1) Given 3 T/F ques, no of ways to answer

1	2	3
F	F	F
F	F	T
F	T	F
F	T	T
T	F	F
T	F	T
T	T	F
T	T	T

ans = 8

$2 \times 2 \times 2 \times 2 \cdots$

$= 2^n$

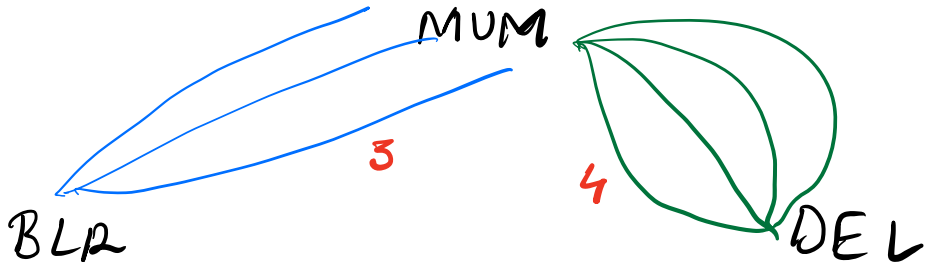
2) 10 boys & 7 girls. How many pairs can be formed

$10 \times 7 = 70$

$B_1 G_1$ $B_2 G_1$ $B_3 G_1$ $\cdots$ $B_{10} G_1$

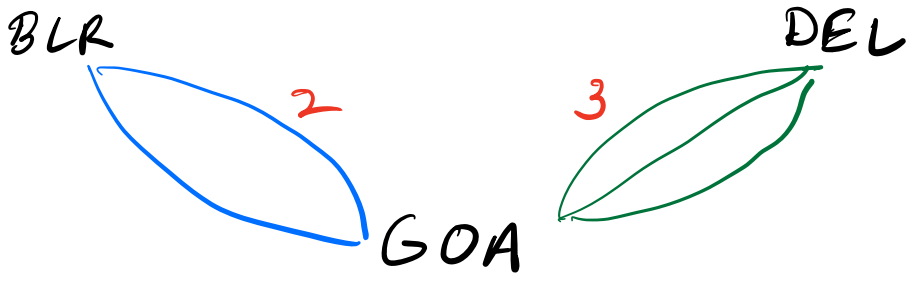
$B_1 G_2$ G_2 G_2 G_2

3)



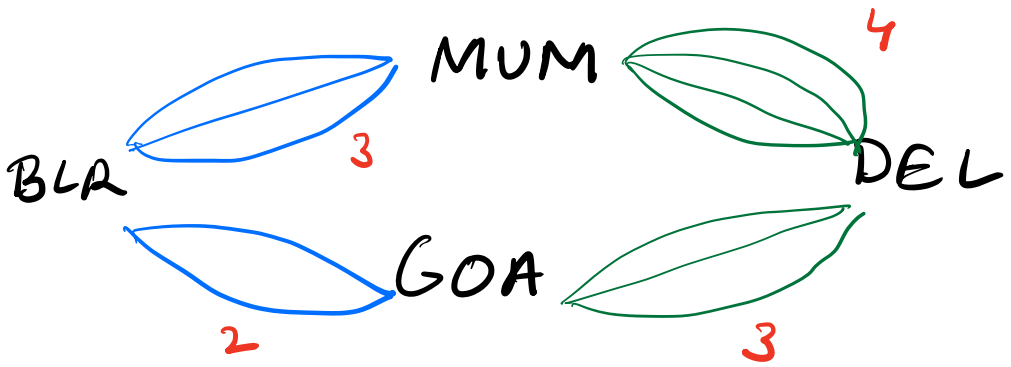
ways = ? $3 \times 4 = 12$

4)



ways = $2 \times 3 = 6$

5)



ways = ? $12 + 6 = 18$

BLR to DEL via MUM OR BLR to DEL via GOA

AND → multiply OR → addition

Permutation : arrangement of objects

Q Given 3 distinct characters.

How many ways to arrange them

Let chars be a, b, c

ans = 6

a b c
a c b
b a c
b c a
c a b
c b a

3 2 1

~~a~~ ~~b~~ ~~c~~

Q Given 4 distinct characters.

How many ways to arrange them

4 3 2 1

$4 \times 3 \times 2 \times 1 = 24$

Q Given N distinct characters.

How many ways to arrange them

N N-1 N-2 ... 2 1

$N \times N-1 \times N-2 \times \dots \times 2 \times 1$

ans = $N!$ factorial

Q 5 distinct chars, ways to arrange 2 of them

5 4 $\quad 5 \times 4 = 20$

5 chars, arrange 3 $\rightarrow 5 \times 4 \times 3 = 60$

Q N distinct char. Arrange r of them

N	N-1	N-2	N-3	...	n-r+1
1	2	3	-----		r

ans = $N\,(N-1)(N-2)\ldots(n-r+1) \times \dfrac{(n-1)(n-1-1)\ldots 3\times 2\times 1}{(n-1)(n-1-1)\ldots 3\times 2\times 1}$

ans = $\dfrac{n!}{(n-r)!} = {}^{n}P_r$ } Permute in r spots for n objects

Permute 7 people in 3 slots

$\Rightarrow {}^{7}P_3 = \dfrac{7!}{(7-3)!} = \dfrac{7!}{4!} = \text{----}$

Combination : selection of objects.

ordering does NOT matter

4 Players P_1 P_2 P_3 P_4 select team of 3

1→ $P_1 P_2 P_3$ 2→ $P_1 P_2 P_4$

3→ $P_1 P_3 P_4$ 4→ $P_2 P_3 P_4$

First try to arrange

Say r slots n people

Arrangements		Selection
$r!$	⟶	1
${}^nP_r$	⟶	$\frac{{}^nP_r}{r!}$

$$\frac{n!}{(n-r)!\,r!} = {}^nC_r$$

} Choose r objects out of n objects

Out of 5, choose 2 ⟹ ${}^5C_2 = 10$

Properties

1) ${}^{N}C_{0} = 1$ $\qquad \frac{n!}{0!\,n!} = 1$ $\qquad 0! = 1$

2) ${}^{N}C_{N} = 1$ $\qquad \frac{n!}{n!\,(n-n)!} = \frac{1}{0!} = 1$

3) ${}^{N}C_{R} = \frac{n!}{r!\,(n-r)!}$

${}^{N}C_{N-R} = \frac{n!}{(n-r)!\,(n-(n-1))!} = \frac{n!}{(n-1)!\,r!}$

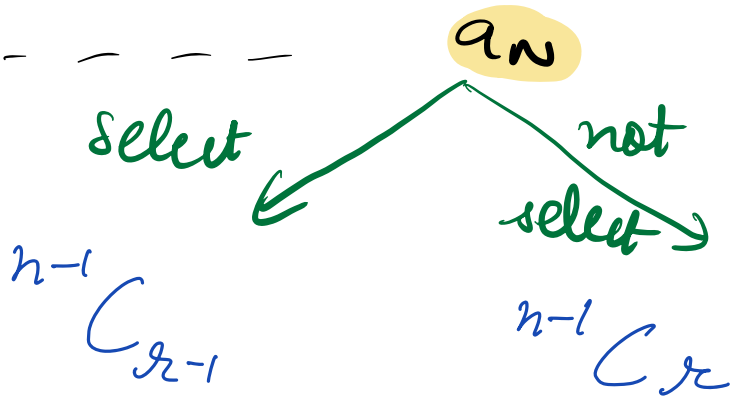
$${}^{n}C_{r} = {}^{n}C_{n-r}$$

2) Pascals Triangle

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

Proof

$a_1 \quad a_2 \quad a_3 \quad - - - - \quad a_N$



Select OR dont select

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

$^{0}C_0$

$^{1}C_0 \quad {}^{1}C_1$

$^{2}C_0 \quad {}^{2}C_1 \quad {}^{2}C_2$

$^{3}C_0 \quad {}^{3}C_1 \quad {}^{3}C_2 \quad {}^{3}C_3$

$^{4}C_0 \quad {}^{4}C_1 \quad {}^{4}C_2 \quad {}^{4}C_3 \quad {}^{4}C_4$

$\vdots$

$^{n}C_0 \quad {}^{n}C_1 \quad - - - - \quad {}^{n}C_n$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

Q. Create Pascal triangle for value n

$^{n}Cr[n+1][n+1] = \{0\}$

$^{n}Cr[0][0] = 1$

```
for(i=1 ; i<=n ; i++){
    nCr[i][0] = 1
    for(j=1 ; j<=i ; j++){
        nCr[i][j] = (nCr[i-1][j-1] +
                     nCr[i-1][j]) %M
    }
}
```

SC, TC: $O(n^2)$

```
for(i=0 ; i<=n ; i++){
    for(j=0 ; j<(i+1) ; j++){
        print(nCr[i][j]) + "_"
    }
    print(newline)
}
```

y

Excel Column Title

$1 \rightarrow A$

$2 \rightarrow B$

$3 \rightarrow C$

$\vdots$

$26 \rightarrow Z$

$27 \rightarrow AA$

$28 \rightarrow AB$

$\vdots$

$N = ?$

A A

Obs → this seems like numbers written in base 26.

$$\begin{matrix} 1 & 0 \\ A & A \end{matrix}$$

$$1 \times 26^1 + 1 \times 26^0 = 27$$

$$\begin{matrix} 1 & 0 \\ A & B \end{matrix}$$

$$1 \times 26^1 + 2 \times 26^0 = 28$$

$$\begin{array}{cc} 1 & 0 \\ A & Z \end{array} = 52$$

$1 \times 26^1 + 26 \times 26^0$

$$\begin{array}{cc} 1 & 0 \\ B & A \end{array} = 53$$

$2 \times 26^1 + 1 \times 26^0$

Now, how to get title from number

divide by 26

$(n-1)$

$52 \,\%\, 26 = 0$

$51 \,\%\, 26 = 25 \Rightarrow Z$

$1 \rightarrow 0$

$0 \,\%\, 26 = 0 \Rightarrow A$

AZ

53

52 %. 26 = 0 $\Rightarrow$ A

2 $\Rightarrow$ 1 %. 26 = 1 $\Rightarrow$ B

Code

```
string columnTitle (int n){
    string ans = "";
    while (n > 0){
        n--
        rem = n %. 26
        char = 'A' + rem
        ans = ans + char
        n = n / 26
    }
    return reverse(ans)
}
```

TC : $O(\log_{26} N)$

SC : $O(1)$

Dey un

$\dot{N} = 53 \quad 52 \quad x \quad 1 \quad 0$

$rem = \emptyset \quad 1$

$ans = AB$

BA