Counting

product rule

Step দেওয়া থাকবে যেমন যাইতে হবে — Dhaka to ctg to saint martin
কিন্তু মাধ্যমে বা steps তাও হবে।

Dhaka to ctg → train 4 টা
ctg to teknaf → bus 7 টা
Teknaf to saint Martin → ship 2 টা

$\therefore 4 \times 7 \times 2 = 56$ ভাবে

$$\prod_{i=1}^{n} n_m$$

sum rule

sum rule এ অপশন দেওয়া থাকবে

Dhaka to saint martin → bus 4 টা
Dhaka to saint martin → train 2 টা
Dhaka to saint martin → biman 6 টা

∴ মোট ভাবে সে যেতে পারবে! $4+2+6$
$\Rightarrow 12$ ভাবে

$$\sum_{i=1}^{m} n_i$$

product rule

* There are twelve empty rooms in the office of acme softwares, inc. Alif and laila join the company. How many ways can they be assigned a room each from these twelve?

step 1: Assigning a room for alif → 12 ways
step 2: " " " laila → 11 "

∴ By product rule, total assign room = 12 × 11
= 132 ways

* what is the total number of bit string of lenght 7?

character = R
string = Rakib
bit string = 0011001...

$\frac{0/1}{2}$ $\frac{0/1}{2}$ $\frac{0/1}{2}$ $\frac{0/1}{2}$ $\frac{0/1}{2}$ $\frac{0/1}{2}$ $\frac{0/1}{2}$

∴ total of bit string = 2^7
= 128

* what is the total number of binary number of 7 significant bits? → 1000000

1 1/0 1/0 1/0 1/0 1/0 1/0

1 2 2 2 2 2 2 ⇒ $2^6 = 64$ ways

sum rule

Travelling from Dhaka to Rajshahi

available bus service : Hanif, Shymoli, Desh, Ekota.

Available train " : padma, Dhumketu, Banalata,

Available air " : Biman, US-Bangla, Navoair

How many total ways to travel from Dhaka to Rajshahi ? ∴ 4 + 3 + 3

⇒ 10 ways

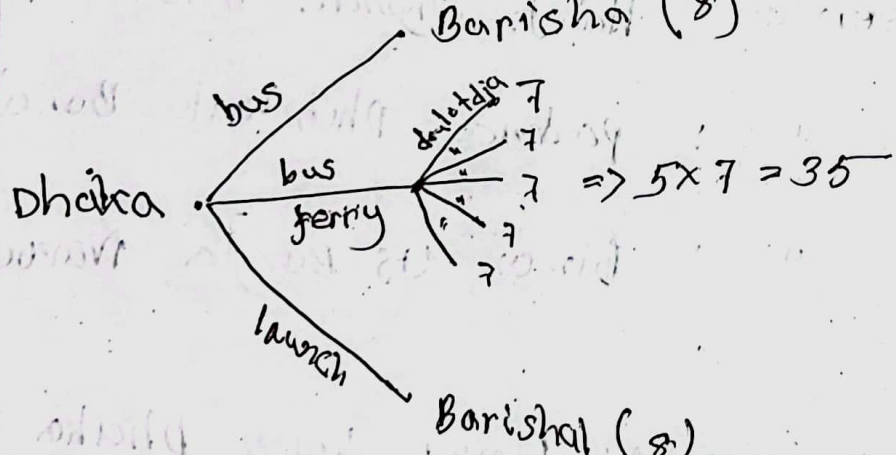
* Travelling from Dhaka to Barishal.

Available bus service (8) Directly Barisal

Available but " (5) by ferry another from Doulotdia to Barishal (7)

Available launch (8)

∴ How many ways can you go to from Dhaka to Barishal.



∴ total = 8 + 35 + 8

= 51 ways.

* How many strings of ~~way~~ lowercase letter are there of lenght four or less?

a-z	a-z	a-z	a-z	= 26^4
26	26	26	26	

a-z	a-z	a-z	= 26^3
26	26	26	

a-z	a-z	= 26^2
26	26	

a-z	= 26
26	

$\therefore$ total ways = $26^1 + 26^2 + 26^3 + 26^4$

The pigeonhole principle

$\lceil \rceil$ ceiling

$\lfloor \rfloor$ floor

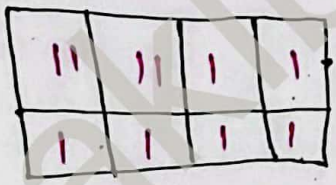
* $\lceil 5 \rceil = 5$ $\quad \lfloor 5 \rfloor = 5$

$\lceil 4.5 \rceil = 5$ $\quad \lfloor 4.5 \rfloor = 4$

$\lceil -5.4 \rceil = -5$ $\quad \lfloor -5.4 \rfloor = -6$

If there are more object than capacity, then there must be at least one overflowed box.

যদি বক্সের থেকে বেশি অবজেক্ট থাকে তাহলে একটা বক্সে অন্তত একটার বেশি অবজেক্ট থাকবে।



$N = 10 \rightarrow$ object
$k = 8 \rightarrow$ box

$$\left\lceil \frac{N}{k} \right\rceil \Rightarrow \left\lceil \frac{10}{8} \right\rceil = \lceil 1.25 \rceil = 2$$

Among 100 people, at least how many are guaranteed to be born in the same month?

Here $N = 100$
$k = 12$

$\therefore \lceil \frac{N}{k} \rceil = \lceil \frac{100}{12} \rceil = \lceil 8.33 \rceil = 9$

what should be the minimum number of student in a class so that at leat six ~~recie~~ received the same grade? (passible grade = A, B, C, d, ~~e~~, f)

$k = 5$
$N = ?$

$\therefore \lceil \frac{N}{5} \rceil = 6 = 5 < \frac{N}{5} \leq 6$

$= 25 < N \leq 30$

$\therefore$ minimum number of student $= 25 + 1$
$= 26$

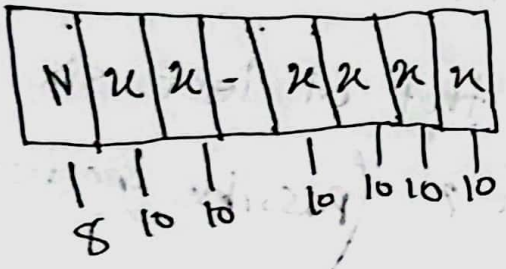
Telephone number formate: NXX - NXX - XXXX

where N = 2 to 9 X = 0 to 9

The first 3 digit make an area code

25 million people in the state

atleast how many area code is needed?



$\therefore k = 8 \times 10^6$

$N = 25 \times 10^6$

$\therefore$ minimum no. of area code $= \left\lceil \frac{25}{8} \right\rceil$

$= \lceil 3.125 \rceil$

$= 4$ Ans

permutation (বিন্যাস) and combination (সমাবেশ)

order → বিন্যাস

কোন কিছু সাজানো যেমন ক্রম-বিন্যাস

$${}^{n}P_r = P(n, r)$$

number of ways how to pick r elements out of n and arrange them.

$${}^{7}P_3 = 7 \times 6 \times 5 \qquad {}^{7}P_7 = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 7!$$

$${}^{n}P_r = n(n-1)(n-2)\cdots(n-r+1)$$

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

How do we choose 6 students out of 10 and arrange them in one line ?

$$10 \times 9 \times 8 \times 7 \times 6 \times 5$$

$$= 151200$$

or $= {}^{10}P_6$

$= 151200$ ways

Combination

$${}^{n}C_{r} = C(n,r)$$

কোনো কিছু বিবেচনা করলে সেটা combination

number of ways how to pick r elements out of n without order

$${}^{n}C_{r} = \frac{{}^{n}P_{r}}{r!} = \frac{n!}{r!(n-r)!}$$

$${}^{n}C_{r} = \frac{10!}{6!(10-6)!}$$

$$= 210$$

How many ways to award gold, silver and bronze medals from 8 runners is a race?

$n = 8$ $\quad \therefore {}^{n}P_{r} = {}^{8}P_{3}$

$r = 3$ $\quad = 336$

How many ways to award gold, silver and bronze medals from 8 runners is a race, if one of them is Usain Bolt?

$= \underline{\quad} \; \underline{\quad} \; \underline{\quad}$

Usain Bolt

$${}_{7}C_{2} + 1$$

How many permutations of the letters ABCDEFGH contain the string ABC?

Contain ABC as one object

There are 6 object is in total

Thus, total # of permutation = 6!

How many permutations of the letters ABCDEFGH contain the latters A, B, C together?

After 6!, we have to further arrange A, B, C 3 ways themselves $\therefore$ $\boxed{6! \times 3!}$

How many ways permutation of the letter ABCDEFGH do not all of A, B, C together (atleast one is separate)

Opposite of together

∴ # of permutations = 8! - (6! × 3!)

How many ways permutation of the letters ABCDEFGH contains all of A, B, C separated.

We first have to arrange the other 5 letter among themselves in 5! ways.

DEFGH = 5! × _D_E_F_G_H_

∴ total $5! \times P(6,3)$ $\quad {}^{6}P_{3}$ $\quad ABC = 3$

How many ways can the letters of word SILHOUETTE be re arranged, such that

$E = 2$

$T = 2$

Vowel $= 5$ ($E \to 2$ with 2E'S)

no special condition is given =

of arrangement $= \frac{10!}{2!2!}$

# of rearrangement $= \frac{10!}{2!2!} - 1$

together মানি ভাওয়েল এক
সাথে থাকতে হবে অন্য তাদের
মধ্যে ও হবে

All the vowel are together

We will have to group the vowels and arrange themselves

IOUEE SLHTT

IOUEE

$\therefore$ # of arrange $= \frac{6!}{2!} \times \frac{5!}{2!}$

$\therefore$ rearrange $= \frac{6!\,5!}{2!\,2!}$

All the T's are together.

2টা T একসাথে থাকবে

# of arrange = $\frac{9!}{2!}$

SILHOUETTE

# of rearrange = $\frac{9!}{2!} - 1$

All the E's are together

of arrange = $\frac{9!}{2!}$

SILHOUETTE

1

#of rearrange = $\frac{9!}{2!}$

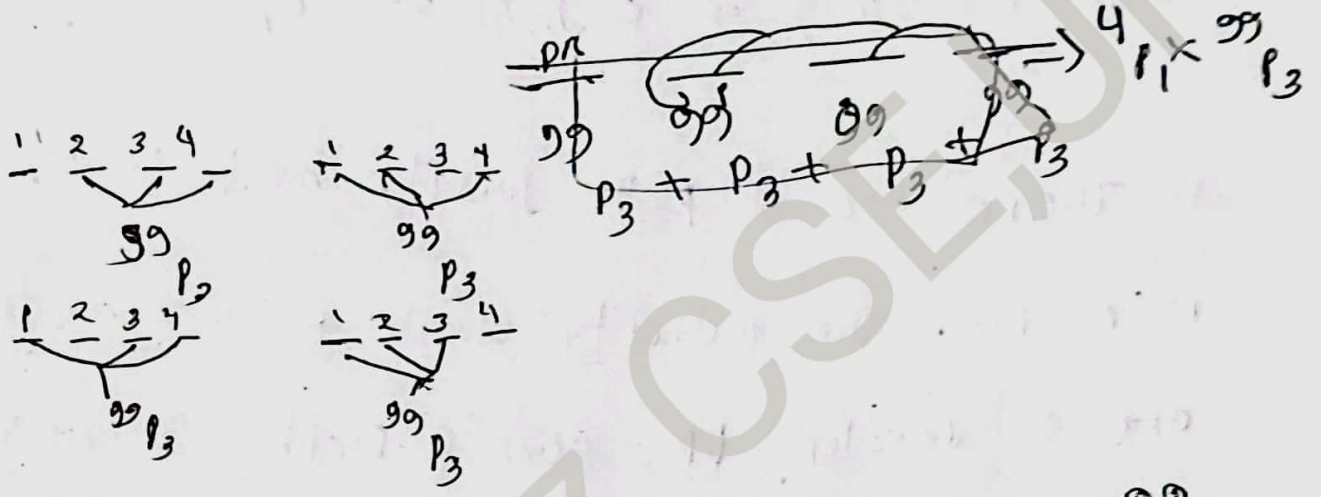
~~One~~ 100 ticket, number 1, 2, 3, ..., 100 are sold to 100 diffent people for a drawing. four diffant prizes are awarded

How many ways ~~can~~ are there to award the prizes if

1/ There are no restriction = 100_{P_4}

2/ Ticket 47 wins the grand prise = $^{99}P_3$

3/ Ticket 47 wins a prize = $^{99}P_3 + {}^{99}P_3 + {}^{99}P_3 + {}^{99}P_3$



4/ Ticket 47 does not wins a prize = $^{99}P_4$

5/ Ticket 47 and 19 both wins prizes = $^{4}P_2 \times {}^{96}P_2$

6/ Ticket 19, 47 and 73 all wins prizes = $^{4}P_3 \times {}^{97}P_1$

7/ Ticket 19, 47, 73 and 97 all wins prizes = $^{4}P_4$

8/ Ticket 19, 97, 23 and 97 all not wins = $^{96}P_4$

9/ Ticket 19, 47, 73, and 97 wins the grand prizes = $^{4}P_1 \times {}^{99}P_3$

10/ 19, 47 wins prize but, 73, 94 not wins = $^{4}P_2 \times {}^{96}P_2$

How many bit strings of lenght n contain exactly r 1's

of bit string is $c(n,r) = {}^{n}C_{r}$

There are 9 math faculty and 11 cs faculty is a cm. The authority wants to form a committee ~~are~~ to develop DM. such 3 matt, 4 are cs faculty from,

$${}^{9}C_{3} \times {}^{11}C_{4}$$

seven women and nine men are on the faculty in math department at cm. How many ways are there to select a committee of 5 members.. if at least one women must be on the committee

$$({}^{7}C_{1} \times {}^{9}C_{4}) + ({}^{7}C_{2} \times {}^{9}C_{3}) + ({}^{7}C_{3} \times {}^{9}C_{2}) + ({}^{7}C_{4} \times {}^{9}C_{1}) + {}^{7}C_{5}$$

permutation :- কোন কিছু ~~ক্র~~ সাজানো। অর্ডার দেওয়া
অবস্থান বা ক্রম সাজানো, বাছাই ~~ধরা~~
সহজ করা। লাইসেন্স প্লেট তৈরি

combination :- দল গঠন, কমিটি গঠন, সিলেক্টিং, বাছাই করা