Charotar University of Science and Technology

Faculty of Technology and Engineering

Devang Patel Institute of Advance Technology and Research

Department: Information Technology, Computer Engineering, Computer Science and Engineering

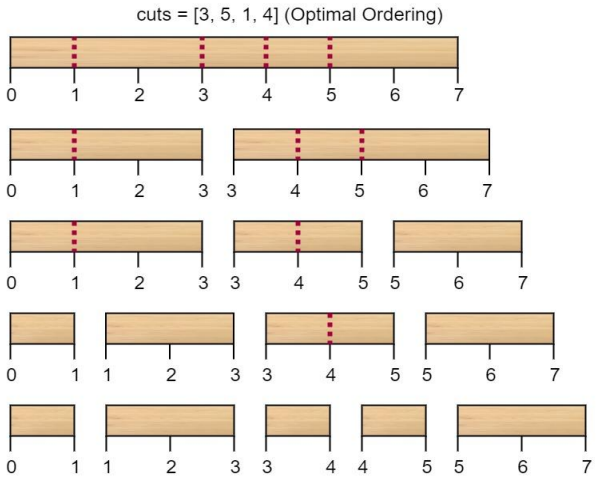
Continuous Internal Evaluation 2

Subject: IT397/CE390/CSE311 - Competitive Programming Essentials
Semester: V
Marks: 10
Duration: 1 hour 30 minutes
Time: In Lab Hour of CPE

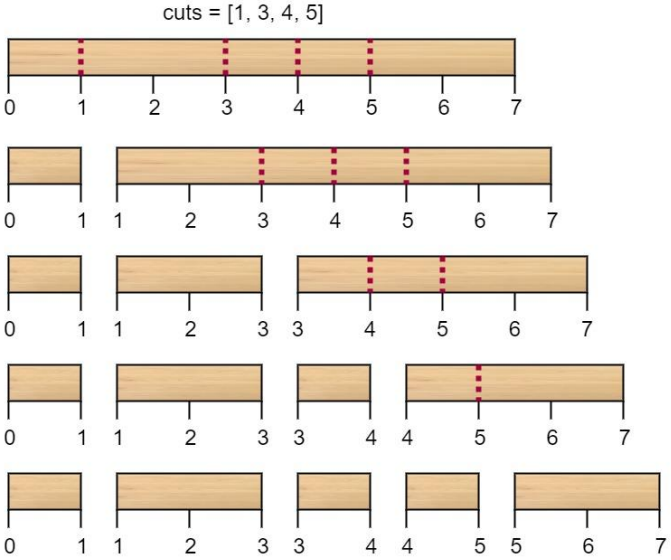
Q-2. Given a wooden stick of length n units. The stick is labelled from 0 to n. For example, a stick of length 6 is labelled as follows:

Given an integer array cuts where cuts[i] denotes a position you should perform a cut at.
You should perform the cuts in order, you can change the order of the cuts as you wish.
The cost of one cut is the length of the stick to be cut, the total cost is the sum of costs of all cuts. When you cut a stick, it will be split into two smaller sticks (i.e. the sum of their lengths is the length of the stick before the cut). Please refer to the first example for a better explanation.
Return *the minimum total cost* of the cuts.

Example 1:



Input: n = 7, cuts = [1,3,4,5]
Output: 16
Explanation: Using cuts order = [1, 3, 4, 5] as in the input leads to the following scenario:



The first cut is done to a rod of length 7 so the cost is 7. The second cut is done to a rod of length 6 (i.e. the second part of the first cut), the third is done to a rod of length 4 and the last cut is to a rod of length 3. The total cost is 7 + 6 + 4 + 3 = 20.
Rearranging the cuts to be [3, 5, 1, 4] for example will lead to a scenario with total cost = 16 (as shown in the example photo 7 + 4 + 3 + 2 = 16).

Example 2:
Input: n = 9, cuts = [5,6,1,4,2]
Output: 22

Explanation: If you try the given cuts ordering the cost will be 25.
There are much ordering with total cost <= 25, for example, the order [4, 6, 5, 2, 1] has total cost = 22 which is the minimum possible.

Constraints:

- 2 <= n <= 106
- 1 <= cuts.length <= min(n - 1, 100)
- 1 <= cuts[i] <= n - 1
- All the integers in cuts array are **distinct**.

Code :

```
import java.util.*;

public class CIE_2 {
   public static int minCost(int n, int[] cuts) {
      int m = cuts.length;
      int[] allCuts = new int[m + 2];
      allCuts[0] = 0;
      allCuts[m + 1] = n;
      for (int i = 0; i < m; i++) {
         allCuts[i + 1] = cuts[i];
      }
      Arrays.sort(allCuts);
      int[][] dp = new int[m + 2][m + 2];

      for (int len = 2; len < m + 2; len++) {
         for (int i = 0; i + len < m + 2; i++) {
            int j = i + len;
            dp[i][j] = Integer.MAX_VALUE;
            for (int k = i + 1; k < j; k++) {
               int cost = (allCuts[j] - allCuts[i]) + dp[i][k] + dp[k][j];
               dp[i][j] = Math.min(dp[i][j], cost);
            }
            if (dp[i][j] == Integer.MAX_VALUE) dp[i][j] = 0;
         }
      }
      return dp[0][m + 1];
   }
   public static void main(String[] args) {
      Scanner s = new Scanner(System.in);
      System.out.print("Enter Length of Stick : ");
      int n = s.nextInt();
      System.out.print("Enter Number of Cuts : ");
      int cut = s.nextInt();
      int[] cuts = new int[cut];
      System.out.print("Enter the cuts : ");
      for(int i=0 ; i<cut ; i++){
         cuts[i] = s.nextInt();
      }
      System.out.println("Minimum cost to cut stick: " + minCost(n, cuts));
      s.close();
   }
}
```

Output :

```
Enter Length of Stick : 7
Enter Number of Cuts : 4
Enter the cuts : 1 3 4 5
Minimum cost to cut stick: 16
```

```
Enter Length of Stick : 9
Enter Number of Cuts : 5
Enter the cuts : 5 6 1 4 2
Minimum cost to cut stick: 22
```