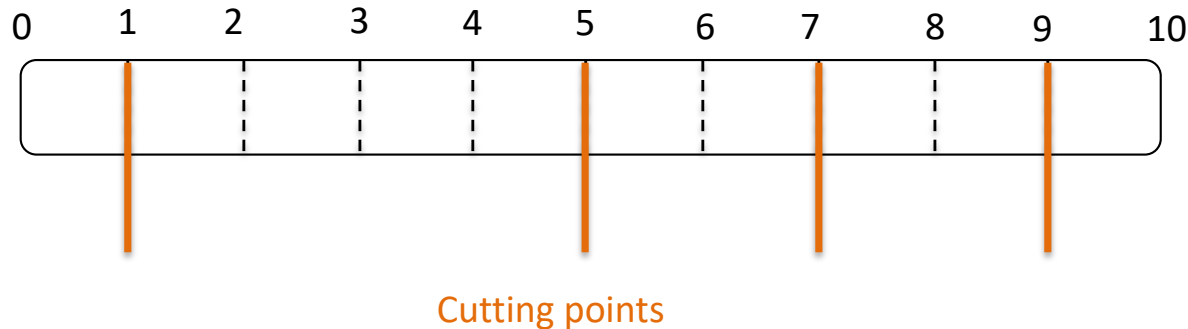
# Minimum Cost Rod Cutting

- You are given a rod that is **N inches long** and a set of **M cutting points** on the rod.
- You will need to cut the rod from these M points.
- You can perform the cuts in any order of these points.
- After a cut, rod gets divided into two smaller sub-rods.
- **The cost of making a cut is the length of the current sub-rod in which you are making a cut on.**
- Your goal is to minimize the total cost of cutting.
- Output will show only the minimum cost.

# Assignment 4

- Write a program cm401.java that reads the size of the rod and cutting points in the format below:
- The size of the rod,  $N$ , in the first line.  $N \geq 2$ ,  $N \leq 100$
- The number of cutting points,  $M$ , in the second line.  $M \geq 1$ ,  $M \leq N-1$
- The location of each of  $M$  distinct cutting points (will be  $>0$  and  $<N$ )
  - Only integer values

10  
4  
1  
5  
7  
9



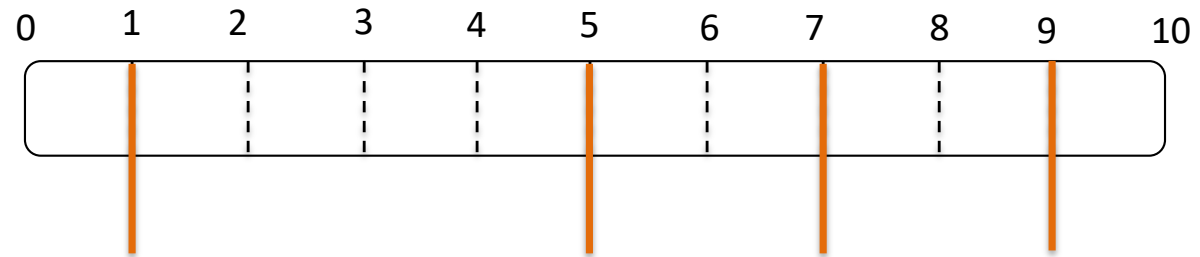
# Example

Input in correct format

10  
4  
1  
5  
7  
9

Correct output

23



Cutting points

Order	Cost
1) Cutting at 5:	10
2) Cutting at 1:	5
3) Cutting at 7:	5
4) Cutting at 9:	3

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Total Cost: 23

An order of cutting points that gives the min cost is 5,1,7,9 (there are also others giving the same minimum, e.g., 5,7,9,1)

Bad cut example: Cutting in the order of 1,5,7,9 which has cost  $10+9+5+3=27$ .

# Hint

- Define the problem in terms of cutting the rod from one cutting point to another one
  - $C(i,j)$  = cost of cutting the rod from point  $i$  to point  $j$
- Find the recursive formula
- Apply a dynamic programming method
- Algorithm should have  $O(M^3)$  complexity
  - $M$ : number of cutting points
  - Complexity **should not depend on  $N$** , the length of rod.

# Submission

- **Date due:** Sunday, Dec 6<sup>th</sup>, 11:59 pm
- Upload through Blackboard
  - Your submission should be a zip archive **4\_FamilyName\_FirstName.zip** containing
    - Java source code in a single file **cmssc401.java** (all lower case letters!)
    - The file should have *your name* in a comment in the first line
    - Remember: in Java, class name should match the file name, and is case sensitive
- Please do NOT create your own packages
- Do NOT place the file into a folder – just zip the file
- Use standard I/O to read input (System.in, System.out) and output
- Make sure the program compiles and WORKS!
- Late submissions are accepted up to 2 days!