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$$0+1+2+\cdots+9 = 45$$

$$1,\ 2,\ 3,\ \ldots,\ 9 \rightarrow 9!$$

$$0,\ 1,\ 2,\ \ldots,\ 8 \rightarrow 8 \times 8!$$

Permutation of alike objects taken all at a time

Find no. of words formed using all letters of word

ABCBA

$$= \frac{5!}{2!2!}$$

$A_1 B_1 C B_2 A_2$

$A_1 B_2 C B_1 A_2$

$A_2 B_1 C B_2 A_1$

$A_2 B_2 C B_1 A_1$

4 ✓

$= 2!2!$

2: Find no. of words formed using all letters of the word MAHABHARAT

M, AAAA, B, HH, R, T

$$\frac{10!}{4!\,2!}$$

3: 21 White and 19 Black balls are arranged in a line (balls of same colour alike). Find no. of arrangements of all the balls if black balls are separated.

$$\times \underline{\underline{w}} \times \underline{\underline{w}} \times \underline{\underline{w}} \times \underline{\underline{w}} \times \qquad \times \underline{\underline{w}} \times \qquad 1 \times {}^{22}C_{19} \times 1$$

4. 'ASSASSINATION'

A A A, I I, O
S S S S, N N, T

(i) $\frac{7!}{4!2!} \times {}^{8}C_6 \times \frac{6!}{3!2!}$

(ii) S's are separated.

$\frac{9!}{3!2!2!} \times {}^{10}C_4 \times 1$

(iii) $\left({}^{13}C_6 \times 1\right)\frac{7!}{4!2!}$ or $\frac{13!}{4!2!6!}$

(iv) $\frac{13!}{4!2!3!2!} - \frac{10!}{3!2!2!}$

(v) $\frac{7!}{4!2!}$

(vi) $\frac{6!}{2!3!} \times \frac{7!}{4!2!}$

5. Find the number of numbers greater than a million that can be formed using the digits 2, 3, 0, 3, 4, 2, 5. How many of these are divisible by 5.

① $\frac{6 \times 6!}{2!\,2!}$

②

$+ \frac{\frac{6!}{2!2!} + 5 \times 5!}{2!\,2!}$

6. How many different words can be formed using all letters of the word 'HONOLULU' if no two alike letters are together.

H OO, N, L L, U U

OO together, UU together, LL together $\Rightarrow$ A, B, C

$$\frac{8!}{2!2!2!} - n(A \cup B \cup C)$$

$$\frac{8!}{2!2!2!} - \left(\frac{7!}{2!2!} \times {}^3C_1 - {}^3C_2 \frac{6!}{2!} + 5! \right)$$

2220

7. Find the number of 7 digit numbers if the sum of their digits is 59. How many of these are divisible by 11.

9 9 9 9 9 9 5 → $\frac{7!}{6!}$

9 9 9 9 9 8 6 → $\frac{7!}{5!}$

9 9 9 9 9 7 7 → $\frac{7!}{5!2!}$

9 9 9 9 8 8 7 → $\frac{7!}{4!2!}$

9 9 9 8 8 8 8 → $\frac{7!}{3!4!}$

$\longrightarrow$

9 9 8 6 9 9 9 → $\frac{4!}{3!} \times \frac{3!}{2!}$

9 7 9 9 8 8 9 → $\frac{4!}{3!} \times 3!$

9 8 9 8 9 8 8 → $\frac{4!}{3!} \times 1$

HW → P&C → DPP-3

Circles → SC (62-66)