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Addition and Multiplication Rule

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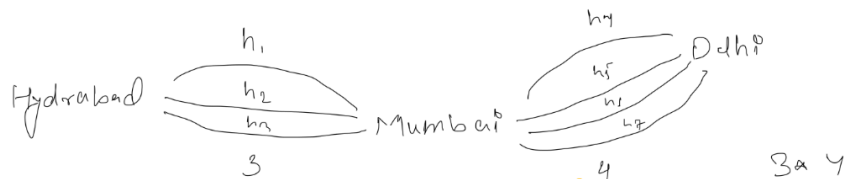
Q1) Given 3 T/F questions, every question needs to be answered T/F. How many ways we can answer all questions.

TTT
TTF
3
2
2
8 ways.

Q2) Given 10 girls 7 boys. How many different ways are possible.

1 G 1 B
B, 10 G, 70
10
:
:
B, 10
G, 10

Q2)



Hyderabad to Delhi via Mumbai!

AND $\equiv \times$
OR $\equiv +$

4 + 1
+ 4 + 1
+ 4 + 1
or 3 x 4

Addition/Multiplication rule.

Permutation

Permutations :-

Arrangement of objects. Order matters
 $(i, j) \neq (j, i)$

Q1 Given 3 distinct characters?
 How many ways we can arrange them?

S = "abc"
 $\left. \begin{array}{l} abc \\ bac \\ cab \end{array} \right\} 6 \text{ ways.}$

$\frac{3}{a} \quad \frac{2}{b/c} \quad \frac{1}{a/b}$
 $\begin{array}{c} a \\ b \\ c \end{array} \quad \begin{array}{c} b/c \\ a/c \\ b/a \end{array} \quad \begin{array}{c} a/b \\ b/a \\ c \end{array}$

Ex abc d

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

If Given N distinct elements. How many ways we can arrange them?

$$n \times (n-1) \times (n-2) \times \dots \times 1$$

$$\equiv n!$$

Q2 Given 5 distinct elements, how many ways we can arrange 3 of them?

$$\underline{5} \quad \underline{4} \quad \underline{3} = 60$$

* N distinct characters, arrange r characters.

$$N \times (N-1) \times (N-2) \times \dots \times (N-r+1)$$

$$\equiv \frac{N \times (N-1) \times \dots \times (N-r+1) \times (N-r) \times \dots \times 1}{(N-r) \times (N-r-1) \times \dots \times 1}$$

$$N P_r \equiv \frac{N!}{(N-r)!}$$

→ Permutation of N items taken r at a time.

Combination

Combination :-

→ Selection of objects

$(i, j) \rightarrow (j, i) \equiv$ Order doesn't matter.

Ex: B_1, B_2, B_3, B_4 } Number of ways we can select 3 boys out of 4.

$B_1, B_2, B_3 = B_3, B_1, B_2$
 B_2, B_3, B_4
 B_1, B_2, B_4
 B_1, B_3, B_4 } 4 ways of selecting 3 boys out of 4

$\equiv 24$ arrangements $4 \times 3 \times 2$

B_1, B_2, B_3 B_2, B_3, B_4 B_1, B_2, B_4 B_1, B_3, B_4
 \vdots \vdots \vdots \vdots
 6 6 6 6
 4 selections

No. of selections \times No. of arrangements = Total no. of arrangements

Given N distinct elements, arrange r elements :-

$$NP_r = \frac{N!}{(N-r)!}$$

Arrange r elements = $r!$

$$N C_r = \frac{N!}{(N-r)! \times r!}$$

Given N no. of ways we can select r .

Properties of Combination

① $N C_0 = 1$

② $N C_N = 1$

③ $N C_{N-r} = \frac{N!}{r! (N-r)!}$

$N C_{N-r} = N C_r$

④ $N C_r = N-1 C_{r-1} + N-1 C_r$
 No. of selections + No. of rejections.

Pascal Triangle

Problem 10
 PASCAL Triangle
 Generate pascal's triangle for a given value N .
 $C_i C_j = {}^i C_j$



Brute force :- For each and every value, calculate the factorial and print it.

$${}^i C_j = {}^{i-1} C_{j-1} + {}^{i-1} C_j$$

i^{th} row
 j^{th} column

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

edge case :-
 $\text{mat}[0][0] = 1$
 $\text{mat}[0][i] = 1$
 $\text{mat}[i][0] = 1$

$$\text{mat}[i][j] = \text{mat}[i-1][j-1] + \text{mat}[i-1][j]$$

```
for (i=1; i<N; i++)
    mat[i][0] = 1
    mat[i][i] = 1
    for (j=1; j<i; j++)
        mat[i][j] = mat[i-1][j] + mat[i-1][j-1]
```

T.C :- $O(N^2)$

S.C :- $O(N^2)$

Finding Nth column title in the excel sheet

Problem 2

Find the Nth Column title

A B C D ... Z AA AB ... AZ BA BB ... BZ
CA ... CZ ... ZA ... AAA ...

$N = 3 : C$

$N = 30 : AD$

26 alphabets (A-Z)

$N = 3 : C$

'A' + 3 = 'D'

$N = 1 : A$

$97 + 3 = 100$

$N = 50$

26 $50 - 1 = 49$ 23 AX
49 % 26
1 - 1 = 0 0

$N = 29$

$28 \% 26 = 2 \rightarrow AC$

ans = ""

while (N > 0) {

pos = (N-1) % 26

ans = (pos + 'A') + ans

N = (N-1) / 26

}

return ans.