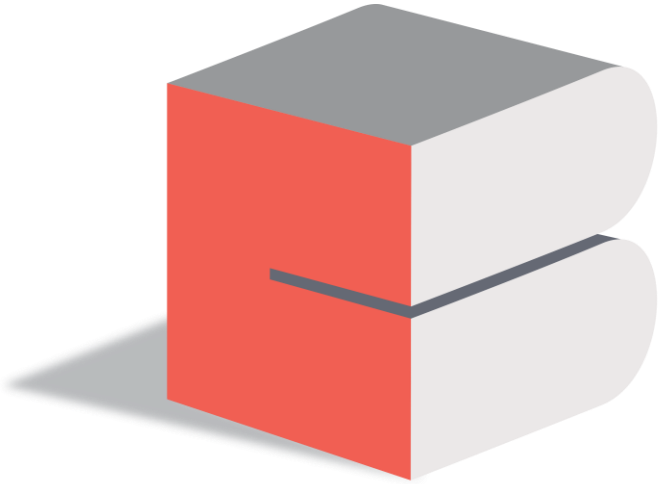

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PROBLEM SOLVING

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Instructor, Java

Motivation

- Problem Solving
- Optimization
- Algorithms
- Recursion
- Greedy

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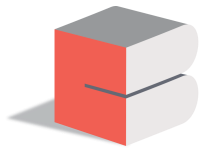
Recursion

- Smaller Problem
- Factorial
- Fibonacci



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Valid Parentheses

Write a function to generate all possible n pairs of balanced parentheses.

Input : n=1

Output: { }

Input : n=2

Output: { } { } , { { } }

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No Consecutive One

Given a positive integer N, count all possible distinct binary strings of length N such that there are no consecutive 1's.

Examples:

Input: N = 2 Output: 3 // The 3 strings are 00, 01, 10
Input: N = 3 Output: 5 // The 5 strings are 000, 001, 010, 100, 101

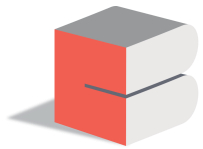
Wildcard Matching

Given a text and a wildcard pattern, implement wildcard pattern matching algorithm that finds if wildcard pattern is matched with text. The matching should cover the entire text (not partial text).

The wildcard pattern can include the characters '?' and '*'

'?' – matches any single character

'*' – Matches any sequence of characters (including the empty sequence)



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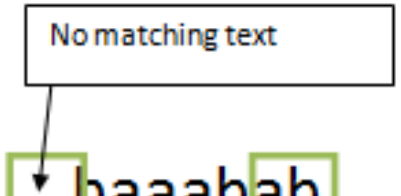
```
Input =          ba aab ab
Pattern = *****ba*****ab
Output : true
```




```
Input =          baaabab
Pattern =        a *   ab
Output : false
```

```
Input =          ba aab ab
Pattern =        ba  *  a?
Output : true
```

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Greedy Algorithm

- What is it ?
- Makes locally optimal choice at each stage with the hope of finding a global optimum.
- Examples : MST, Huffman

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Min Step to One

You are given an integer N, you need to reduce it to 1 in minimum number of operations. Following operations are allowed.

Subtract 1 from it. (n = n - 1)

If its divisible by 2, divide by 2. (if n % 2 == 0 , then n = n / 2)

If its divisible by 3, divide by 3. (if n % 3 == 0 , then n = n / 3)

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Wine Problem

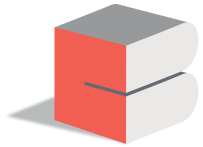
Imagine you have a collection of N wines placed next to each other on a shelf.

For simplicity, let's number the wines from left to right as they are standing on the shelf with integers from 1 to N, respectively. The price of the ith wine is pi. (prices of different wines can be different).

Because the wines get better every year, supposing today is the year 1, on year y the price of the ith wine will be y*pi, i.e. y-times the value of initial year.

You want to sell all the wines you have, but you want to sell exactly one wine per year, starting on this year. One more constraint - on each year you are allowed to sell only either the leftmost or the rightmost wine on the shelf and you are not allowed to reorder the wines on the shelf (i.e. they must stay in the same order as they are in the beginning).

You want to find out, what is the maximum profit you can get, if you sell the wines in optimal order?



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Wine Problem

Example 1:

p1=1, p2=4, p3=2, p4=3

Solution :

p1, p4, p3, p4

Profit : 1 * 1 + 3 * 2 + 2 * 3 + 4 * 4 = 29

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Wine Problem : What you think ?

Example 2:

p1=2, p2=3, p3=5, p4=1, p5=4

Solution :

p1, p2, p5, p4, p3

Profit : 2 * 1 + 3 * 2 + 4 * 3 + 1 * 4 + 5 * 5 = 49

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Wine Problem : What actually works ?

Example 2:

p1=2, p2=3, p3=5, p4=1, p5=4

Solution :

p1, p5, p4, p2, p3

Profit : 2 * 1 + 4 * 2 + 1 * 3 + 3 * 4 + 5 * 5 = 50

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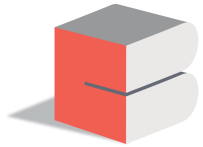
Friend Pairing Problem

Given n friends, each one can remain single or can be paired up with some other friend. Each friend can be paired only once. Find out the total number of ways in which friends can remain single or can be paired up.

Example :
Input : n = 3 Output : 4
Explanation
{1}, {2}, {3} : all single
{1}, {2,3} : 2 and 3 paired but 1 is single.
{1,2}, {3} : 1 and 2 are paired but 3 is single.
{1,3}, {2} : 1 and 3 are paired but 2 is single.

Note : {1,2} and {2,1} are considered same.



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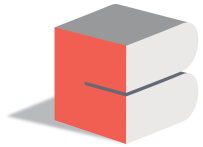
Conclusion

- Recursion
- Difference b/w Greedy & DP

- Practice is key
- Online Judges



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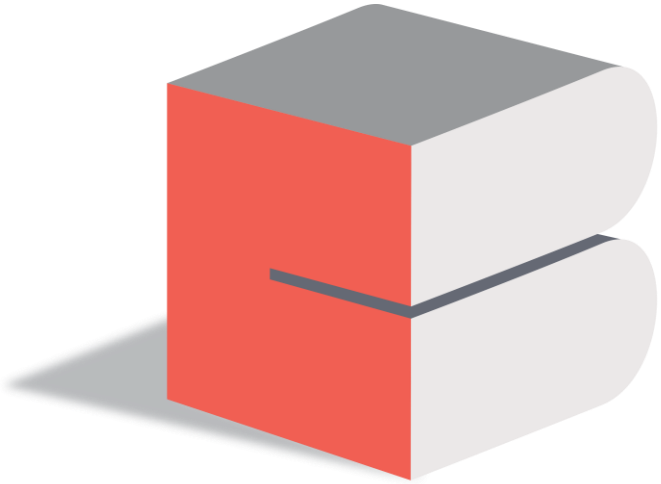

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THANK YOU !!!