OTM – Only This Much

PERMUTATIONS

MATH, LR & STATS

CA FOUNDATION DEC 2023

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Permutations and Combinations | Past Trends

Attempt	Easy	Moderate	Advance Level	Total
May 2018	2	0	0	2
Nov 2018	2	2	0	4
Jun 2019	2	1	1	4
Nov 2019	3	2	0	5
Nov 2020	2	2	0	4
Jan 2021	3	2	2	7
Jul 2021	2	2	0	4
Dec 2021	4	1	0	5
Jun 2022	6	2	0	8
Dec 2022	4	0	0	4
Jun 2023	3	1	1	4

Permutations – Basics

Rules of Counting

Multiplication Rule / AND Rule	Ways of doing things together = $m \times n$ ways
Addition Rule/ OR Rule	Ways of either one or other thing = $m+n$ ways

PYQ Jan 21
PYQ Jun 22

There are ten flights operating between City A and City B. The number of ways in which a person can travel from A to B and return by different flight?

a. 90 b. 95 c. 80 d. 78

Ans: a

PYQ Jul 21

A person can go from A to B by 11 different modes of transport but is allowed to return to A by mode other than earlier. The number of different ways in which the entire journey can be completed is

a. 110 b. 10^{10} c. 9^5 d. 10^9

Ans: a

Factorial

Symbol	$n!$ or $\lfloor n$
Calculation	$n! = n(n-1)(n-2)...3 \times 2 \times 1$ or $n! = 1 \times 2 \times 3...(n-2) \times (n-1) \times n$
Special Trick	$n! = n(n-1)!$ $n! = n(n-1)(n-2)!$

Permutations

Meaning

- The ways of **arranging** or **selecting + arranging**
- **smaller or equal** number of persons or objects
- from a **group** of persons or **collection** of objects
- with due regard being paid to the **order of arrangement** or selection are called **PERMUTATIONS**

	Theorem	Number of Permutations when r objects are chosen out of n different objects ${}^{n}P_{r} = \frac{n!}{(n-r)!}$ **Condition:** $n \geq r$
	Shortcut of Theorem	To find ${}^{n}P_{r}$ do reverse multiplication of n for r times. No. of Factors in ${}^{n}P_{r}$ = r
	Special Formula	$(n+1)!-n! = n.n!$

PYQ Nov 18

The value of N in $\frac{1}{7!}+\frac{1}{8!}=\frac{N}{9!}$ is

a. 81 b. 78 c. 89 d. 64

Ans: a

PYQ Jun 19

Which of the following statement is correct:

a. ${}^{n}P_{n} = {}^{n}P_{n-1}$

b. ${}^{n}P_{n} = {}^{2n}P_{n-2}$

c. ${}^{n}P_{n} = {}^{3n}P_{n-3}$

d. ${}^{n}P_{n} = {}^{n(n-1)}P_{n-1}$

Ans: a

PYQ Nov 19

${}^{n}P_{3} : {}^{n}P_{2} = 3:1$. Find n

a. 5 b. 7/2 c. 4 d. 2/7

Ans: a

PYQ Nov 20
PYQ Jul 21

If ${}^{n}P_{4} = 20\,{}^{n}P_{2}$ where p denotes the number of permutations, then n is

a. 4 b. 2 c. 5 d. 7

Ans: d

PYQ Dec 21

If ${}^{n}P_{2} = 12$, then the value of n is

a. 2 b. 3 c. 4 d. 6

Ans: c

PYQ Jun 22

If $\frac{n!}{10} = \frac{(n-1)!}{(n-1-n+3)!}$ then find n

a. 4 b. 5 c. 6 d. 7

Ans: b

Number Formations

Why Permutations	• Any number is formed by arranging the given digits • So for the purpose of calculating number of possible numbers formed, we use permutations.
Assumption	• When question is silent, we assume that digits will not be repeated in forming number
Condition 1	• If there is a zero, it cannot come to first place of the number
Condition 2	• If there is a restriction that the numbers formed should be larger than a particular value, then we will use counting rules to find solution
Problem on Summation of all possible numbers	Use below Steps: 1. Find the number of numbers that can be formed 2. Find repetition value of each digit 3. Repetition of each digit = $\frac{\text{Value of Step 1}}{\text{no. of different digits}}$ 4. Find sum of digits 5. Sum of digits x Repetition 6. Multiply value of step 4 by 1111, 111, etc. in case of four-digit numbers and three-digit numbers respectively

PYQ Nov 19
PYQ Jul 21

How many numbers can be formed with the help of 2, 3, 4, 5, 6, 1 which are not divisible by 5, given that it is a five-digit number and digits are not repeating?

a. 600 b. 400 c. 1200 d. 1400

Ans: a

PYQ Jan 21

How many four-digit odd numbers can be formed with digits 0, 1, 2, 3, 4, 7 and 8?

a. 150 b. 300 c. 120 d. 210

Ans: b

Exercise 5A Que 19

The sum of all 4-digit number containing the digits 2, 4, 6, 8 without repetitions is

a. 133330 b. 122220 c. 213330 d. 133320

Ans: d

Exercise 5B Que 10

The number of numbers lying between 10 and 1000 can be formed with the digits 2, 3, 4, 0, 8, 9 is

a. 124 b. 120 c. 125 d. None

Ans: c

PYQ Dec 22

How many 3 digit odd numbers can be formed using the digits 5, 6, 7, 8, 9 if the digits can be repeated?

a. 55 b. 75 c. 65 d. 85

Ans: b

Word Formations

Why Permutations	• Any arrangement of letters as a word, • Meaning or Pronunciation is irrelevant	
Words always Together/ Not Together	Total ways when some letters are together	• Group of things which are together should be counted as one thing only • Things within group can change their place within themselves, their arrangements also need to be considered. • If based on information in questions, things in the group cannot change their places, ignore their arrangement
	Total ways when some letters are not together	Total ways – Ways of always together = Ways of Never Together
Permutations when letters are alike	$p = \frac{n!}{n_1!n_2!n_3!}$	

PYQ Jan 21
PYQ Dec 21

In how many ways can the letters of the word "DETAIL" be arranged so that vowels occupy only the odd positions?

a. 32 b. 36 c. 48 d. 60

Ans: b

PYQ Dec 21

The number of words that can be formed using the letters of the word "PETROL" such that the words do not have P in the first position is

a. 720 b. 120 c. 600 d. 540

Ans: c

PYQ Jun 22

If four letters are taken with or without meaning from the word "LOGARITHAM" without repetition, how many words will be formed?

a. 5040 b. 2520 c. 120 d. 40320

Ans: b

Circular Permutations

Meaning	if we arrange the objects along a **closed curve** viz., a circle, the permutations are known as circular permutations
Theorem	The number of circular permutations of n different things **chosen all** at a time is $(n-1)!$ (This theorem applies only when we choose all of n things)
Circular Permutations	number of ways of arranging n persons along a closed curve **so that no person has the same two neighbours is**

Type II	$\frac{1}{2}(n-1)!$ Examples: Garlands, Necklaces

MTP May 20

5 persons are sitting in a round table in such way that Tallest Person is always on the right-side of the shortest person; the number of such arrangements is

a. 6 b. 8 c. 24 d. None

Ans: a

Exercise 5B Que 3

If 50 different jewels can be set to form a necklace, then the number of ways is

e. 50! / 2 f. 49! / 2 g. 49! h. None

Miscellaneous Problems

PYQ Dec 22

The number of ways 4 boys and 3 girls can be seated in a row so that they are alternate is:

a. 12 b. 288 c. 144 d. 256

Ans: c

PYQ Nov 19

Three girls and five boys are to be seated in a row so that no girls sit together. Total number of ways of this arrangement are

a. 120 b. 14400 c. ${}^{5}P_{3}$ d. $3! \times 5!$

Ans: b

PYQ Dec 21

Six boys and five girls are to be seated for a photograph in a row such that no two girls sit together, and no two boys sit together. Find the number of ways in which this can be done.

a. 74200 b. 96900 c. 45990 d. 86400

Ans: d

PYQ Jun 22

8 people are seated in a row in a meeting among them the president and vice president are to be seated always in the centre. What is the arrangement?

a. 7! 2! b. 6! 2! c. 6! d. 1!

Ans: b