# Permutations and Combinations

## Question1

**The number of non-negative integral solutions of the equation $x+y+z+t=10$ when $x \geq 2, z \geq 5$ is**

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**Options:**

A.

80

B.

20

C.

50

D.

10

**Answer: B**

## Solution:

We have, $x+y+z+t=10 \quad \ldots(i)$

When $x \geq 2, z \geq 5$

let $\quad x'=x-2$

$\Rightarrow \quad x=x'+2$

$z'=z-5$

$\Rightarrow \quad z=z'+5$

Here, $x', z', y \geq 0$ and $t \geq 0$ are non-negative integers.

$\therefore$ Substitude these value in Eq. (i), we get

$$\begin{aligned} & \left(x'+2\right)+y+\left(z'+5\right)+t=10 \\ \Rightarrow \quad & x'+y+z'+t=3 \qquad \ldots(ii) \end{aligned}$$

$\therefore$ Number of non-negative integral solution for Eq. (ii)

$$\begin{aligned} & ={ }^{3+4-1} C_{4-1}={ }^6 C_3 \\ & =\frac{6 \times 5 \times 4}{3 \times 2 \times 1}=20 \end{aligned}$$

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# Question2

## The number of integers lying between 1000 and 10000 such that the sum of all the digits in each of those numbers becomes 30 is

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**Options:**

A.

84

B.

96

C.

45

D.

75

**Answer: A**

## Solution:

Integers lying between 1000 and 10000 such that the sum of all the digits in each of those numbers becomes 30 .

$\therefore$ Coefficient of $x^{30}$ in the expansion of

$$\left(x^1+x^2+\ldots+x^9\right)\left(x^0+x^1+\ldots+x^9\right)^3$$
$$=x\left(\frac{1-x^9}{1-x}\right)\left(\frac{1-x^{10}}{1-x}\right)^3$$
$$=x\left(1-x^9\right)\left(1-x^{10}\right)^3(1-x)^{-4}$$

$\Rightarrow$ Coefficient of $x^{29}$ in

$\left(1-x^9\right)\left(1-x^{10}\right)^3(1-x)^{-4}$

$$=\left(1-x^9\right)\left(1-3x^{10}+3x^{20}-x^{30}\right)(1-x)^{-4}$$
$$=\left(1-x^9-3x^{10}+3x^{19}+3x^{20}-3x^{29}\right.$$
$$\left.-x^{30}+x^{39}\right)(1-x)^{-4}$$

Here, $(1-x)^{-4}=\sum_{k=0}^{\infty} k+{}^3C_3x^k$

$\therefore$ Coefficient of $x^{29}$ from $1\cdot(1-x)^{-4}$

$={}^{29+3}C_3={}^{32}C_3=4960$

Coefficient of $x^{20}$ from $-x^9\cdot(1-x)^{-4}$

$=-{}^{20+3}C_3=-{}^{23}C_3=-1771$

Coefficient of $x^{19}$ from $-3x^{10}\cdot(1-x)^{-4}$

$$=-3\left({}^{19+3}C_3\right)$$
$$=-3(1540)=-4620$$

Coefficient of $x^{10}$ from $3x^{19}(1-x)^{-4}$

(Means form is $3x^{19}\Sigma^{k+3}C_3x^k$ need

$x^{29}, k=10)$

$$=3^{10+^3}C_3=3\left({}^{13}C_3\right)=858$$

Coefficient of $x^9$ from $3x^{20}\cdot(1-x)^{-4}$

$=3\left({}^{9+3}C_3\right)=3(220)=660$

Coefficient of $x^0$ from $-3x^{29}\cdot(1-x)^{-4}$

$=-3\left({}^{0+3}C_3\right)=-3(1)=-3$

$\therefore$ Total numbers

$$=4960-1771-4620+858+660-3$$
$$=84$$

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# Question3

**If all the letters of the word MOST are permuted and the words (with or without meaning) thus obtained are arranged in the dictionary order, then the rank of the words STOM when counted from the rank of the word MOST, is**

## TG EAPCET 2025 (Online) 2nd May Evening Shift

**Options:**

A.

24

B.

21

C.

12

D.

18

**Answer: D**

## Solution:

Given word in most

Words start with $M = 3! = 6$

Words start with O $= 3! = 6$

Words start with SM $= 2! = 2$

Words start with SO $= 2! = 2$

Words start with STM = 1 ! = 1

Words start with STO is STOM

Rank of STOM is $(6 + 6 + 2 + 2 + 1) + 1 = 18$

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# Question4

**A student has to answer a multiple-choice question having 5 alternatives in which two or more than two alternatives are correct. Then, the number of ways in which the student can answer that question is**

## TG EAPCET 2025 (Online) 2nd May Morning Shift

**Options:**

A.

31

B.

30

C.

27

D.

26

**Answer: D**

## Solution:

The total number of ways to choose any subset of the 5 options $= 2^5 = 32$

These 32 subsets include choosing 2, 3, 4 or 5 options.

But choosing options 0 and 1 are not allowed.

Now, subsets with 0 options

$= {}^5C_0 = \frac{5!}{0!5!} = 1$

Subsets with 1 options

$= {}^5C_1 = \frac{5!}{1!4!} = 5$

So, total subsets with options 0 and 1

$= 1 + 5 = 6$

Thus, the number of ways in which the student can answer that questions

$= 32 - 6 = 26$

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# Question5

**Number of triangles whose vertices are the points $(x, y)$ in the $XY$-plane with integer coordinates satisfying $0 \leq x \leq 4$ and $0 \leq y \leq 4$ is**

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**Options:**

A.

2300

B.

2260

C.

2160

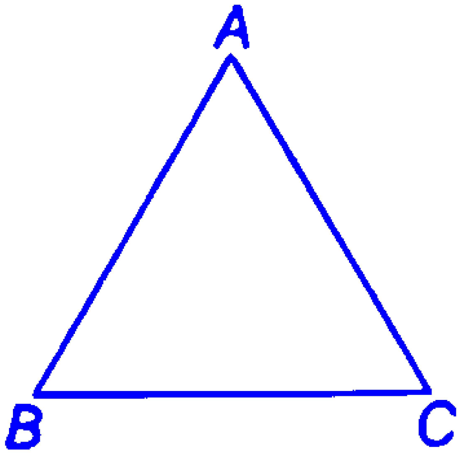
D.

2230

**Answer: C**

## Solution:

Let the triangle be $ABC$ with point $(x, y)$,



where $0 \leq x \leq 4$ and $0 \leq y \leq 4$

So, the points $(x, y)$ are $(0,0),(0,1),(0,2),(0,3),(0,4),(1,0),(1,1),(1,2)$, $(1,3),(1,4),(2,0),(2,1),(2,2),(2,3),(2,4),(3,0),(3,1),(3,2),(3,3),(3,4)$, $(4,0),(4,1),(4,2),(4,3),(4,4)$.

Total coordinates are 25 , but we need to select only 3 .

Now, the number of triangles with sets of 3 non-collinear points. Total number of ways to choose 3 points $= {}^{25}C_3$

But, we must subtract the number of collinear triplets.

Case I Horizontal lines

Number of ways to choose 3 collinear points

$\Rightarrow \quad {}^5C_3 = 10$

So, in 5 rows $= 5 \times 10 = 50$

Case II Vertical lines

Same as above $\rightarrow$ 5 columns

$= 5 \times 10 = 50$

Now, diagonal from bottom-left to top-right

$=$ Length 3 : 2 such diagonals + Length

4 : 2 diagonals + Length 5:1 diagonal

$$
\begin{aligned}
&= 2\left({}^3C_3\right) + 2\left({}^4C_3\right) + {}^5C_3 \\
&\quad 2(1) + 2(4) + 10 \\
&= 2 + 8 + 10 = 20
\end{aligned}
$$

And, diagonals from top-left to bottom-right $= 20$

Total collinear triplets

$= 50 + 50 + 20 + 20 = 140$

So, total number of triangles $= {}^{25}C_3 - 140$

$\Rightarrow \quad 2300 - 140 = 2160$

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# Question6

**If all the letters of the word 'HANDLE' are permuted in all possible ways and the words (with or without meaning) thus formed are arranged in dictionary order, then the rank of the word 'HELAND' is**

## TG EAPCET 2025 (Online) 2nd May Morning Shift

**Options:**

A.

420

B.

422

C.

456

D.

475

**Answer: B**

## Solution:

Total Alphabets are A, D, E, H, L, N Letters before H are A, D, E.

So, the number of letters before H $= 3 \times 5\,!$

$= 3 \times 120 = 360$

Letters before $E$ are A, D.

So, the number of letters before $E = 2 \times 4\,!$

$= 2 \times 24 = 48$

Letters before L are A, D.

So, the number of letters before $L$

$= 2 \times 3! = 12$

Letters before N is D

So, the number of letters with N only

$\Rightarrow \quad 1 \times 1! = 1$

So, total words $= 360 + 48 + 12 + 1 = 421$

Now, only 1 letter remaining, that is D .

So, Rank of HELAND $= 421 + 1 = 422$

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# Question7

## The sum of all the 4-digit numbers formed by taking all the digits from $0, 3, 6, 9$ without repetition is

## TG EAPCET 2024 (Online) 11th May Morning Shift

**Options:**

A. 119592

B. 115992

C. 211599

D. 119952

**Answer: B**

## Solution:

We need to find the sum of all the 4-digit numbers formed using the digits $\{0, 3, 6, 9\}$ without repetition. Note that since the number is 4-digit, the thousands place cannot be 0.

**Step 1. Count the Valid Numbers**

**Thousands Place:** Can be chosen from $\{3, 6, 9\}$ — 3 possibilities.

**Other Places:** After choosing the thousands digit, the remaining three digits can be arranged in 3! ways (i.e. 6 ways).

Thus, the total number of valid numbers is:

$3 \times 6 = 18.$

## Step 2. Sum by Place Value Contribution

We calculate the contribution to the total sum from each digit place (thousands, hundreds, tens, and units).

**(a) Thousands Place**

Allowed digits: $3, 6, 9$.

**Frequency:** Each digit (3, 6, 9) appears in the thousands place 6 times.

**Contribution:**

$$\text{Sum}_{\text{thousands}} = (3 + 6 + 9) \times 6 \times 1000 = 18 \times 6 \times 1000 = 108000.$$

**(b) Hundreds Place**

For the hundreds place, consider the following:

**Case 1:** When thousands digit is 3, the remaining digits are $\{0, 6, 9\}$. In these 6 numbers, each of 0, 6, and 9 appears exactly 2 times in the hundreds place.

**Case 2:** When thousands digit is 6, the remaining digits are $\{0, 3, 9\}$. Each appears 2 times.

**Case 3:** When thousands digit is 9, the remaining digits are $\{0, 3, 6\}$. Each appears 2 times.

Thus, the total frequency in the hundreds place is:

$0:$ appears $2 + 2 + 2 = 6$ times.

$3:$ appears in cases 2 and 3: $2 + 2 = 4$ times.

$6:$ appears in cases 1 and 3: $2 + 2 = 4$ times.

$9:$ appears in cases 1 and 2: $2 + 2 = 4$ times.

**Contribution:**

$$\text{Sum}_{\text{hundreds}} = (0 \cdot 6 + 3 \cdot 4 + 6 \cdot 4 + 9 \cdot 4) \times 100.$$

First calculate the inner sum:

$$3 \cdot 4 + 6 \cdot 4 + 9 \cdot 4 = 4(3 + 6 + 9) = 4 \times 18 = 72.$$

So,

$\text{Sum}_{\text{hundreds}} \quad = 72 \times 100 = 7200.$

**(c) Tens Place**

By symmetry (since after the thousands digit is fixed, the remaining three digits are uniformly permuted among the hundreds, tens, and units places), the distribution for the tens place is identical to that for the hundreds place.

**Contribution:**

$\text{Sum}_{\text{tens}} \quad = 72 \times 10 = 720.$

**(d) Units Place**

Again, by similar reasoning, the units place has the same digit frequency as the hundreds and tens places.

**Contribution:**

$\text{Sum}_{\text{units}} \quad = 72 \times 1 = 72.$

### Step 3. Total Sum

Add the contributions from all four places:

$\text{Total Sum} = 108000 + 7200 + 720 + 72.$

Calculate step-by-step:

$108000 + 7200 = 115200,$

$115200 + 720 = 115920,$

$115920 + 72 = 115992.$

### Final Answer

The sum of all the 4-digit numbers formed is **115992**.

Thus, the correct option is:

**Option B – 115992**.

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# Question8

## The number of ways in which 6 distinct things can be distributed into 2 boxes so that no box is empty is

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### Options:

A. 36

B. 64

C. 62

D. 34

**Answer: C**

## Solution:

Every things has two choices to go in to lst box and there are 6 such things there are two cases in which all the things go into lst or 2 nd box.

$\because$ Total number of ways $= 2^6 - 2 = 62$

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# Question9

## Number of ways in which the number 831600 can be split into two factors which are relatively prime is

## TG EAPCET 2024 (Online) 11th May Morning Shift

**Options:**

A. 8

B. 64

C. 32

D. 16

**Answer: D**

## Solution:

To find the number of ways in which the number 831600 can be divided into two factors that are relatively prime, we start by determining the prime factorization of 831600:

$M = 831600 = 2^4 \times 3^3 \times 5^2 \times 7 \times 11$

The number of different prime factors is 5: $2, 3, 5, 7, 11$.

When dividing a number into two relatively prime factors, each prime factor must entirely go to one factor or the other. The general formula to calculate the number of ways to partition these prime factors into two groups is given by:

$2^{n-1}$

where $n$ represents the number of distinct prime factors. Thus, for 831600:

$2^{5-1} = 2^4 = 16$

Therefore, there are 16 different ways to split 831600 into two factors that are relatively prime.

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# Question10

### If 4 letters are selected at random from the letters of the word PROBABILITY, then the probability of getting a combination of letters in which atleast one letter is repeated is

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**Options:**

A. $\frac{43}{170}$

B. $\frac{19}{61}$

C. $\frac{57}{184}$

D. $\frac{29}{155}$

**Answer: B**

## Solution:

Given, word Probability

Number of letter in probability

P,R,O,A,L,T,Y,BB,II

(i) 4 letter are selected alone different

i.e. ${}^9C_4 = \frac{9!}{4!5!} = 126$

(ii) Two letter or alike other are different

$2C_1 \times 8C_2 = \frac{2\times8!}{2!6!} = 56$

(iii) Two letter are alike

$2C_2 = 1$

Total number of sample space

$= 126 + 56 + 1 = 183$

Favorable case in which at least one letter is repeated

i.e., $56 + 1 = 57$

$\therefore$ Reqmend probability $= \frac{57}{183} = \frac{19}{61}$

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# Question11

### The number of ways of arranging all the letters of the word 'COMBINATIONS' around a circle so that no two vowels together is

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### Options:

A. $\frac{7!6!}{(2!)^4}$

B. $\frac{7!6!}{(2!)^3}$

C. $\frac{{}^8P_5 \times 6!}{(2!)^3}$

D. $\frac{7!x^8P_5}{(2!)^3}$

**Answer: A**

## Solution:

To find the number of ways to arrange all the letters of the word 'COMBINATIONS' around a circle such that no two vowels are together, let's break it down step-by-step.

**Identify Vowels and Consonants:**

Vowels: O, O, I, I, A (total of 5 vowels)

Consonants: C, M, B, N, T, N, S (total of 7 consonants)

**Arrangement of Consonants:**

Since the arrangement is in a circle, we arrange the consonants in $(7 - 1)! = 6!$ ways because in circular permutations, we fix one position to break the circle and linearly order the rest.

**Interleaving Vowels:**

Arranging the consonants creates 7 gaps (before the first consonant, between each pair, and after the last consonant) to place the vowels. We need to select 5 gaps for the vowels, ensuring no two vowels are adjacent, which is crucial since we want them not together.

**Arrangement of Vowels:**

Arrange the vowels O, O, I, I, A in these gaps.

The arrangement of the vowels is affected by repetition. The formula for arranging 'n' items where there are repetitions is given by $\frac{n!}{k1!\cdot k2!\cdot\ldots\cdot kr!}$, where $k_i$ represents the number of times each repeated letter occurs.

The necessary calculation for the vowels: $\frac{5!}{2!\cdot 2!}$ because O and I each repeat twice.

**Total Arrangements:**

Combine the arrangements of consonants and vowels as follows:

Total ways $= 6! \times \frac{5!}{2!\times 2!}$

By further expanding this calculation based on the repetitions:

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

This gives the total number of arrangements of the letters in 'COMBINATIONS' around a circle, ensuring that no two vowels are adjacent.

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# Question12

**If all the numbers which are greater than 6000 and less than 10000 are formed with the digits, $3, 5, 6, 7, 8$ without repetition of the digits, then the difference between the number of odd numbers and the number of even number among them is**

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**Options:**

A. ${}^4P_3$

B. $3\left({}^4P_2\right)$

C. ${}^5P_3$

D. $2\left({}^4P_3\right)$

**Answer: A**

## Solution:

**Explanation**

To find the difference between the number of odd and even numbers formed by the digits 3, 5, 6, 7, and 8, where the numbers are greater than 6000 and less than 10000, we consider the following process:

**Odd Numbers:**

**Set I**: When the first digit (thousands place) is 6, 7, or 8, and the last digit (units place) is 3.

**Choices**:

3 choices for the first digit (6, 7, 8).

3 choices for the second digit.

2 choices for the third digit.

1 choice for the last digit (3).

**Combinations**:

$3 \times 3 \times 2 \times 1 = 18$

**Set II**: Similar to Set I, but the last digit (units place) is 5.

**Choices**:

3 choices for the first digit (6, 7, 8).

3 choices for the second digit.

2 choices for the third digit.

1 choice for the last digit (5).

**Combinations**:

$3 \times 3 \times 2 \times 1 = 18$

**Set III**: The first digit (thousands place) is 6 or 8, and the last digit is 7.

**Choices**:

2 choices for the first digit (6, 8).

3 choices for the second digit.

2 choices for the third digit.

1 choice for the last digit (7).

**Combinations**:

$2 \times 3 \times 2 \times 1 = 12$

**Total Odd Numbers**:

$18 + 18 + 12 = 48$

**Even Numbers:**

**Set I**: The first digit (thousands place) is 7 or 8, and the last digit (units place) is 6.

**Choices**:

2 choices for the first digit (7, 8).

3 choices for the second digit.

2 choices for the third digit.

1 choice for the last digit (6).

**Combinations**:

$2 \times 3 \times 2 \times 1 = 12$

**Set II**: The first digit (thousands place) is 6 or 7, and the last digit (units place) is 8.

**Choices**:

2 choices for the first digit (6, 7).

3 choices for the second digit.

2 choices for the third digit.

1 choice for the last digit (8).

**Combinations**:

$2 \times 3 \times 2 \times 1 = 12$

**Total Even Numbers**:

$12 + 12 = 24$

**Calculating the Difference:**

The required difference between the number of odd and even numbers is:

$48 - 24 = 24$

This result can be expressed as ${}^4P_3$.

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# Question13

## A man has 7 relatives, 4 of them are ladies and 3 gents; his wife has 7 other relatives, 3 of them are ladies and 4 gents. The number of ways they can invite them to a party of 3 ladies and 3 gents so that the there are 3 of man's relatives and 3 of wife's relatives, is

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**Options:**

A. $341^{\circ}$

B. 161

C. 485

D. 435

**Answer: C**

## Solution:

There are 4 possibilities for inviting the relatives to the party:

**3 ladies from the husband's side and 3 gentlemen from the wife's side**:

Total number of ways:

$= {}^4C_3 \times {}^4C_3 = 16$

**3 gentlemen from the husband's side and 3 ladies from the wife's side**:

Total number of ways:

$= {}^3C_3 \times {}^3C_3 = 1$

**2 ladies and 1 gentleman from the husband's side and 2 gentlemen and 1 lady from the wife's side**:

Total number of ways:

$= \left({}^4C_2 \times {}^3C_1\right) \times \left({}^3C_1 \times {}^4C_2\right) = 324$

**1 lady and 2 gentlemen from the husband's side, and 2 ladies and 1 gentleman from the wife's side**:

Total number of ways:

$= \left({}^4C_1 \times {}^3C_2\right) \times \left({}^3C_2 \times {}^4C_1\right) = 144$

The total number of ways to invite 3 of the man's relatives and 3 of the wife's relatives is:

$= 16 + 1 + 324 + 144 = 485$

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# Question14

**All the letters of word 'COLLEGE' are arranged in all possible ways and all the seven letter words (with or without meaning) thus formed are arranged in the dictionary order. Then, the rank of the word 'COLLEGE' is**

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**Options:**

A. 119

B. 149

C. 176

D. 179

**Answer: D**

# Solution:

Alphabets present in the word 'COLLEGE' are C, O, L, E, G

Alphabets in ascending order are

C, E, G, L, O

Number of words starts with CE $= \frac{5!}{2!}$

Number of words starts with CG $= \frac{5!}{2!2!}$

Number of words starts with CL $= \frac{5!}{2!}$

Number of words starts with COE $= \frac{4!}{2!}$

Number of words starts with COG $= \frac{4!}{2!2!}$

Number of words starts with COLE $= 3\,!$

Number of words starts with COLG $= \frac{3!}{2!}$

Number of words starts with

COLLEE $= 1\,!$

Next words in COLLEGE

$\therefore$ Required number of ways

$= \frac{5!}{2!} + \frac{5!}{2!2!} + \frac{5!}{2!} + \frac{4!}{2!} + \frac{4!}{2!2!} + 3! + \frac{3!}{2!} + 1 + 1$

$= 60 + 30 + 60 + 12 + 6 + 6 + 3 + 2$

$= 179$

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## Question15

**If all the possible 3-digit numbers are formed using the digits $1, 3, 5, 7$ and 9 without repeating any digit, then the number of such 3 -digit numbers which are divisible by 3 is**

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**Options:**

A. 6

B. 12

C. 18

D. 24

**Answer: D**

## Solution:

Case I Let one digit be 1 or 7 , then sum of the other two digits be $2, 5, 8, 11$ or 14 or $3x + 2$ Therefore, the 2 digits can be $(3, 5), (5, 9)$.

$\therefore$ The possible number are 8 .

Case II Let one digit be 3 or 9 the sum of other two digits can be multiple of 3 . The other 2 digit can be $(1, 5)$ or $(7, 5)$ $\therefore$ The possible numbers are 8 .

Case III Let one digit can be 5 , then sum of other digit can be $1, 4, 7, 10, 13$ or 16.

$\therefore$ The other 2 digit numbers can be $(1, 3), (1, 9), (3, 7), (7, 6)$

$\therefore$ The possible number can be 8 in $^{-}$ number.

Hence, the required number are

$8 + 8 + 8 = 24$

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## Question16

**A question paper has 3 parts $A, B$ and $C$. Part $A$ contains 7 questions, part $B$ contains 5 questions and Part Ccontains 3 questions. If a candidate is allowed to answer not more than 4 questions from part $A$; not more than 3 questions from part $B$ and not more than 2 questions from part $C$, then the number of ways in which a candidate can answer exactly 7 questions is**

**Options:**

A. 4655

B. 4025

C. 3675

D. 2625

**Answer: A**

## Solution:

We have, part A has 7 questions, Part B has 5 questions and part $C$ has 3 questions.

Case I 4 questions from part $A$, then 3 questions from part $B$ and $C$

Number of ways

$= {}^7C_4 \times \left[{}^5C_3 + {}^5C_2 \times {}^3C_1 + {}^5C_1 \times {}^3C_2\right]$

$= \frac{7\times6\times5}{1\times2\times3}[10 + 30 + 15]$

$= 35 \times 55 = 1925$

Case II 3 questions from Part $A$, then 4 questions from part $B$ and $C$.

$\therefore$ Number of ways

$= {}^7C_3 \times \left[{}^5C_3 \times {}^3C_1 + {}^5C_2 \times {}^3C_2\right]$

$= 35 \times [30 + 30] = 35 \times 60 = 2100$

Case III 2 questions from part $A$, then 5 question from part $A$ and $B$

Number of ways $= {}^7C_2 \left[{}^5C_3 \times {}^3C_2\right]$

$= 21 \times 10 \times 3 = 630$

$\therefore$ Required number of ways

$= 1925 + 2100 + 630 = 4655$

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## Question17

**Among the 4 -digit numbers that can be formed using the digits $1, 2, 3, 4, 5$ and 6 without repeating any digit, the number of numbers which are divisible by 6 is**

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**Options:**

A. 60

B. 66

C. 52

D. 57

**Answer: A**

## Solution:

The numbers will be divisible by 6 if and only if the unit digit of numbers is an even number and the sum of digits is divisible by 3 .

Collection of 4 -digits whose sum is divisible by 3 .

$(1236) \rightarrow \ldots\ldots\ldots\ldots 2$ or $6 \rightarrow 3 \times 2 \times 1 \times 2 = 12$

$(1245) \rightarrow \ldots\ldots\ldots 2$ or $4 \rightarrow 3 \times 2 \times 1 \times 2 = 12$

$(1356) \rightarrow \ldots\ldots\ldots 6 \rightarrow 3 \times 2 \times 1 \times 1 = 6$

$(2346) \rightarrow \ldots\ldots\ldots 2$ or $4$ or $6 \rightarrow$

$3 \times 2 \times 1 \times 3 = 18$

$(3456) \rightarrow \ldots\ldots\ldots 4$ or $6 \rightarrow 3 \times 2 \times 1 \times 2 = 12$

Total $= 12 + 12 + 6 + 18 + 12 = 60$

$\therefore$ The number of numbers which are divisible by 4 are 60.

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## Question18

**If the number of circular permutations of 9 distinct things taken 5 at a time is $n_1$ and the number of linear permutation of 8 distinct things taken 4 at a time is $n_2$, then $\frac{n_1}{n_2} =$**

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**Options:**

A. $\frac{5}{9}$

B. 2

C. $\frac{1}{2}$

D. $\frac{9}{5}$

**Answer: D**

## Solution:

Given that the number of circular permutation of 9 distinct things taken 5 at a time is $n_1$.

$$\therefore \quad n_1 = {}^9C_5(5-1)!$$

$$= \frac{9!}{5!(9-5)!} \times 4! = 9 \times 8 \times 7 \times 6$$

Also, given that the number of linear permutation of 8 distinct things taken 4 at a time is $n_2$.

$$\therefore n_2 = {}^8C_4(4!) = \frac{8!}{4!(8-4)!} \times 4!$$

$$= 8 \times 7 \times 6 \times 5$$

Now, $\frac{n_1}{n_2} = \frac{9\times8\times7\times6}{8\times7\times6\times5} = \frac{9}{5}$

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## Question19

### The number of ways in which 4 different things can be distributed to 6 persons so that no person gets all the things is

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**Options:**

A. 1292

B. 1296

C. 1290

D. 4090

**Answer: C**

## Solution:

We know that

The number of ways in which $n$ different things can be distributed to $m$ person so that no person gets all the things is same as the number of functions (whose range is not a singleton set) from set $A$ (containing $n$ elements) to set $B$ (containing $m$ elements).

$\therefore$ The number of ways in which 4 different things can distributed to 6 person so that no person gets all the things

$$=6^4-6=6(216-1)$$

$$=6(215)=1290$$

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# Question20

### The sum of all the 4 -digit numbers formed by taking all the digits from $2,3,5,7$ without repetition, is

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**Options:**

A. 331122

B. 123312

C. 113322

D. 132132

**Answer: C**

## Solution:

We have,

$2,3,5,7$

No repetition

Number of given digits $= n = 4$

Sum of digits = 17

Sum of all four digits formed

$= (n-1)!(\text{ Sum of digits}) (11111 \text{ ......... n times})$

$= 3!(17)(1111)$

$= 6 \times 17 \times 1111$

$= 113322$

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# Question21

## The number of ways in which 15 identical gold coins can be distributed among 3 persons such that each one gets atleast 3 gold coins, is

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**Options:**

A. 27

B. 28

C. 22

D. 25

**Answer: B**

## Solution:

Given that there are 15 identical gold coins to be distributed among 3 persons.

Also, each person gets at least 3 coins $\Rightarrow$ total $= 3 \times 3 = 9$ coins

$\therefore$ 9 coins are already distributed in 1 ways. we now have 6 coins to be distributed between 3 people.

$\Rightarrow x_1 + x_2 + x_3 = 6, x_i \geq 0$

Number of

Number of solutions is given by

${}^{n+r-1}C_{r-1}$

$\Rightarrow \quad n=6, r=3$

$\therefore$ Reanired solution

$\therefore$ Required Number $= {}^{6+3-1}C_{3-1}$

$= {}^{8}C_{2} = 28$

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# Question22

## The number of all possible combinations of 4 letters which are taken from the letters of the word 'ACCOMMODATION', is

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**Options:**

A. 167

B. 161

C. 160

D. 157

**Answer: A**

## Solution:

4 letter words from

ACCOMMODATION

There are different letters

"ACCOMMODATION"

namely,

A, C, D, I, M, N, O, T

2 2 1 1 2 1 3 1

Case (I) all 4 letters of the word are different numbers of combinations

$= {}^{8}c_{4} = 70$

Case (II) 2 letters are same and 2 are different.

$= {}^4c_1 \cdot {}^7c_2 - 6 = 78$

( $\because$ when we select 2 same letter from 0 and 3rd letter also from, 0 then this need to be subtracted and such cases are 6)

Case (III) When 3 letters are same

$= 1.\,{}^7c_1 = 7$

Case (IV) When 2 letters are same and other 2 are also same.

$= {}^4c_1 \times {}^3c_1 = 12$

Hence, total number of combination

$= 70 + 78 + 7 + 12 = 167$

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# Question23

**If ${}^nc_r = c_r$ and $2\frac{c_1}{c_0} + 4\frac{c_2}{c_1} + 6\frac{c_3}{c_2} + \ldots. + 2n\frac{c_n}{c_{n-1}} = 650$, then ${}^nC_2 =$**

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**Options:**

A. 25

B. 300

C. 225

D. 625

**Answer: B**

## Solution:

We have,

$$2\frac{c_1}{c_0} + 4\frac{c_2}{c_1} + 6\frac{c_3}{c_2} + \ldots. + 2n\frac{c_n}{c_{n-1}} = 650$$

$$\Rightarrow \sum_{r=1}^{n} 2r\frac{{}^nc_r}{{}^nc_{r-1}} = 650$$

$$\Rightarrow \quad 2\sum_{r=1}^{n} r\left[\frac{\frac{n!}{r!(n-r)!}}{\frac{n!}{(r-1)!(n-r+1)!}}\right]=650$$

$$\Rightarrow 2\sum_{r=1}^{n} r\left[\begin{array}{l}\frac{n!}{r\cdot(r-1)!(n-r)!} \\ \\ \times\frac{(r-1)!(n-r+1)\cdot(n-r)!}{n!}\end{array}\right]$$

$= 650$

$$\Rightarrow \quad 2\Sigma(n-r+1)=650$$

$$\Rightarrow \quad 2\left[n^2+n-\frac{n(n+1)}{2}\right]=650$$

$$\Rightarrow \quad n^2+n-650=0$$

$$\Rightarrow \quad (n+26)(n-25)=0$$

$$\Rightarrow \quad n=25$$

Hence, ${}^{n}c_2={}^{25}c_2=300$

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# Question24

## The total number of all those 3-digit numbers in which the sum of all the digits in each of them is 10 , is

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**Options:**

A. 54

B. 55

C. 56

D. 58

**Answer: A**

## Solution:

Let three digits are $a, b$ and $c$ such that

$a+b+c=10 \quad \ldots(i)$

where, $a \geq 1, b \geq 0, c \geq 0$

Let $d=a-1 \Rightarrow a=d+1$, where $d \geq 0$

$\Rightarrow d+b+c=9$, where $0 \leq d \leq 8$,

$0 \leq b \leq 9, 0 \leq c \leq 9$

Thus, total number of 3 -digits number is

$$\begin{aligned} {}^{9+3-1}C_{3-1}-1={}^{11}C_2-1 \\ =\frac{11 \times 10 \times 9!}{9! \times 2}-1 \\ =55-1=54 \end{aligned}$$

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# Question25

**All the letters of the word 'MOTHER' are written in all possible ways and the strings of letters (with or without meaning), so formed are written as in a dictionary order. Then, the position of the word 'THROEM' is**

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**Options:**

A. 642

B. 648

C. 647

D. 646

**Answer: C**

## Solution:

The number of words start with E , H, M, O and R $=5 \times 5!=5 \times 120=600$

The number of words start with TE $=4!=24$

The number of words start with

THE, THM and THO $= 3 \times 3! = 3 \times 6 = 18$

The number of words start with

THRE, THRM $= 2 \times 2! = 2 \times 2 = 4$

Next word will be "THROEM".

Hence, the position of word "THROEM" is $600 + 24 + 18 + 4 + 1 = 647$

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# Question26

## A student is allowed to select at most $n$ books from a collection of ( $2n + 1$ ) books. If the total number of ways in which he can select at least one book is 255 , then the value of $n$ is

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**Options:**

A. 4

B. 5

C. 6

D. 7

**Answer: A**

## Solution:

A student is allowed to select at most $n$ books from a collection of $(2n + 1)$ books.

The number of ways, he select at least one book is 255.

This selection is given by combination concepts, we get

$$^{2n+1}C_1 + {}^{2n+1}C_2 + {}^{2n+1}C_3 + \ldots + {}^{2n+1}C_n = 255 \quad \ldots (i)$$

We know that, $^nC_r = {}^nC_{n-r}$ and

$$^{2n+1}C_0 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n = \frac{2^{2n+1}}{2}$$

Thus, $2\left({}^{2n+1}C_0 + {}^{2n+1}C_1 + \ldots + {}^{2n+1}C_n\right)$

$= 2^{2n+1}$

$$\Rightarrow \left({}^{2n+1}C_0 + {}^{2n+1}C_1 + \ldots + {}^{2n+1}C_n\right)$$
$$= \frac{2^{2n} \cdot 2}{2} = 2^{2n}$$

$$\Rightarrow \left(1 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n\right)$$
$$= 2^{2n}$$
$$\left[\because {}^{2n+1}C_0 = 1\right]$$

$$\Rightarrow {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots + {}^{2n+1}C_n$$
$$= 2^{2n} - 1 \quad \ldots(ii)$$

Now, comparing the Eqs. (i) and (ii), we get

$$2^{2\pi} - 1 = 255$$
$$\Rightarrow \quad 2^{2\pi} = 256 = 2^8 \Rightarrow 2n = 8$$
$$(\because a^m = a^n \Rightarrow am = n, \quad \text{where } a > 0)$$
$$\Rightarrow \quad n = 4$$

Then, the value of $n$ is 4.

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# Question27

**The number of ways of arranging all the letters of the word "SUNITHA" so that the vowels always occupy the first, middle and last places is**

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**Options:**

A. 5040

B. 24

C. 3

D. 144

**Answer: D**

## Solution:

To determine the number of ways to arrange the letters in "SUNITHA" such that the vowels occupy the first, middle, and last positions, consider the following:

The vowels in "SUNITHA" are A, U, and I.

**Arrangement of Vowels**:

There are 3 vowels that need to be placed in specific positions: the first, middle, and last slots.

These 3 vowels can be arranged in these 3 slots in 3! (factorial of 3) ways.

**Arrangement of Consonants**:

The remaining letters, S, N, T, and H, which are consonants, can occupy the remaining 4 slots.

These 4 consonants can be arranged among themselves in 4! (factorial of 4) ways.

**Calculating the Total Number of Arrangements**:

Multiply the number of arrangements for vowels by the number of arrangements for consonants:

$3! \times 4! = 6 \times 24 = 144$

Thus, there are a total of 144 ways to arrange the letters in "SUNITHA" with vowels occupying the first, middle, and last positions.

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# Question28

## The number of all four digit numbers that can be formed with the digits $0, 1, 2, 3, 4, 5$ when the repetition of the digits is not allowed, is

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**Options:**

A. 360

B. 600

C. 240

D. 300

**Answer: D**

## Solution:

To determine the number of four-digit numbers that can be formed using the digits 0, 1, 2, 3, 4, and 5 without repeating any digits, consider the following:

**Thousand's Place**: This digit cannot be 0 (as it would not be a four-digit number), leaving us with 5 options: 1, 2, 3, 4, or 5.

**Hundred's Place**: After choosing a digit for the thousand's place, there are still 5 remaining digits (including 0) that can be used, since repetition is not allowed.

**Ten's Place**: Once the thousand's and hundred's places are filled, we are left with 4 digits to choose from.

**Unit's Place**: Finally, for the unit's place, there are 3 remaining digits available.

Thus, the total number of four-digit numbers that can be formed is calculated by multiplying the number of choices for each place:

$5 \times 5 \times 4 \times 3 = 300$

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# Question29

## The number of four digit numbers that can be formed using the digits $1, 2, 3, 4, 5, 6$ and 7 which are divisible by 4 , when the repetition of any digit is not allowed,

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**Options:**

A. 100

B. 200

C. 300

D. 400

**Answer: B**

## Solution:

For a number to be divisible by 4, last 2 digits must be divisible by 4 . Possible cases $12, 16, 24, 32, 36, 52, 56, 64, 72, 76$