Counting

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(1) Permutation :-

Que. Define permutation with suitable example.

Permutation is an arrangement of 'r' object from 'n' object. It is denoted be ${}^nP_r$ & it is given by -

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

Ex. How many variable names 8 letters can be form from the letter A, B, C, D, E, F, G, H, I if no letter is repeated.

→ These are a, b, c, d, e, f, g, h, i nine letters

$$\boxed{n = 9}$$

Eight letters word is to be formed

$$\boxed{r = 8}$$

$\therefore$ No. of words formed $= {}^nP_r$

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

$$= \frac{9!}{(9-8)!}$$

$$= \frac{9!}{1!}$$

$\therefore$ No. of words formed = 362880

Ex. There are 10 person called for an interview each one is to be selected for the job. How many p. are there to selected 4 from 10.

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→ There are 10 person called for an interview

$n = 10$

four person is to be selected

$r = 4$

∴ No. of ways to be selected $= {}^{n}P_{r}$

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

$$= \frac{10!}{(10-4)!}$$

$$= \frac{10!}{6!}$$

∴ No. of ways to be selected = 5040

Ex. How many word of 3 distinct letter can be form from the letter of the word ~~mast~~ MAST

→ There are four letters in the word MAST

$n = 4$

3 letters word is to be formed.

$r = 3$

∴ No. of word form $= {}^{n}P_{r}$

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

$$= \frac{4!}{(4-3)!}$$

$$= \frac{4!}{1!}$$

∴ No. of word form = 24

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Ex. How many distinguishable of the letters in the word BANANA are these.

→ There are 6 letters in the word BANANA.

$n=6$

∴ No. of B's $= r_1 = 1$

No. of A's $= r_2 = 3$

No. of N's $= r_3 = 2$

∴ No. of distinguishable word $= \frac{6!}{1!3!2!}$

$= \frac{6!}{1!6!2!}$

$= \frac{720}{12}$

∴ No. of distinguishable word $= 60$

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Ex. How many distinguishable of word in the 'PASCAL'

→ There are 6 letters in the word PASCAL

$n=6$

No. of P's $= r_1 = 1$

No. of A's $= r_2 = 2$

No. of S's $= r_3 = 1$

No. of C's $= r_4 = 1$

No. of L's $= r_5 = 1$

$\therefore$ No. of distinguishable word $= \frac{n!}{(n-r)!}$

$= \frac{6!}{1!2!1!1!1!}$

$= \frac{720}{2}$

$\therefore$ No. of distinguishable word $= 360$

Ex. How many distinguishable permutation of the letter in the word-

(1) MISSISSIPI

(2) REQUIREMENT

(3) BOOLEAN

→ (1) MISSISSIPI-

There are 10 letters in the word MISSISSIPI.

$\because n = 10$

$\therefore$ No. of M's $= r_1 = 1$

No. of I's $= r_2 = 4$

No. of S's $= r_3 = 4$

No. of P's $= r_4 = 1$

$\therefore$ No. of distinguishable word $= \frac{10!}{1!4!4!1!}$

$= \frac{10!}{24 \cdot 24}$

$= \frac{3628800}{576}$

$\therefore$ No. of distinguishable word $= 6300$

② REQUIREMENT –

There are 11 letters in the word REQUIRMENT.

$n = 11$

$\therefore$ No. of R's $= x_1 = 2$

No. of E's $= x_2 = 3$

No. of Q's $= x_3 = 1$

No. of U's $= x_4 = 1$

No. of I's $= x_5 = 1$

No. of M's $= x_6 = 1$

No. of N's $= x_7 = 1$

No. of T's $= x_8 = 1$

$$\therefore \text{No. of distinguishable word} = \frac{11!}{2!3!1!1!1!1!1!1!}$$

$$= \frac{11!}{12}$$

$$= \frac{39916800}{12}$$

$\therefore$ No. of distinguishable word $= 3326400$

③ BOOLEAN –

There are 7 letters in the word BOOLEAN.

$n = 7$

$\therefore$ No. of B's $= x_1 = 1$

No. of O's $= x_2 = 2$

No. of L's $= x_3 = 1$

No. of E's $= x_4 = 1$

No. of A's $= x_5 = 1$

No. of N's $= x_6 = 1$

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$\therefore$ No. of distinguishable word $= \frac{7!}{1!2!1!1!1!1!}$

$= \frac{5040}{2}$

$\therefore$ No. of distinguishable word $= 2520$

Que. Define following terms.

① Product Set :-

If A & B are two non-empty set then product set is denoted be- A·B & is define as -

$$A \times B = \{(a,b) / a \in R \nleq b \in B\}$$

② Relation :-

Let A & B are two non-empty set then relation R is a subset of $A \times B$ i.e. $R \subseteq A \times B$ we say that - a is related to b by R & we write it as $a \underset{\sim}{R} b$

③ Matrix Relation :-

Let A & B are finite set & R is a relation from A to B then matrix relation is denoted be- M_R & is define as -

$$M_R = \begin{cases} 1 & \text{if } (a_i b_i) \in R \\ 0 & \text{if } (a_i b_i) \notin R \end{cases}$$