SCALER

Combinatorics Basics

9:05 pm

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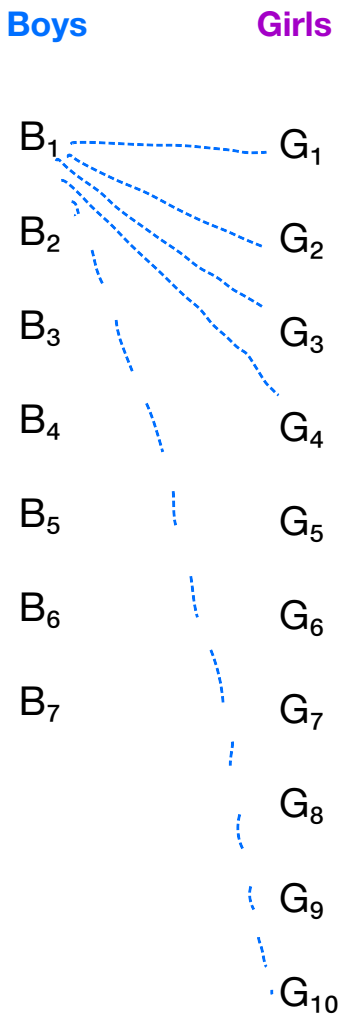
.

Example1: Given 10 Girls and & 7 Boys. How many different pairs?

1 Girl and 1 Boy

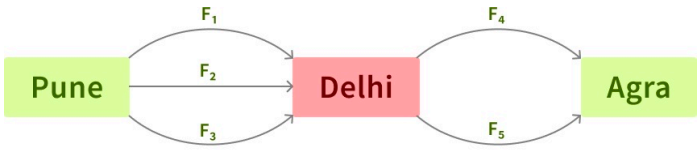


1 boy ⇒ 10 pairs.

7 boys = 7 × 10 = 70 pairs

Example-2 :

3 × 2



AND ⇒ * (multiplication)

Number of ways to reach Agra from Pune via Delhi

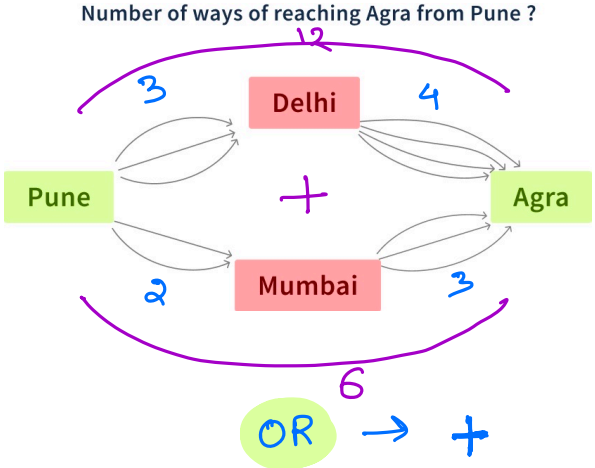
Pune → Delhi : 3 flights

Delhi → Agra : 2 flights

3 × 2 = 6

Example-3

Number of ways of reaching Agra from Pune ?



Pune → Delhi → Agra ⇒ 3 × 4 = 12

Pune → Mumbai → Agra ⇒ 2 × 3 = 6.

OR → +

Total number of ways = 12 + 6 = 18.

Problem

You're tasked with helping **Zomato** identify which restaurant offers the most variety in its meal combos. You're provided with a list, shaped like a grid or a 2D matrix **A**, where each row corresponds to a different restaurant's offerings.

Each row is divided into three parts:

1. A[i][0] tells you the number of main courses,
2. A[i][1] the number of desserts, and
3. A[i][2] the number of beverages a restaurant offers.

Your challenge is to analyze this data and pinpoint which restaurant gives its customers the most options to mix and match their meal combo.

Examples

Example 1 :

main course → dessert → beverage.

```
A = [
    [3, 2, 2],   # Restaurant 1
    [4, 3, 3],   # Restaurant 2
    [1, 1, 1]    # Restaurant 3
]
```

3 × 2 × 2 = 12

4 × 3 × 3 = 36

1 × 1 × 1 = 1

ans = 36 Restaurant 2

Permutations

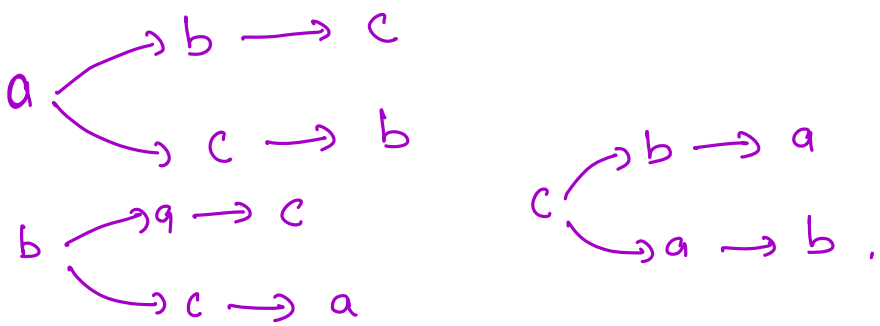
arrangment of objects. * order matters.

$(i, j) \neq (j, i)$

< *Question-1* > : Given 3 distinct characters. In how many ways, we can arrange them?

S = " a b c "

3 a ↑ 2 c ↑ 1 b ↑ $3 \times 2 \times 1 = 6$



< *Question-2* > : In how many ways, you can arrange 4 distinct characters?

$4 * 3 * 2 * 1 = 24$.

< *Question-3* > : In how many ways n distinct characters can be arranged?

$N \times (N-1) \times (N-2) \times \_ \; \_ \; \ldots \; \_ \; \_ \times 1 = n!$

< *Question-4* > : Given 5 distinct characters, in how many ways can we arrange 2 characters?

$5 \times 4 = 20$ ways

< *Question-5* > : 3 distinct characters?

$3 \times 2 = 6$

< *Question-6* > : 4 characters out of N distinct characters?

$N \times (N-1) \times (N-2) \times (N-3)$ $\quad [N - (4-1)]$ ✓

< *Question* > : Given N distinct characters, in how many ways can we arrange r characters?

N
6 distinct char.
3 spaces. ↳ r

$N \quad (N-1) \quad (N-2) \quad \cdots \quad [N-(r-1)]$

$6 \quad 6-1 \quad 6-2 \rightarrow [3-1]$ (N, r-1)

$N \quad (N-1) \quad [N-(r-1)]$

$6-(3-1) = 4$

$\frac{a \times b}{b} = a$

$$\frac{N * (N-1) * (N-2) * (N-3) * \cdots * N-(r-1) * N-(r-2) * \cdots 1}{(n-r) * (n-r-1) \cdots 1}$$

$\Rightarrow \frac{N!}{(n-r)!} \Rightarrow {}^{n}P_{r}$

No. of ways to arrange r places with N distinct characters,

10:05 pm break

Combinations

Combination is defined as number of ways to select something.

Note: In combination order of selection doesn't matter : [(i,j) == (j,i)]

< *Question* > : In how many ways can we select 3 players from a pool of 4 players?

[P1 P2 P3 P4]

P_1 P_2 P_3

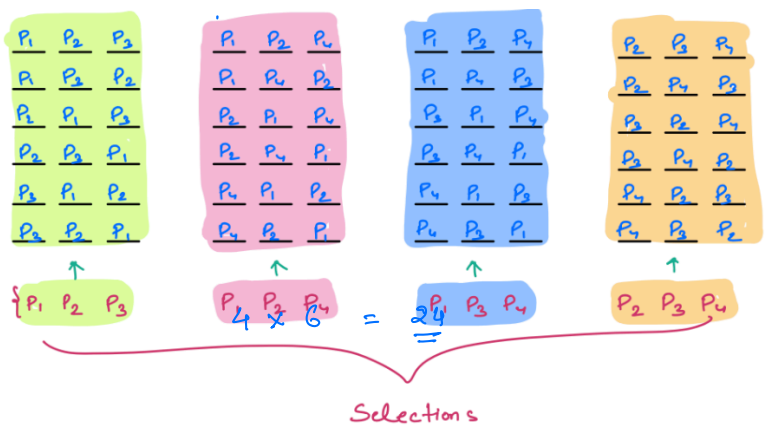
P_1 P_3 P_4

P_1 P_2 P_4

P_2 P_3 P_4

< *Question* > : Number of ways to arrange the players in 3 slots

Given 4 players → [P1 P2 P3 P4]



⇒ No. of selection (x)
= 3 out of 4 plays
⇓
4 ways.

⇒ No. of arrangement in each selection = $3! = 6$

⇒ Total no. of arrangements $4 \times 6 = 24$

No. of selection * no. of arrangement of each selection = Total no. of arrangements

Given n distinct element in how many ways we can select r elements.

n distinct arrange r elemt = $^nP_r = \frac{n!}{(n-r)!}$

arrange r element = $r!$

No. of selection for r distinction elemt: 1

$r! \Rightarrow 1$

$1 = \frac{1}{r!}$

Properties

1. $^NC_0$

^nC_r = Total no of arrang $= \frac{n!}{(n-r)! * r!}$

Select 0 element from N elements :-

$^NC_0 = \frac{N!}{(N-0)! * 0!} \rightarrow 1 = \frac{1}{1}$

2. ^NC_N

$^NC_r = \frac{N!}{(N-N)! * N!} = \frac{1}{1}$

$0! = 1$

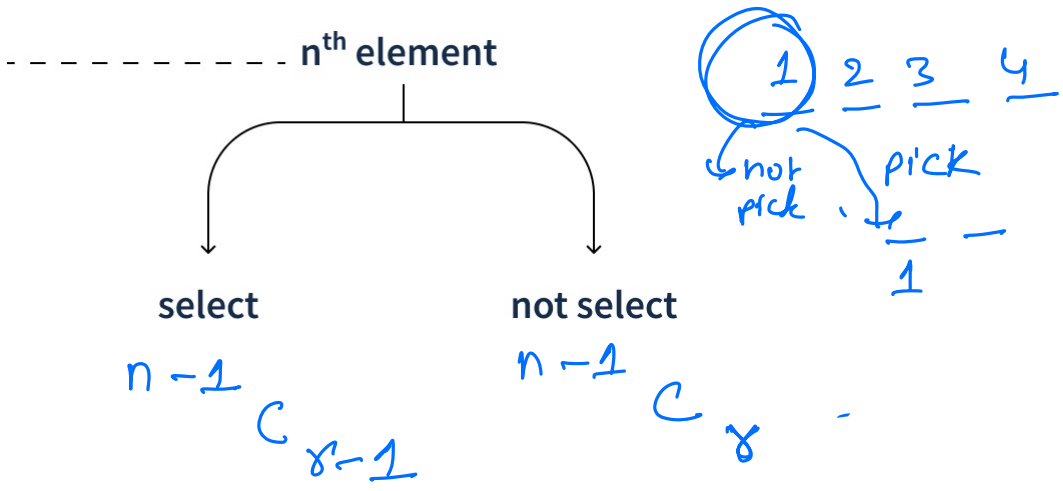
3. $^NC_{N-r}$

$^NC_r = \frac{N!}{(N-(N-r))! * (N-r)!}$

$= \frac{N!}{r! * (N-r)!} = {}^NC_{n-r}$

** $^NC_r = {}^NC_{N-r}$

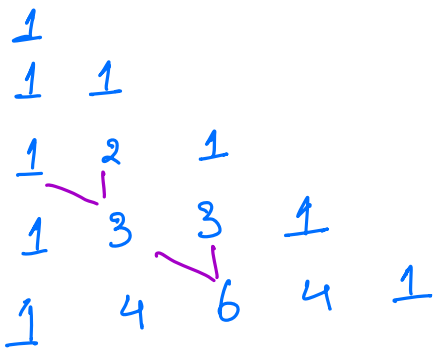
< *Question* > : Given N distinct elements, select r distinct elements.



$$ {}^{n}C_{r} = {}^{n-1}C_{r-1} + {}^{n-1}C_{r} $$

Pascal Triangle

- Generate the Pascal's triangle for given N



0 →	$^0C_0$					1
1 →	$^1C_0$	$^1C_1$				1 1
2 →	$^2C_0$	$^2C_1$	$^2C_2$		→	1 2 1
3 →	$^3C_0$	$^3C_1$	$^3C_2$	$^3C_3$		1 3 3 1
4 →	$^4C_0$	$^4C_1$	$^4C_2$	$^4C_3$	$^4C_4$	1 4 6 4 1
i →	$^iC_0$	$^iC_1$	$^iC_2$	- - - - - - -	^iC_i	

$$^2C_1 = {}^1C_0 + {}^1C_1$$

$$C[i][j] = C[i-1][j] + C[i-1][j-1]$$

< / > Code

```
function pascalTriangle ( n ) {
    ncr[n][n] = {0}
    for ( i -> 0 to n ) {
        ncr[i][0] = 1
        ncr[i][i] = 1
        for ( j -> 1 to i - 1 )
        {
            ncr[i][j] = ncr[i-1][j]
                      + ncr[i-1][j-1]
        }
    }
}
```

T.C.: $O(n^2)$

S.C.: $O(n^2)$

Nth Column Title

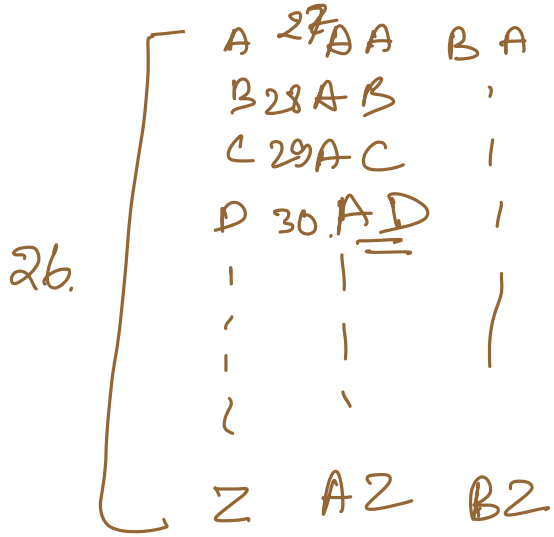
- Find the Nth column title

N =	1	2	3		26	27	28		50	51	52	53	54		
	A	B	C	- - -	Z	AA	AB	- - - - - - - - - -	AX	AY	AZ	BA	BB	- - -	BZ

N = 30 → AD

N = 50 → AX

N = 100 → CV



base 26

N = 30

26	30	1 → A
	4	4 → D
	0	

= AD.

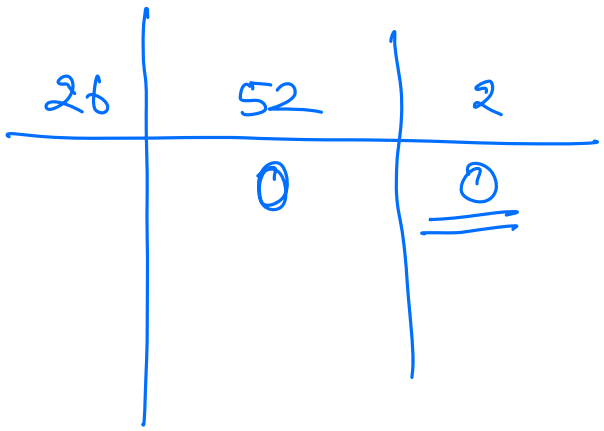
Z = 26

N = 50

26	50	1 → A
	24	24 → X
	0	

= AX

N = 52



* 1) Create map ⇒ ✓

string ans = ""

while (N != 0)

{

rem = N % 26; = 0

if (rem == 0)

{

ans = 'z' + ans; N - 1;

}

else

{

ans = map.get(rem) + ans

}

N = N / 26;

}

return ans;

= AZ

</> Code

N = 100

26	100	3 → C
	22	22 → V
	0	

---

0 - 25

27

```
funct columnTitle(n)
{
    ans = "";
    while(n > 0)
    {
        ans = ((n-1)%26 + 'A') + ans
        n = (n-1)/26
    }
    return ans;
}
```

27 / 1.

0%26 = 0

A A

A A