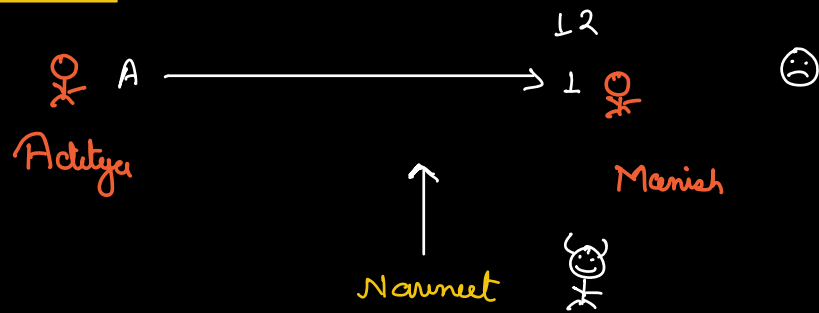


## Q Ways to decode



A  $\rightarrow$  1

B  $\rightarrow$  2

C  $\rightarrow$  3

;

Z  $\rightarrow$  26

12  $\rightarrow$  AB, L

26  $\rightarrow$  BF, Z

121  $\rightarrow$  ABA, LA, AU

Given the string of digits (encoded)

Count the no. of ways of decoding it.

12  $\rightarrow$  2

26  $\rightarrow$  2

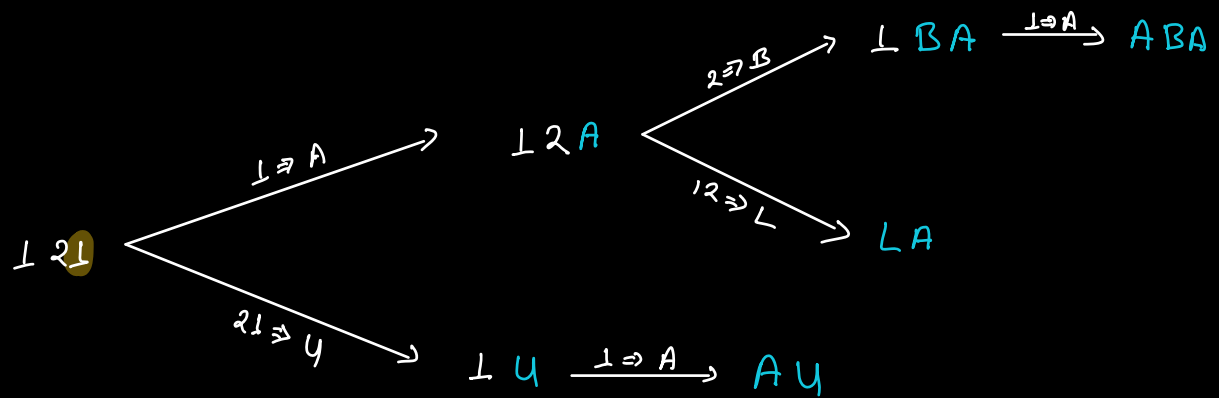
121  $\rightarrow$  3

27  $\rightarrow$  1

1  $\rightarrow$  A  $\Rightarrow$  1

12  $\rightarrow$  AB, L  $\Rightarrow$  2

121  $\rightarrow$  ABA, LA, AU  $\Rightarrow$  3



Choice : Consider the  $i^{\text{th}}$  digit as a single digit

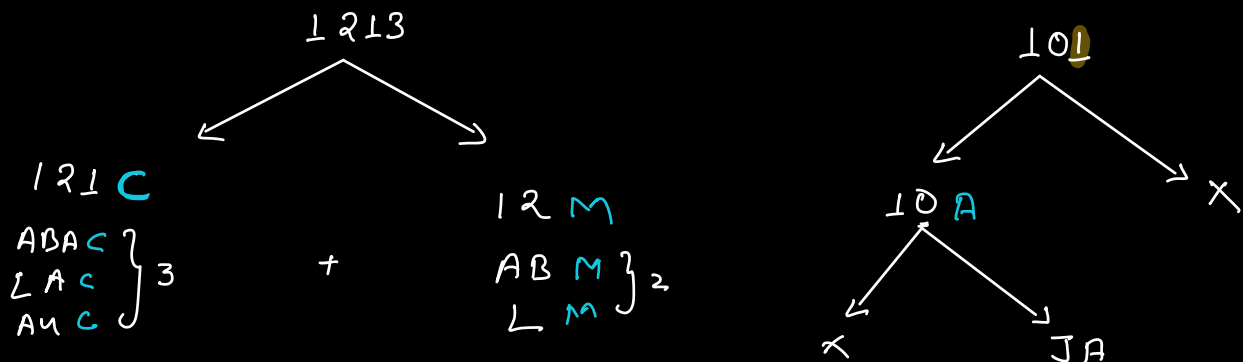
Or

If it is possible to couple with  $(i-1)$  digit then consider as a 2 digit no.

$\text{ways}(i) \longrightarrow$  no. of ways of decoding the string from index 0 to  $i$ .

$$\text{ways}(i) = \text{ways}(i-1) + \text{ways}(i-2)$$

$\uparrow A[i] > 0$ 
 $\uparrow \leq 26$



$\Rightarrow 5$

## Base Case

$$\begin{aligned} \text{ways}(i) &= \text{ways}(i-1) + \text{ways}(i-2) \\ \swarrow \text{index 0 to } i \\ i=3 &= \text{ways}(2) + \text{ways}(1) \checkmark \\ i=2 &= \text{ways}(1) + \text{ways}(0) \checkmark \\ i=1 &= \text{ways}(0) + \text{ways}(-1) \times \end{aligned}$$

if (i == 0) { // No of ways of decoding the sub str from index 0 to 0 (length: 1)  
    ret A[i] > 0 ? 1 : 0  
}

if (i == 1) { // No of ways of decoding the sub str from index 0 to 1 (length: 2)  
    ans = 0;  
    if (possible to convert both as single digits) {  
        ans = 1;  
    }  
}

if (possible to convert as a two digit no) {  
    ans++;  
}  
ret ans;  
}

$\frac{27}{12} \times$   
 $\frac{12}{12} \checkmark$

## Q Ways to party

Given  $N$  people inside a party hall.

One person can enjoy the party in two ways:

(1) Being alone

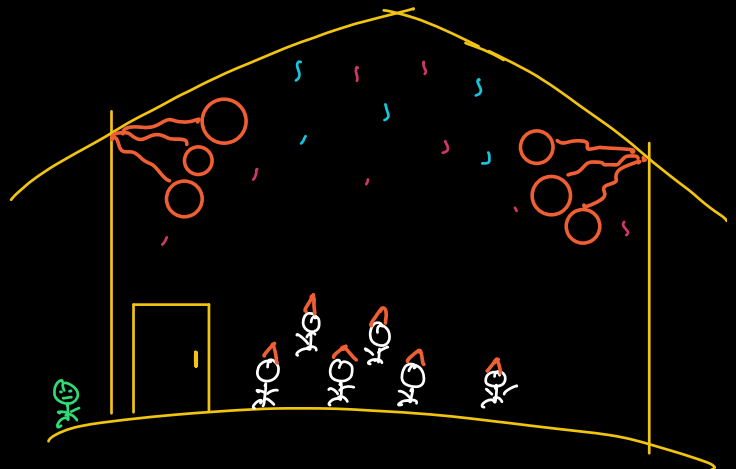
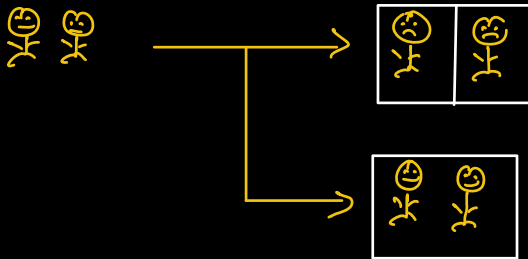
(2) Getting paired with someone.

Return no. of ways in which party can be enjoyed.

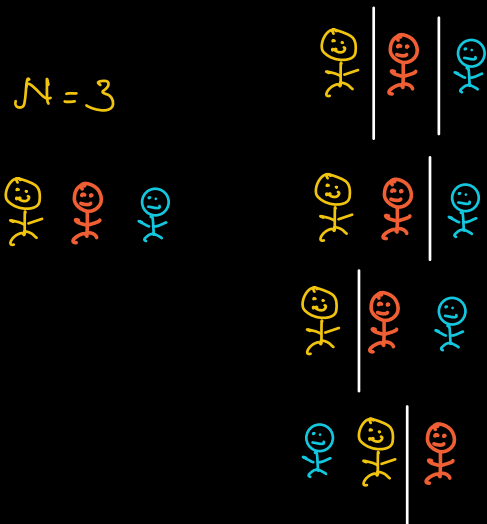
$N=1$

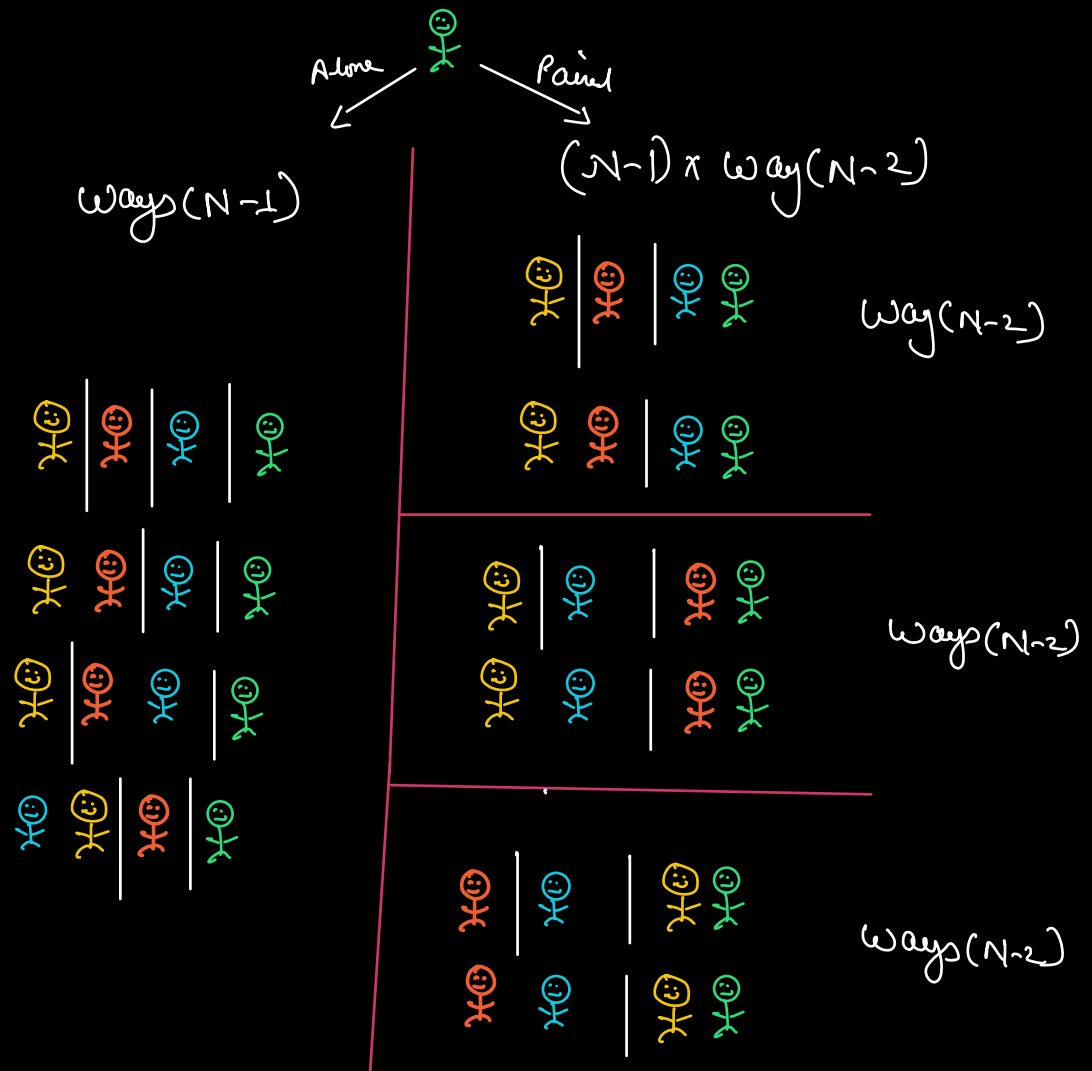


$N=2$



$N=3$





$$ways(i) = ways(i-1) + (i-1) \times ways(i-2)$$

Base cases

if ( $i == 1$ ) // only one person is partying  
ret 1;

if ( $i == 2$ ) // 2 people  
ret 2;

Q Given a 6-face dice. Count the no of ways to get a required sum:  $N$  if you can throw the die as many times as you want.

$$N=2 \quad \left\{ \begin{array}{c} 1, 1 \\ 2 \end{array} \right\} \longrightarrow 2$$

$$N=3 \quad \left\{ \begin{array}{c} 1, 1, 1 \\ 1, 2 \\ 2, 1 \\ 3 \end{array} \right\} \longrightarrow 4$$

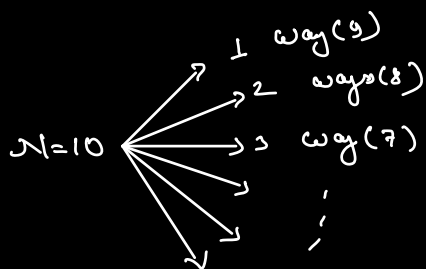
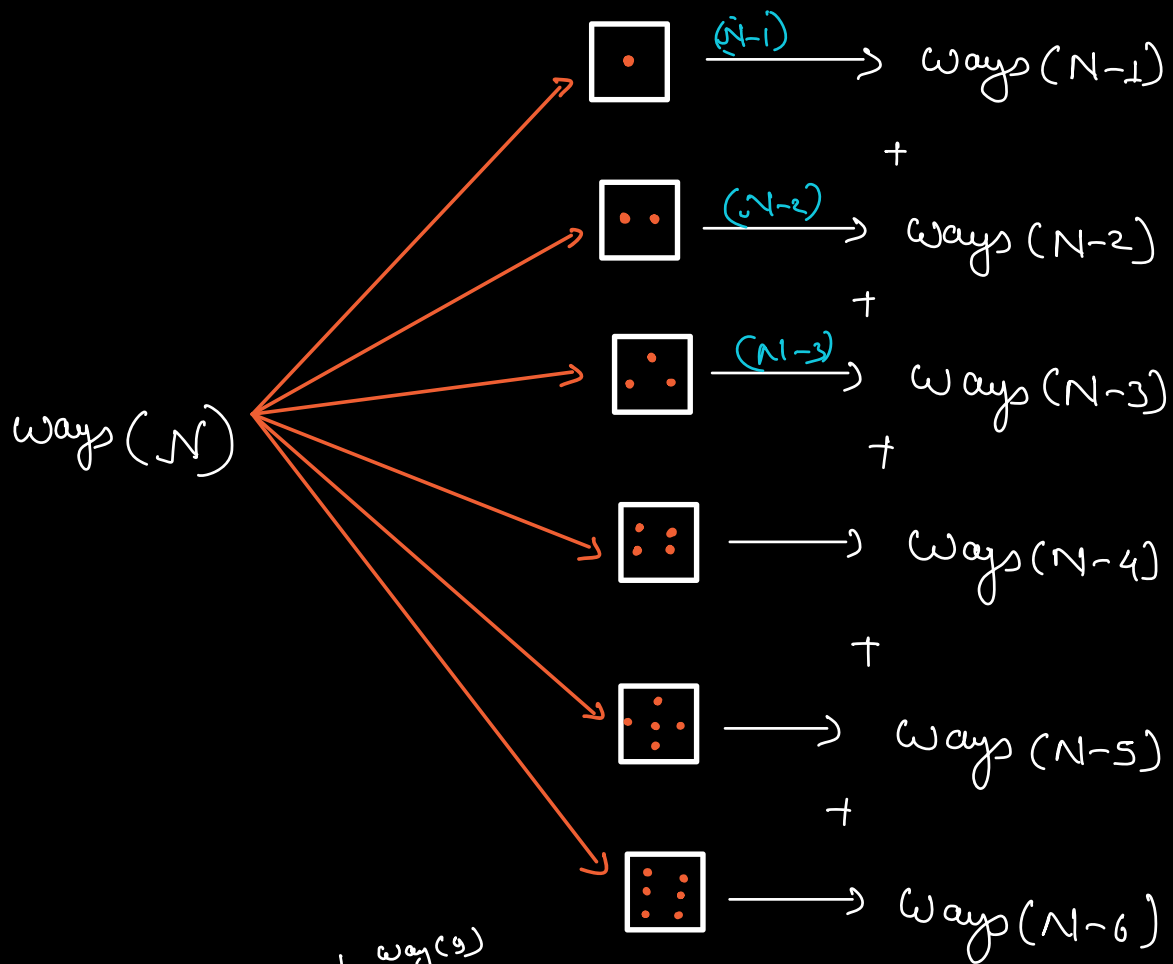
$$N=4 \quad \begin{array}{l} 1, 1, 1, 1 \\ 1, 2, 1 \\ 2, 1, 1 \\ 3, 1 \\ 1, 1, 2 \\ 2, 2 \\ 1, 3 \\ 4 \end{array} \Rightarrow 8$$

$$\underline{\underline{N=5}}$$

$$\textcircled{1} \quad \begin{pmatrix} 1, 1, 1 \\ 1, 2 \\ 2, 1 \\ 3 \end{pmatrix} + 2 \begin{pmatrix} 1, 1 \\ 2 \end{pmatrix} + 3 \begin{pmatrix} 1 \end{pmatrix} + 4$$

$N=4$        $N=3$

1



$\perp ( )$

$$\text{ways}(10) = \text{ways}(9) + \text{ways}(8) + \text{ways}(7) + \text{ways}(6) + \text{ways}(5) + \text{ways}(4)$$

Diagram illustrating the calculation of  $\text{ways}(10)$  using the recursive formula. The terms  $\text{ways}(8)$ ,  $\text{ways}(7)$ , and  $\text{ways}(6)$  are highlighted in red, and arrows point from them to a sub-diagram showing their own recursive breakdowns.