Permutation

1) Suppose you have Rs 500 & Rs 1000 Each 1 No. and you want to distribute them b/w A, B, C What are the possibilities available

1000	500
A	B
B	A
B	C
A	C
C	B
C	A

Total 6 possibilities

Remember like-

2) In short, there is a competition in permutation

Rs 1000 & Rs 500

3) Selection & arranging based on some criteria order, rank, schedule

4) All possibilities should be taken into account

combination

1) Suppose you have Rs 500 (2 No.s). You want to distibute b/w A, B, C, what are the possibilities available

500	500
A	B
B	C
C	A

X
B A
C B
C A

only 3 possibilities

2) There is no competition in combination,

Rs 500 & Rs 500

Each one will be given equal importance

Selection only

order not important,

Take only Reqd possibilities.

Permutation

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

① Non-Repeated Letters

1) Machine

$$\underline{7}\ \underline{6}\ \underline{5}\ \underline{4}\ \underline{3}\ \underline{2}\ \underline{1} = 7!$$

2) Education $= 9!$

② Repeated Letters

1) Sister

$$\underline{6}\ \underline{5}\ 4\ \underline{3}\ \underline{2}\ \underline{1} = 6!$$

Repeated letters = 's' 2 times.

∴ divide by 2!

$$\text{Ans} = \frac{6!}{2!}$$

2) percentage $= \frac{10!}{3!}$

e → 3 times

3) Letter $= \frac{6!}{2!\,2!}$

e → 2 times

t → 2 times

③ Vowels come together

1) Judge

_JDG(UE)

4! X 2!

[UE → can arrange among themselves So 2!)

2) MACHINE

MCHN (AIE)

5! X 3!

3) EDUCATION

DCTN (EUAIO)

5! X 5!

Same method for consonants come together but split consonants

Note: For repeated Letters / divide - No.s

To arrange among themselves multiply by No. of alphabets

④ Vowels never come together

① MACHINE

MCHN (AIE)

Vowels never come together = Total possible words − Vowels come together

$= 7! - 5! \times 3!$

② SISTER

SSTR(IE)

$$Ans = \left(\frac{6!}{2!}\right) - \left(\frac{5! \times 2!}{2!}\right)$$

③ CORPORATION

CRPRTN(OOOAI)

Vowels arrange among themselves

Vowels never come together $= \left(\frac{11!}{3! \times 2!}\right) - \left(\frac{7! \times 5!}{2! \times 3!}\right)$

O − 3 times

R − 2 times

R → 2 times

O → 3 times

(5) No Two Vowels come together

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

* MACHINE

Vowels ≡ A IE

① M ② C ③ H ④ N ⑤

a) In these 5 places 3 vowels can be placed, so $5P_3$

b) MCHN → can arrange among themselves so 4!

Ans $5P_3 \times 4!$

* SISTER

Vowels → IE (2 vowels)

_ S _ S _ T _ R _

$5P_2 \times \frac{4!}{2!}$ → (S 2 times)

(6) Vowels occupy odd/even places

i) Vowels occupy odd places

DETAIL

_ _ _ _ _ _
1 2 3 4 5 6

a) In 3 odd places 3 vowels (EAI) to be placed $^3P_3$

b) Remaining Letters arrange among themselves 3!

$$\text{Ans} = {}^3P_3 \times 3!$$

Qn MACHINE Vowel : (AIE)

_ _ _ _ _ _ _
1 2 3 4 5 6 7

$^4P_3 \times 4!$

ii) Vowels occupy even place

MACHINE Vowels – 3

_ _ _ _ _ _ _
1 2 3 4 5 6 7

$^3P_3 \times 4!$

(7)

	Repetition Allow	Repetition Not Allowed
CRYSTAL	$7^7 = 7\times7\times7\times7\times7\times7\times7$	$7!$
OFFICERS	$\frac{8^8}{2!}$ (F → 2 time)	$\frac{8!}{2!}$
PIRATES	7^7 $7\times7\times7\times7\times7\times7\times7$	$7!$
BOOK	$\frac{4^4}{2!}$ (O → 2 times)	$\frac{4!}{2!}$

$\times$

(8) How many words can be formed from playground

i) $10!$

ii) Starts with 'y' and ends with 'G'

$\frac{Y}{1} \quad \frac{\_\_\_\_\_}{8!} \quad \frac{G}{1} = 8!$

iii) end with vowel (3 vowels)

$\frac{\_\_\_\_\_}{9!} \quad \frac{3}{1} = 9! \times 3$

iii) Start with vowel end with consonant

$\underline{3} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{7}$

$8!$

(Vowels — 3,
consonants — 7)

$Ans = 3 \times 8! \times 7!$

iv) No two vowels come together

P L Y G R N D

1 2 3 4 5 6 7 8

Vowels — A O U — 3 Nos

$^8P_3 \times 7!$

v) Vowels occupy odd places

① 2 ③ 4 ⑤ 6 ⑦ 8 ⑨ 10

$^5P_3 \times 7!$

(3 vowels)
5 odd places

(9) Numbers

1) 21469

How many No.s can be formed

Ans = 5!

With Repetition = 5^5

2) 2 3 4 2

$$\text{Ans} = \frac{4!}{2!}$$

$$\frac{\quad}{\quad} \times \frac{\quad}{\quad}$$

* 4296

In 2000's how many possible no.s

$$\frac{2}{} \; \frac{\quad}{} \; \frac{\quad}{} \; \frac{\quad}{} = 1 \times 3!$$

In 4000's how many no.s

$$\frac{4}{} \; \frac{\quad}{} \; \frac{\quad}{} \; \frac{\quad}{} = 1 \times 3!$$

$$\frac{\quad}{\quad} \times \frac{\quad}{\quad}$$

2049

How many 4 digit no.s can be formed?

$$\frac{3}{\swarrow} \; \frac{3}{} \; \frac{2}{} \; \frac{1}{} = 18 \text{ ways}$$

0 zero can't be placed

CIRCULAR permutation

1) If A B C D E are to be seated in a circular table

Formula $= (n-1)!$

$= (5-1)! = 4!$

2) For, necklace, garland, wreath, bangle problems

If 5 beads / 5 flowers are placed around a circular bangle, In how many - can the beads be arranged,

Formula $= \frac{(n-1)!}{2}$

$= \frac{(5-1)!}{2}$

$= \frac{4!}{2}$

COMBINATION

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

① ${}^nC_{r_1} = {}^nC_{r_2}$

$\boxed{n = r_1 + r_2}$

② $\sum_{r=1}^{3} C(5,r) = {}^5C_1 + {}^5C_2 + {}^5C_3$

③ ${}^nC_r = \frac{n!}{r!(n-r)!}$

④ ${}^nC_r = {}^nC_{n-r}$

⑤ ${}^nC_r = 1$ (when $n=r$)

⑥ ${}^nC_r = n$ (when $r=1$)

⑦ ${}^nC_r = 1$ (when $r=0$)

COMMITTEE BASED

① There are 8 Students out of which ⑤ are doctors ③ are scientist

Qn: Form a committee of 4 in which 3 are doctor and 1 is scientist

$$^5C_3 \times {}^3C_1$$

Qn: A committee of 2 in which there is no doctors

$$^5C_2$$

Qn: A committee of 5 in which 3 doctors

$$^5C_3 \times {}^3C_2$$

Qn: A committee of 2 in which either both are doctors or both scientist

$$^5C_2 + {}^3C_2$$

Qn: A committee of 3 in which atleast 1 doctor is there

$$\left({}^5C_1 \times {}^3C_2\right) + \left({}^5C_2 \times {}^3C_1\right) + {}^5C_3$$

INCLUDED / EXCLUDED

1) In How many ways can a cricket team of 11 players be selected out of 16 players of which 1 particular player is to be i) excluded.
ii) included
iii) if 2 players are included

i) excluded $^{15}C_{11}$

ii) included $^{15}C_{10}$

iii) if 2 players included $^{14}C_{9}$

iv) if 2 players included & 1 excluded

Step1 : $^{14}C_{9}$

Step2 : $^{13}C_{9}$

collinear & non collinear

Non-collinear

* How many straight lines can be drawn from 10 non-collinear points

$$n_{C_r} = {}^{10}C_2$$

$2 \rightarrow$ (∵ 2 points reqd to draw a straight line)

* How many Triangles can be drawn from 10 non-collinear points

$$n_{C_r} = {}^{10}C_3$$

$3 \rightarrow$ (∵ 3 points reqd to draw a triangle)

collinear

* How many straight lines can be drawn from 20 non-collinear points of which 12 are collinear.

Formula: $${}^{n}C_r - {}^{m}C_r + 1$$

$n \rightarrow$ Total points

$m \rightarrow$ No. of collinear pts

$r \rightarrow$ points reqd for drawing straight line

$$^{20}C_2 - {}^{12}C_2 + 1$$

* How many straight lines can be drawn from 5 collinear points

$$^{5}C_2 - {}^{5}C_2 + 1$$

— x —

Triangle

* Total 20 points of which 12 are collinear. How many Triangles can be drawn.

$$^{n}C_r - {}^{m}C_r$$

$$^{20}C_3 - {}^{12}C_3$$

* How many Triangles can be drawn from 12 collinear points

$$^{12}C_3 - {}^{12}C_3$$

$$= 0$$

Triangles can't be drawn with collinear pts.