DAY 47

MCA CET 2025

MATHS

PERMUTATION COMBINATION

INEXORABLE

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PERMUTATION $\longrightarrow$ Arrangement

COMBINATION $\longrightarrow$ Selection

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

FACTORIAL

$$n! = n \times (n-1) \times (n-2) \times \ldots . \times 2 \times 1$$

where $n =$ natural no.

IMPORTANT NOTE:

$$0! = \boxed{1}$$

NOTE:

1. $n!n = (n+1)! - n!$

2. $n! = n(n-1)!$

$$(\underline{n+1})! = (n+1)\underline{n}!$$

$$(n+1)! = n \cdot n! + n!$$

$$(n+1)! - n! = n \cdot n!$$

If any task A can be performed in m ways and any task B can be performed in n ways then task A and B can be performed in ⟶ $m \times n$ ways

task A and task B ⟶ $m \times n$ ways

task A or task B ⟶ $m + n$ ways

If a man and his wife enter a bus, in which five seats are vacant, then the number of different ways in which they can be seated, is

(a) 2

(b) 5

[✓ (c) 20]

(d) 40

M W

$\boxed{5.}$ $\boxed{4}$

$5 \times 4 = \underline{\underline{20}}$

PERMUTATIONS (ARRANGEMENT OF OBJECTS)

If there are 'n' objects out of which r can be arranged in ⟶ $^{n}P_{r}$ ways

$$^{n}P_{r} = \frac{n!}{(n-r)!} \text{ ways} \quad (\forall\, r \leq n)$$

ATTENTION PLEASE $^{n}P_{r}$ can also be denoted as $P(n,r)$

WITHOUT REPETITION

Arranging n objects, taking r at a time in every arrangement

$n=3$

A B C

$r=2$

AB BA

BC CB

AC CA

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

$${}^{3}P_{2} = \frac{3!}{(3-2)!} = \frac{3!}{1!} = \frac{3\times 2\times \cancel{1}}{\cancel{1}}$$

6

In how many ways 6 girls can be seated in two chairs?

$n=6$ $r=2$

(a) 10

(b) 15

(c) 24

(d) 30 ✓

$$\boxed{6}\boxed{5}$$

30

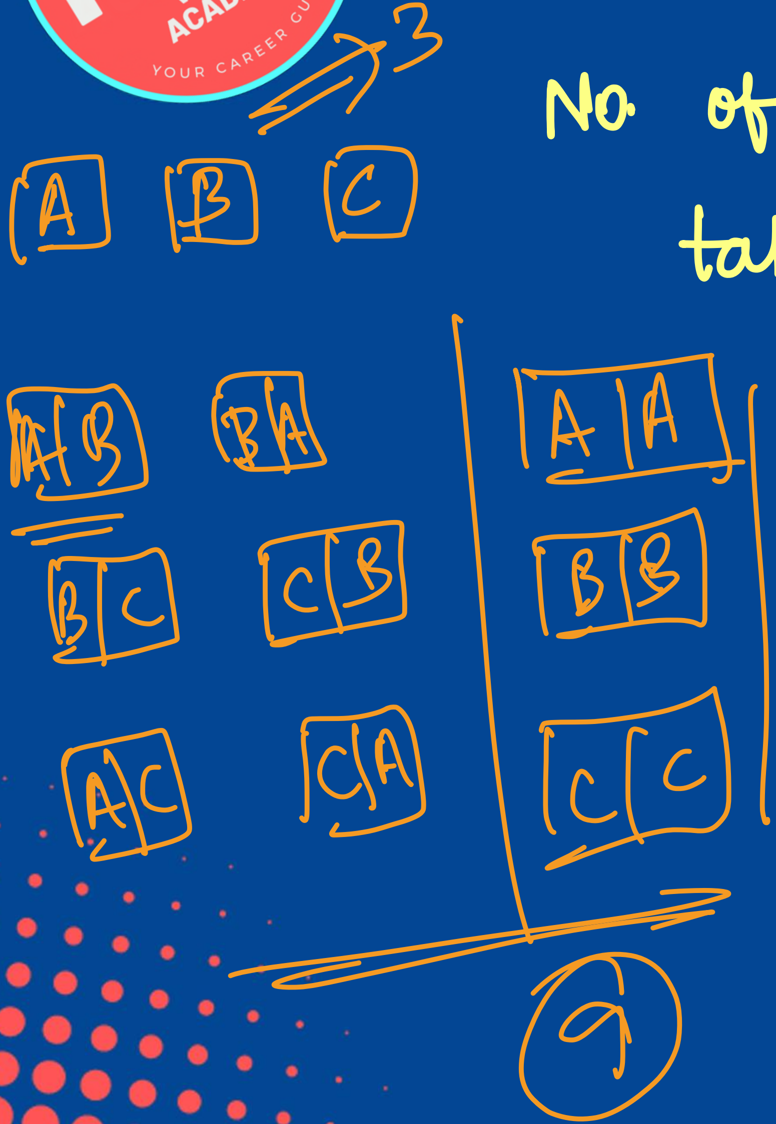
$${}^6P_2 = \frac{6!}{4!}$$

$$= \frac{6\times5\times\cancel{4!}}{\cancel{4!}} = 30$$

WITH REPETITION:

No. of permutations of 'n' different objects taken 'r' at a time

$$\boxed{= n^r}$$ ways.



$$3^2 = 9$$

No. of arrangements of p identical, q identical and r identical objects using total n objects

$$= \frac{n!}{p!q!r!}$$

$$\overset{2}{AA}\ B\ C\ \overset{3}{DDD}$$

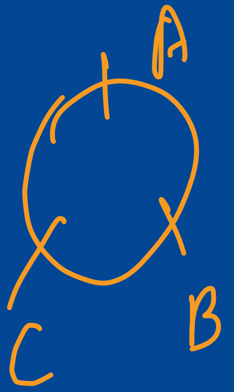
$n=7$

$$\frac{7!}{\Rightarrow 2! \times 3!}$$

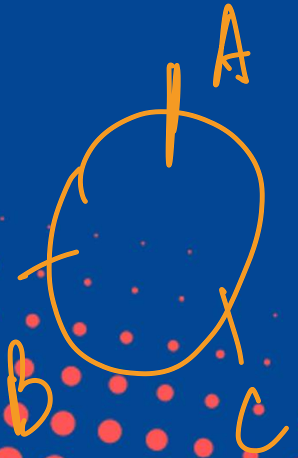
$3 \Rightarrow CP: 2!$

CIRCULAR PERMUTATION

In circular permutation, the total no. of ways in which 'n' person can be arranged



⇒ $(n-1)!$ ways (if distinction made b/n clockwise and anti-clockwise arrangements)



⇒ $\frac{1}{2}(n-1)!$ ways (if no distinction made)

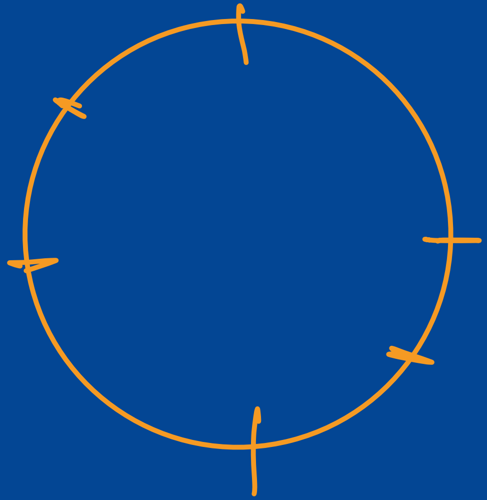
The number of ways in which 6 people can be seated at a round table, is

(a) 6

(b) 60

[✓ (c) 120]

(d) 720



$(6-1)!$

$\underline{5\times4}\times\underline{3\times2}\times1$

$20 \quad 6$

$\underline{\underline{120}}$

The number of words which can be formed from the letters of the word MAXIMUM, if two consonants cannot occur together, is

~~(a)~~ 4!

(b) 3!× 4!

(c) 7!

(d) None of these

C = 4   V = 3

X = 1   M = 3

$\boxed{C}\boxed{V}\boxed{C}\boxed{V}\boxed{C}\boxed{V}\boxed{C}$

$$\frac{\boxed{4!} \times \cancel{3!}}{\cancel{3!}}$$

Consonants = $\boxed{\frac{4!}{3!}}$ ways.

3! = vowels ways.

12

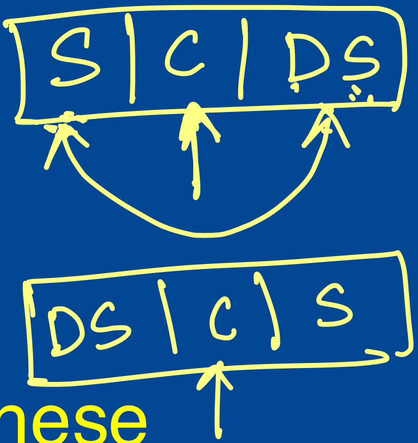
In how many ways can 15 members of a council sit along a circular table, when the Secretary is to sit on one side of the Chairman and the Deputy Secretary on the other side?

(a) 2 × 12!

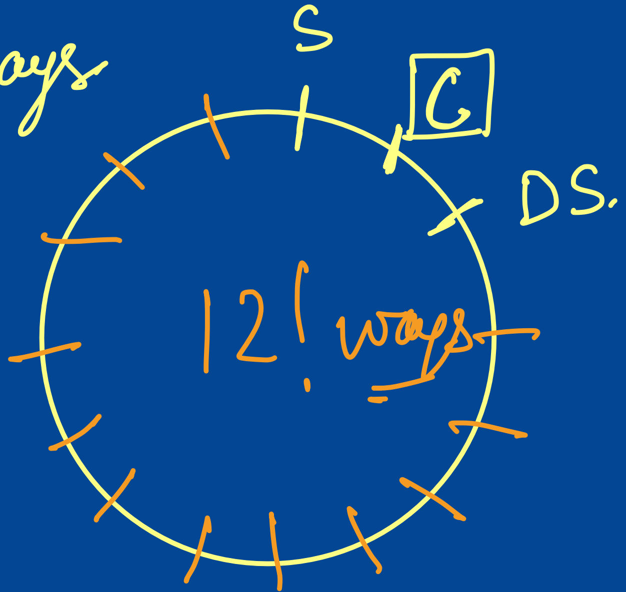
(b) 24

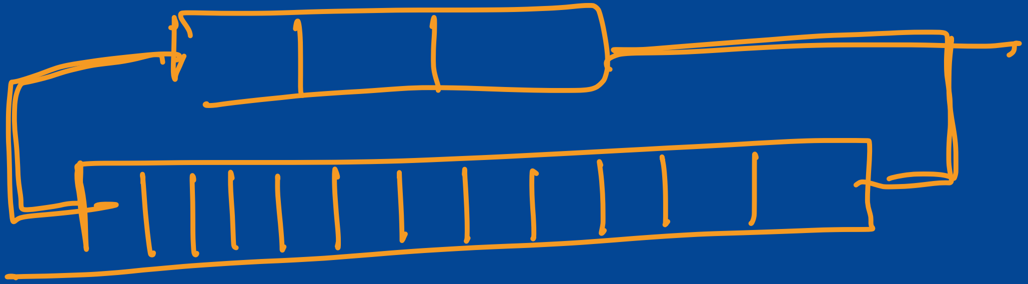
(c) 2 × 15!

(d) None of these



$\boxed{2}$ ways





$\boxed{2 \times 12!}$

Number of circular permutations of n objects when 'r' is taken at a time.

⇒ $\frac{{}^nP_r}{r}$ (if C.W and A.C.W. are distinct.)

⇒ $\frac{{}^nP_r}{2r}$ (if C.W and A.C.W are not taken distinct.)

IMPORTANT RESULTS OF $^{n}P_r$

1. $^{n}P_0 = 1$; $^{n}P_1 = n$; $^{n}P_{n-1} = n!$

2. $^{n}P_r = n \cdot {}^{n-1}P_{r-1}$

3. $${}^{n-1}P_r = (n-r) \times {}^{(\underline{n-1})}P_{(\underline{r-1})}$$

4. $${}^{\underline{n}}P_r = r \cdot {}^{n-1}P_{r-1} + {}^{n-1}P_r$$

COMBINATIONS (SELECTION OF OBJECTS)

n objects → r objects select

1. Without repetition: $^{n}C_{r} = \dfrac{n!}{r!\,(n-r)!}$

2. With repetition: $^{n+r-1}C_{r} = {}^{n+r-1}C_{n-1}$

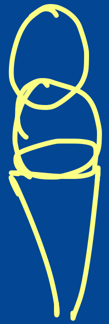
$$= \frac{(n+r-1)!}{r!\,(n-1)!}$$

V SB C

repetition ✓

$n = 3$

$r = 2$



✗	✗	✗			
V	SB	C	V	SB	V
V	SB	C	SB	C	C

$$^{n+r-1}C_r = \frac{4!}{2!\,2!} = \frac{\overset{2}{\cancel{4}} \times 3 \times \cancel{2!}}{2! \times \cancel{2!}}$$

$\cancel{2 \times 1}$

$= 6$

Repetition ⊗

$$^nC_r = {}^3C_2 = \frac{3!}{2!\,\cancel{1!}} = \frac{3 \times \cancel{2!}}{\cancel{2!}} = \boxed{3}$$

3 points.

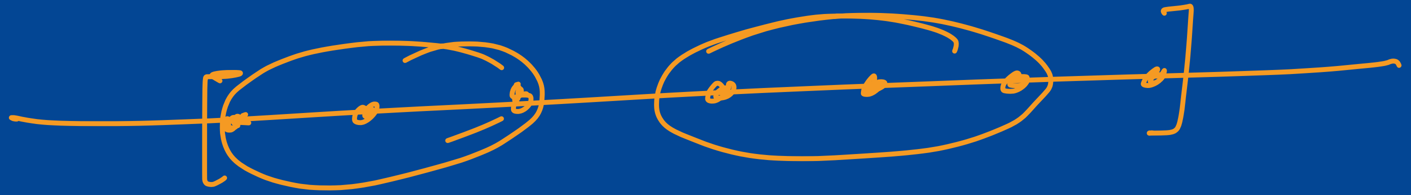
The number of triangles that can be formed by choosing the vertices from a set of 12 points, seven of which lie on the same straight line, is

(a) 185

(b) 175

(c) 115

(d) 105



$^{12}C_3 - {}^{7}C_3$

$= \frac{12!}{3!\,9!} - \frac{7!}{3!\,4!}$

$= \frac{\overset{2}{\cancel{12}}\times 11\times 10\times \cancel{9!}}{\boxed{\cancel{2\times 3}}\times \cancel{9!}} - \frac{7\times \cancel{6}\times 5\times \cancel{4!}}{\cancel{3!}\times \cancel{4!}}$

$= 220 - 35 =$

Ⓞ Ⓑ Ⓡ Ⓖ

There are four balls of different colours and four boxes of colours same as those of the balls. The number of ways in which the balls, one in each box, could be placed such that a ball does not go to box of its own colour, is

(a) 8

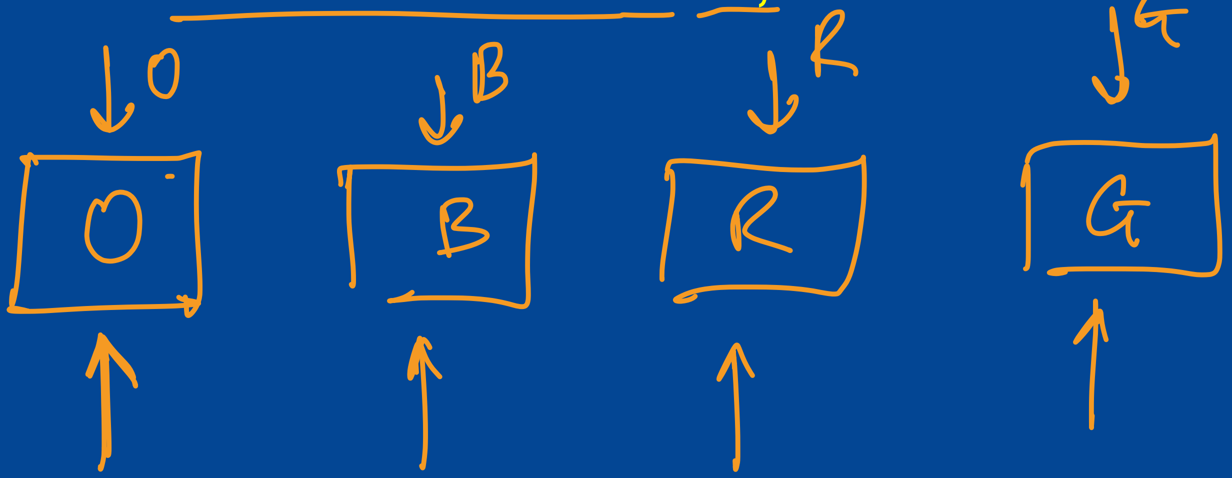
(b) 7

[✓ (c) 9]

(d) None of these

4 Balls.

$n = 4$



$$ {}^4C_1 + {}^3C_1 + {}^2C_1 + {}^1C_1 $$

$$ = \frac{4!}{\cancel{1!}\times\cancel{3!}} + \frac{3!}{1!\,2!} + \frac{2!}{1!\,1!} + \frac{1!}{1!\,0!} $$

$$ = 10 - 1 = 9 $$

Permutation	Combination	Repetition
n^r	${}^{n+r-1}C_r = \frac{(n+r-1)!}{r!\,(n-1)!}$	YES
${}^nP_r = \frac{n!}{(n-r)!}$	${}^nC_r = \frac{n!}{r!\,(n-r)!}$	NO

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Relationship between ^nP_r and ^nC_r

$$\boxed{^nP_r = {^nC_r} \times r!}$$

$$\frac{n!}{(n-r)!} \qquad \frac{n!}{\cancel{r!}\,(n-r)!} \times \cancel{r!}$$

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IMPORTANT RESULTS RELATED TO $^{n}C_{r}$

1. $^{n}C_{r} = {}^{n}C_{n-r}$ [Conjugate Rule]

2. If $^{n}C_{r} = {}^{n}C_{k}$ then $\boxed{r = k \quad \text{or} \quad n-r = k}$

With Rep.

$$^{n+r-1}C_{\underline{r}} = {}^{\underline{n+r-1}}C_{n-1}$$

$$n+\cancel{r}-1-\cancel{r}$$

$$\boxed{n-1}$$

The number of five digits numbers that can be formed without any restriction is

(a) 990000

(b) 100000

[✓ (c) 90000]

(d) None of these

$$\rightarrow \begin{array}{r} 99999 \\ -\ 9999 \\ \hline 90000 \end{array}$$

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What is the smallest natural number n such that n! is divisible by 990?

(a) 9 ~~(b)~~ 11 (c) 33 (d) 99

$\boxed{11 \times 10 \times 9}$

$$\frac{n!}{[990]}$$

$$990 = 9 \times 10 \times 11$$

$$[11 \times 10 \times 9]$$

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