Permutation & Combination

Question1

Let m denotes the number of ways in which 5 boys and 5 girls can be arranged in a line alternately and n denotes the number of ways in which 5 boys and 5 girls can be arranged in a circle so that no two boys are together. If $m = kn$, then the value of k is MHT CET 2025 (27 Apr Shift 2)

Options:

A. 30

B. 5

C. 6

D. 10

Answer: D

Solution:

Step 1: Linear arrangement (m)

Boys and girls alternate.

- Fix order: start with boy → arrangement unique up to choice.
- Ways: $5! \times 5!$ for permutations.
- Two possible patterns (BGBG... or GBGB...).

So,

$$m = 2 \cdot 5! \cdot 5! = 2 \cdot 120 \cdot 120 = 28800.$$

Step 2: Circular arrangement (n)

Arrange 5 girls in a circle: $(5 - 1)! = 4!$.

Place 5 boys in the 5 gaps: $5!$.

So,

$$n = 4! \cdot 5! = 24 \cdot 120 = 2880.$$

Step 3: Ratio

$$m = kn \quad \Rightarrow \quad k = \frac{28800}{2880} = 10.$$

✅ Final Answer:

$$\boxed{10}$$

Option (D)

Question2

The number of ways in which 6 boys and 4 girls can be seated around a round table such that 2 special boys and a special girl never sit together is MHT CET 2025 (26 Apr Shift 2)

Options:

A. 332620

B. 332540

C. 332640

D. 332520

Answer: C

Solution:

Interpretation (standard): "2 special boys and a special girl **never sit together**" = the three specified persons are **not all consecutive as a block.**

- Total circular arrangements of 10 distinct people: $(10-1)! = 9! = 362880$.
- Arrangements where the three specials sit together as one block:
  - Treat the trio as one block → $7!$ circular ways.
  - Internal arrangements of the trio → $3!$ ways.
  - Count $= 7! \cdot 3! = 5040 \cdot 6 = 30240$.

So required number:

$$9! - 7! \cdot 3! = 362880 - 30240 = \boxed{332640}.$$

Correct option: C (332640).

Question3

The number of ways in which a team of 11 players can be formed out of 25 players, if 6 out of them are always to be included and 5 of them are always to be excluded, is MHT CET 2025 (26 Apr Shift 1)

Options:

A. 2002

B. ${}^{20}C_{11}$

C. ${}^{20}C_6$

D. ${}^{14}C_6$

Answer: A

Solution:

- Total players = 25.
- 6 are **always included**, 5 are **always excluded**.

So effectively, we must choose the remaining $11 - 6 = 5$ players from

$$25 - (6 + 5) = 14 \quad \text{players.}$$

Number of ways:

$$\binom{14}{5} = 2002.$$

✅ **Final Answer: 2002 (Option A)**

Question4

There are 11 points in a plane of which 5 points are collinear. Then the total number of distinct quadrilaterals with vertices at these points is MHT CET 2025 (25 Apr Shift 2)

Options:

A. 265

B. 330

C. 250

D. 325

Answer: A

Solution:

Given: 11 points, among them 5 are collinear. Find number of quadrilaterals (no three of chosen four collinear).

Formula used:
Total 4-point choices: $\binom{11}{4}$.
Invalid sets = (4 from the collinear 5) $+$ (3 from the collinear 5 and 1 from the remaining 6).

Compute:

$$\binom{11}{4} = 330, \quad \binom{5}{4} = 5, \quad \binom{5}{3}\binom{6}{1} = 10 \cdot 6 = 60.$$

Valid $= 330 - (5 + 60) = 330 - 65 = 265.$

Concept: A quadrilateral needs four vertices with no three collinear; any selection containing 3 (or 4) of the 5 collinear points is degenerate and must be excluded.

✅ **Final Answer: 265 (Option A)**

Question5

A family consisting of a mother, father and their 8 children (4 boys and 4 girls) are to be seated at a round table in a party. How many ways can this be done if the mother and father sit together and the males and females alternate? MHT CET 2025 (23 Apr Shift 1)

Options:

A. 567

B. 765

C. 657

D. 576

Answer: D

Solution:

- Seat the **5 males** around a round table: $(5-1)! = 4!$ ways.
- There are **5 gaps** for females. For the **mother** to sit next to the **father**, she must be in one of the **two** gaps adjacent to the father: 2 choices.
- Arrange the remaining **4 girls** in the remaining **4** gaps: $4!$ ways.

Count (with only rotations considered the same):

$$4! \times 2 \times 4! = 24 \times 2 \times 24 = 1152.$$

If the table is considered **undirected** (clockwise and anticlockwise same), divide by 2:

$$\frac{1152}{2} = \boxed{576}.$$

✅ **Final Answer: 576 (Option D)**

Question6

If four digit numbers are formed by using the digits $1, 2, 3, 4, 5, 6, 7$ without repetition, then out of these numbers, the numbers exactly divisible by 25 are MHT CET 2025 (22 Apr Shift 2)

Options:

A. 20

B. 40

C. 50

D. 51

Answer: B

Solution:

Rule used: A number is divisible by 25 iff its last two digits are $00,\ 25,\ 50,\ 75$.

Here digits are $1–7$ (no 0), no repetition ⇒ possible endings: **25** or **75**.

- Ending **25**: first two places from remaining $\{1,3,4,6,7\} \rightarrow {}^5P_2 = 5 \cdot 4 = 20$.
- Ending **75**: first two places from $\{1,2,3,4,6\} \rightarrow {}^5P_2 = 20$.

Total $= 20 + 20 = 40$.

✅ **Final Answer: 40 (Option B)**

Question7

21 friends were invited for a party. Two round tables can accommodate 12 and 9 friends each. The number of ways of the seating arrangements of friends is ..... MHT CET 2025 (22 Apr Shift 1)

Options:

A. $11! \times 8!$

B. $12! \times 9!$

C. $\frac{35}{9} \times 19!$

D. $\frac{20!}{12!8!} \times 11! \times 9!$

Answer: C

Solution:

We have **21 friends**, two round tables: one of size **12**, other of size **9**.

Step 1: Choose who sits where

Select 12 people for the first table:

$$\binom{21}{12}$$

Remaining 9 automatically go to the second table.

Step 2: Seating around round tables

- Seating n people around a round table = $(n-1)!$.
  So:
- For 12 friends: $11!$ ways
- For 9 friends: $8!$ ways

Step 3: Total arrangements

$$\binom{21}{12} \times 11! \times 8!$$

Step 4: Simplify

$$\binom{21}{12} = \frac{21!}{12!\,9!}$$

So total =

$$\frac{21!}{12!\,9!} \times 11! \times 8! = \frac{21!}{12 \cdot 9} \times 19! = \frac{35}{9} \times 19!$$

✅ **Final Answer:** $\frac{35}{9} \times 19!$ **(Option C)**

Question8

If $^{n+4}C_{n+1} - {}^{n+3}C_n = 15(n+2)$, then $n =$ MHT CET 2025 (21 Apr Shift 2)

Options:

A. 15

B. 23

C. 21

D. 27

Answer: D

Solution:

We are solving:

$$^{n+4}C_{n+1} -^{n+3} C_n = 15(n+2)$$

Step 1: Expand combinations

$$^{n+4}C_{n+1} = \frac{(n+4)!}{(n+1)!(3!)} = \frac{(n+4)(n+3)(n+2)}{6}$$

$$^{n+3}C_n = \frac{(n+3)!}{n!(3!)} = \frac{(n+3)(n+2)(n+1)}{6}$$

Step 2: Subtract

$$^{n+4}C_{n+1} - ^{n+3}C_n = \frac{(n+3)(n+2)}{6}[(n+4)-(n+1)]$$

$$= \frac{(n+3)(n+2)}{6} \cdot 3 = \frac{(n+3)(n+2)}{2}$$

Step 3: Equation

$$\frac{(n+3)(n+2)}{2} = 15(n+2)$$

Cancel $(n+2)$ (non-zero):

$$\frac{n+3}{2} = 15$$

$$n+3 = 30 \quad \Rightarrow \quad n = 27$$

✅ Final Answer: $n = 27$ (Option D)

Question9

The greatest possible number of points of intersection of 8 distinct straight lines and 4 distinct circles is MHT CET 2025 (21 Apr Shift 1)

Options:

A. 28

B. 104

C. $^{12}C_2$

D. $^{4}C_2$

Answer: B

Solution:

Max intersections (general position: no tangencies, no three concurrent):

- Line–line: $\binom{8}{2} = 28$.
- Circle–circle: each pair meets in 2 points ⇒ $2\binom{4}{2} = 2 \cdot 6 = 12$.
- Line–circle: each line meets each circle in 2 points ⇒ $8 \cdot 4 \cdot 2 = 64$.

Total $= 28 + 12 + 64 = 104$.

✅ **Final Answer: 104 (Option B)**

Question10

The probability that in a random arrangement of the letters of the word 'UNIVERSITY' , the two 'I' s do not come together is MHT CET 2025 (21 Apr Shift 1)

Options:

A. $\frac{1}{5}$

B. $\frac{1}{10}$

C. $\frac{4}{5}$

D. $\frac{3}{10}$

Answer: C

Solution:

Word **UNIVERSITY** has 10 letters with 2 I's.

- Total arrangements = $\frac{10!}{2!}$.
- Treat the 2 I's as 1 block ⇒ effective letters = 9 ⇒ arrangements = $9!$.
- Probability that I's are together = $\frac{9!}{\frac{10!}{2}} = \frac{2}{10} = \frac{1}{5}$.
- Probability that I's are **not together** = $1 - \frac{1}{5} = \frac{4}{5}$.

✅ **Final Answer:** $\frac{4}{5}$ **(Option C)**

Question11

4 red balls and 5 green balls are selected from n balls. If the sum of both the selections is greater then ${}^{n+1}C_4$ then the value of n is equal to MHT

CET 2025 (20 Apr Shift 2)

Options:

A. $n > 8$

B. n < 8

C. $n > 10$

D. $n > 12$

Answer: A

Solution:

Let the counts be:

- ways to choose 4 red from n: $\binom{n}{4}$
- ways to choose 5 green from n: $\binom{n}{5}$

Given:

$$\binom{n}{4} + \binom{n}{5} > \binom{n+1}{4}$$

Use identity: $\binom{n+1}{4} = \binom{n}{4} + \binom{n}{3}$

So,

$$\binom{n}{5} > \binom{n}{3}$$

$$\frac{\binom{n}{5}}{\binom{n}{3}} = \frac{(n-3)(n-4)}{20} > 1 \Rightarrow (n-3)(n-4) > 20$$

$$n^2 - 7n + 12 > 20 \Rightarrow n^2 - 7n - 8 > 0$$

Roots: $\frac{7 \pm 9}{2} = -1, 8$. Hence for integer n,

$$\boxed{n > 8}.$$

Answer: A

Question12

A regular polygon has 20 sides. The number of triangles that can be drawn by using the vertices but not using the sides are MHT CET 2025 (20 Apr Shift 1)

Options:

A. 1140

B. 800

C. 340

D. 20

Answer: B

Solution:

Total triangles from 20 vertices:
$\binom{20}{3} = 1140.$

Subtract those that use at least one polygon side.

For each of the 20 sides, pick the third vertex in $20 - 2 = 18$ ways $\Rightarrow 20 \cdot 18.$

But triangles formed by **three consecutive vertices** (2 sides) are counted twice; there are 20 of them.

So invalid $= 20 \cdot 18 - 20 = 20(18 - 1) = 20 \cdot 17 = 340.$

Required: $1140 - 340 = 800.$

✅ Final Answer: 800 (Option B)

Question13

Total number of 3-digit numbers, whose g.c.d with 36 is 2 , is MHT CET 2025 (19 Apr Shift 2)

Options:

A. 140

B. 150

C. 165

D. 170

Answer: B

Solution:

Idea: For $\gcd(n, 36) = 2$ with $36 = 2^2 \cdot 3^2$, a 3-digit number n must be:

- even but **not** divisible by $4 \Rightarrow n \equiv 2 \pmod 4$,
- **not** divisible by 3.

Numbers $n \equiv 2 \pmod 4$ have residues $2, 6, 10 \pmod{12}$. Exclude those $\equiv 6 \pmod{12}$ (multiples of 3).

So valid residues: 2 or 10 mod 12.

Count in $[100, 999]$:

- $n \equiv 2 \pmod{12}$: from 110 to $998 \rightarrow \frac{998-110}{12} + 1 = 75$.
- $n \equiv 10 \pmod{12}$: from 106 to $994 \rightarrow \frac{994-106}{12} + 1 = 75$.

Total $= 75 + 75 = 150$.

✅ **Final Answer: 150 (Option B)**

Question14

The number of ways, in which 6 boys and 5 girls can sit at a round table, if no two girls are to sit together, is MHT CET 2025 (19 Apr Shift 1)

Options:

A. 518400

B. 14400

C. 86400

D. 17280

Answer: C

Solution:

Arrange boys first: seat 6 boys around a round table $\rightarrow (6-1)! = 5! = 120$ ways.

Place girls: there are 6 gaps between boys; choose 5 distinct gaps and permute the 5 girls $\binom{6}{5} \cdot 5! = 6 \cdot 120 = 720$.

Total: $120 \times 720 = 86400$.

✅ **Final Answer: 86400 (Option C)**

Question15

A five digit number divisible by 3 is to be formed using the digits $0, 1, 2, 3, 4, 5$ without repetition, then the total number of ways this can be done is MHT CET 2024 (16 May Shift 2)

Options:

A. 216

B. 240

C. 96

D. 120

Answer: A

Solution:

We know that a five digit number is divisible by 3 , if and only if sum of its digits $(=15)$ is divisible by 3. Therefore, we should not use 0 and 3 in a same number while forming the five digit numbers.

Now,

i. In case we do not use 0 , the five digit number can be formed (using digits $1, 2, 3, 4, 5$) in ${}^5P_5 = 120$ ways.

ii. In case we do not use 3, the five digit number can be formed (using digits $0, 1, 2, 4, 5$) in ${}^5P_5 - {}^4P_4 = 5! - 4! = 120 - 24 = 96$ ways

$\therefore$ The total number of such 5 digit number $= 120 + 96 = 216$

Question16

Eight chairs are numbered 1 to 8 . Two women and three men wish to occupy one chair each. First the women choose chairs from amongst the chairs marked 1 to 4 , and then the men select the chairs from amongst the remaining. The number of possible arrangements is MHT CET 2024 (16 May Shift 1)

Options:

A. ${}^6C_3 \times {}^4C_2$

B. ${}^4P_2 \times {}^6P_3$

C. ${}^{4}\dot{C}_2 + {}^{4}\mathrm{P}_3$

D. ${}^{4}\mathrm{P}_2 + {}^{6}\mathrm{P}_3$

Answer: B

Solution:

Two women can be made to sit on chairs marked 1 to 4 in ${}^{4}P_2$ ways and then three men can be seated in 6 available seats in ${}^{6}\mathrm{P}_3$ ways.$\therefore$ number of possible arrangements is ${}^{4}\mathrm{P}_2 \times {}^{6}\mathrm{P}_3$.

Question17

There are 3 sections in a question paper and each section contains 5 questions. A candidate has to answer a total of 5 questions, choosing at least one question from each section. Then the number of ways, in which the candidate can choose the questions, is MHT CET 2024 (15 May Shift 2)

Options:

A. 750

B. 1500

C. 2255

D. 2250

Answer: D

Solution:

Total number of ways

$$= {}^{5}\mathrm{C}_1 \times {}^{5}\mathrm{C}_1 \times {}^{5}\mathrm{C}_3 + {}^{5}\mathrm{C}_1 \times {}^{5}\mathrm{C}_2 \times {}^{5}\mathrm{C}_2$$
$$+ {}^{5}\mathrm{C}_1 \times {}^{5}\mathrm{C}_3 \times {}^{5}\mathrm{C}_1 + {}^{5}\mathrm{C}_2 \times {}^{5}\mathrm{C}_1 \times {}^{5}\mathrm{C}_2$$

$$
\begin{aligned}
&+{}^5C_2 \times {}^5C_2 \times {}^5C_1 + {}^5C_3 \times {}^5C_1 \times {}^5C_1 \\
&= 5 \times 5 \times 10 + 5 \times 10 \times 10 + 5 \times 10 \times 5 \\
&\quad + 10 \times 5 \times 10 + 10 \times 10 \times 5 + 10 \times 5 \times 5 \\
&= 250 + 500 + 250 + 500 + 500 + 250 \\
&= 2250
\end{aligned}
$$

Question18

The number of arrangements, of the letters of the word MANAMA in which two M's do not appear adjacent, is MHT CET 2024 (11 May Shift 2)

Options:

A. 40

B. 60

C. 80

D. 100

Answer: A

Solution:

There are 6 letters.

M repeats 2 times,

A repeats 3 times.

We first arrange all letters except $2\mathrm{M}'\mathrm{s}$ in $\frac{4!}{3!} = 4$ ways

These 4 letters create 5 gaps, where we can arrange $2\mathrm{M}'\mathrm{s}$ in $\frac{{}^5\mathrm{P}_2}{2!} = 10$ ways

$\therefore$ Required number of arrangements $= 4 \times 10 = 40$

Question19

__________ numbers greater than a million can be formed with the digits 2, 3, 0, 3, 4, 2, 3.

Options:

A. 60

B. 360

C. 420

D. 120

Answer: B

Solution:

All seven-digit numbers formed with the given digits are greater than a million.

Note that the digit at millions place cannot be 0 .

∴ It can be any one of the digits 2,3,4.

Case I :

Digit at millions place is ' 2 '.

Remaining 6 digits can be arranged in $\frac{6!}{3!}=120$ ways.

Case II :

Digit at millions place is ' 3 '.

Remaining 6 digits can be arranged in $\frac{6!}{2!\times 2!}=180$ ways.

Case III :

Digit at millions place is ' 4 '.

Remaining 6 digits can be arraigned in $\frac{6!}{3!\times 2!}=60$ ways

$$\begin{aligned}\therefore \quad \text{Required number of numbers} &= 120+180+60 \\ &= 360\end{aligned}$$

Question20

Words of length 10 are formed by using the letters A, B, C, D, E, F, G, H, I, J. Let x. be number of such words where no letter is repeated and y be number of such words where exactly two letters are repeated twice and no other letter is repeated, then the value of $\frac{y}{x}$ is MHT CET 2024 (10 May Shift 1)

Options:

A. 45

B. 415

C. 315

D. 215

Answer: C

Solution:

Letters are A, B, C, D, E, F, G, H, I, J

Number of words that can be formed by

$$10 \text{ letters } = 10! \times {}^{10}C_{10}$$

$$\therefore \quad x = 10!$$

Now, for repetition of two letters. Two letters can be selected in ${}^{10}C_2$ ways which are used twice in the word and remaining 6 letters can be selected from 8 letters in ${}^{8}C_6$ ways. Hence, Number

$$= {}^{10}C_2 \times {}^{8}C_6 \times \frac{10!}{2! \times 2!}$$

$$\therefore \quad y = {}^{10}C_2 \times {}^{8}C_6 \times \frac{10!}{2! \times 2!}$$

of words can be formed $\therefore$

$$\frac{y}{x}=\frac{{}^{10}C_2\times{}^{8}C_2\times\frac{10!}{2!\times 2!}}{10!}$$

$$=\frac{{}^{10}C_2\times{}^{8}C_6}{2!\times 2!}$$

$$=\frac{45\times 28}{4}$$

$$=315$$

Question21

Consider a group of 5 boys and 7 girls. The number of different teams, consisting of 2 boys and 3 girls that can be formed from this group if there are two specific girls A and B , who refuse to be the members of the same team, is MHT CET 2024 (09 May Shift 2)

Options:

A. 350

B. 300

C. 200

D. 500

Answer: B

Solution:

There are 5 boys and 7 girls in a class.

Total number of ways $= {}^5C_2 \times {}^7C_3 = 350$

If both girls A and B are in the same team, then ${}^5C_1 \times {}^5C_2 = 50$

$\therefore$ Required number of ways

$=$ Total number of ways

- Both girls A and B are in the same team

$= 350 - 50 = 300$

Question22

Five persons A, B, C, D and E are seated in a circular arangement, if each of them is given a hat of one of the three colours red, blue and green, then the number of ways, of distributing the hats such that the person seated in adjacent seats get different coloured hats, is MHT CET 2024 (04 May Shift 2)

Options:

A. 30

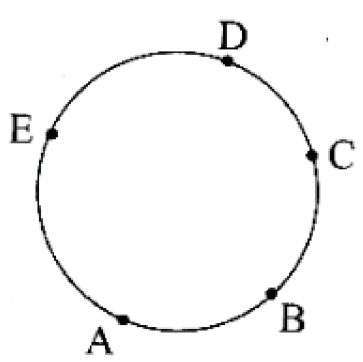
B. 15

C. 60

D. 40

Answer: A

Solution:



Given, 5 persons having 5 hats of colour red, blue and green

$\therefore$ i.e., 3 colours

Maximum 2 hats of same colour can be used.

$\therefore$ Number of ways of selecting single colour hat out of 3 colours $= {}^3C_1$ ways.

$\therefore$ Single colour hat is distributed in 5 persons in ${}^5C_1$ ways

Also, number of ways to distribute alternative coloured hat to adjacent person $= {}^2C_1$

$$\begin{aligned} \therefore \quad \text{Required number of ways } &= {}^3C_1 \times {}^5C_1 \times {}^2C_1 \\ &= 3 \times 5 \times 2 \\ &= 30 \end{aligned}$$

Question23

The number of ways in which 5 boys and 3 girls can be seated on a round table, if a particular boy B_1 and a particular girl G_1 never sit adjacent to each other, is MHT CET 2024 (04 May Shift 1)

Options:

A. 7 !

B. 5×6 !

C. 6×6 !

D. 5×7 !

Answer: B

Solution:

First, we arrange 4 boys and 2 girls (excluding B_1 and G_1) around the table, which can be done in 5! ways.

In any such arrangement, B_1 and G_1 can be arranged in 6 available gaps in ${}^6P_2 = 6 \times 5$ ways.

$\therefore$ Total number of arrangements $= 5! \times 6 \times 5$

$= 6! \times 5$

Question24

A committee of 11 members is to be formed from 8 males and 5 females. If m is the number of ways the committee is formed with at least 6 males and n is the number of ways the committee is formed with at least 3 females, then MHT CET 2024 (03 May Shift 2)

Options:

A. $\mathrm{m}+\mathrm{n}=68$

B. $\mathrm{m}=\mathrm{n}=78$

C. $\mathrm{m}=\mathrm{n}=68$

D. $\mathrm{n}=\mathrm{m}-8$

Answer: B

Solution:

A committee of 11 members is to be formed form 8 males and 5 females.$\therefore$ When atleast 6 males are included, the committee contains(6 Males and 5 females), (7 males and 4 females), (8 males and 3 Females)

$\therefore$ Required number of ways

$$= {}^{8}C_{6} \times {}^{5}C_{5} + {}^{8}C_{7} \times {}^{5}C_{4} + {}^{8}C_{8} \times {}^{5}C_{3}$$

$\therefore \quad m = 78$

When atleast 3 females are included, the committee contains

(3 females and 8 males), (4 females and 7 males), (5 females and 6 males)

$\therefore$ Required number of ways

$$= {}^{5}C_{3} \times {}^{8}C_{8} + {}^{5}C_{4} \times {}^{8}C_{7} + {}^{5}C_{5} \times {}^{8}C_{6}$$

$$= 78$$

$\therefore \quad n = 78$

$\therefore \quad m = n = 78$

Question25

The number of four letter words that can be formed using letters of the word BARRACK is MHT CET 2024 (03 May Shift 1)

Options:

A. · 120

B. 264

C. 270

D. 144

Answer: C

Solution:

Word BARRACK has 7 letters in which 'A' and ' R ' repeats twice.
Case I :

All four letters are different. (B, A, R, C, K)

$\therefore$ No. of letters $= {}^5C_4 \times 4! = 120$

Case II :

' R ' repeats twice and remaining letter three letters are different (B, A, C, K)

$\therefore$ No. of letters $= {}^4C_2 \times \frac{4!}{2!} = 72$

Case III :

'A' repeats twice and remaining letter three letters are different (B, R, C, K)

$\therefore$ No. of letters $= {}^4C_2 \times \frac{4!}{2!} = 72$

Case IV :

Both 'A' and 'R' repeat twice.

$\therefore$ No. of letters $= \frac{4!}{2!2!} = 6$

$\therefore$ Total no. of letters form $= 120 + 72 + 72 + 6$

$= 270$

Question26

Number of different nine digit numbers, that can be formed from the digits in the number 223355888 by rearranging its digits, so that the odd digits occupy even positions, is MHT CET 2024 (02 May Shift 2)

Options:

A. 16

B. 40

C. 60

D. 180

Answer: C

Solution:

Since $3, 3, 5, 5$, i.e., odd digits occupy even positions and $2, 2, 8, 8, 8$ occupy remaining 5 odd places.

$$\therefore \quad \text{Required number of ways } = \frac{4!}{2!2!} \cdot \frac{5!}{2!3!} = 6 \times 10 = 60$$

Question27

If 3 books on Physics, 2 books on Chemistry and 4 books on Mathematics are to be arranged on a shelf so that all the Physics books are together and all the Mathematics books are together, then the number of such arrangements is MHT CET 2024 (02 May Shift 1)

Options:

A. 576

B. 288

C. 3456

D. 1152

Answer: C

Solution:

There are 3 books on physics, 2 books on Chemistry and 4 books on Mathematics.

All Physics books and Mathematics books are kept together.

∴ All Physics books will be considered as 1 unit and all Mathematics books are also considered as 1 unit.

∴ Physics, Mathematics and 2 Chemistry books can be arranged in 4 ! ways.

Also, 3 Physics and 4 Mathematics books can be arranged themselves in 3! × 4 ! ways

$$\therefore \quad \text{Total number of arrangements } = 4! \times 3! \times 4! = 3456$$

Question28

If in a regular polygon, the number of diagonals are 54 , then the number of sides of the polygon are MHT CET 2023 (14 May Shift 2)

Options:

A. 10

B. 12

C. 9

D. 6

Answer: B

Solution:

Number of diagonals in a polygon of n sides is ${}^{n}C_2 - n$.

$$
\begin{aligned}
\therefore \quad & {}^{n}C_2 - n = 54 \\
& \Rightarrow \frac{n(n-1)}{2} - n = 54 \\
& \Rightarrow n^2 - 3n - 108 = 0 \\
& \Rightarrow (n-12)(n+9) = 0
\end{aligned}
$$

But, number of sides cannot be negative.

$$\therefore \quad n = 12$$

Question29

A linguistic club consists of 6 girls and 4 boys. A team of 4 members is to be selected from this group including the selection of a leader (from among these 4 members) for the team. If the team has to include at most one boy, the number of ways of selecting the team is MHT CET 2023 (14 May Shift 1)

Options:

A. 140

B. 320

C. 76

D. 380

Answer: D

Solution:

Case I: No boy is included.

Selecting 4 girls from 6 girls $= {}^6C_4$

Selecting 1 captain from selected members $= {}^4C_1$

Total number of ways $= {}^6C_4 \times {}^4C_1 = 60$

Case II: One boy is included.

Selecting 3 girls and 1 boy from given members $= {}^6C_3 \times {}^4C_1$.

Selecting 1 captain from the selected members $= {}^4C_1$.

Total Number of ways $= {}^6C_3 \times {}^4C_1 \times {}^4C_1 = 320$.

$\therefore$ Total Number of ways $= 320 + 60 = 380$.

Question30

Five students are selected from n students such that the ratio of number of ways in which 2 particular students are selected to the number of ways 2 particular students not selected is $2 : 3$. Then the value of n is MHT CET 2023 (13 May Shift 2)

Options:

A. 5

B. 6

C. 11

D. not possible

Answer: C

Solution:

Five students are selected from n students. Number of ways in which 2 particular students are sélected $={ }^{\mathrm{n}-2}\mathrm{C}_3$

Number of ways in which 2 particular students are not selected $={ }^{\mathrm{n}-2}\mathrm{C}_5$

$\therefore$ According to the given condition,

$$\frac{{ }^{n-2}C_3}{{ }^{n-2}C_5}=\frac{2}{3}$$

$$\Rightarrow \frac{(\mathrm{n}-2)!}{3!(\mathrm{n}-5)!} \times \frac{5!(\mathrm{n}-7)!}{(\mathrm{n}-2)!}=\frac{2}{3}$$

$$\Rightarrow(\mathrm{n}-5)(\mathrm{n}-6)=30$$

$$\Rightarrow \mathrm{n}=11$$

Question31

Five persons $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}$ and E are seated in a circular arrangement. If each of them is given a cap of one of the three colours red, blue and green, then the number of ways of distributing the caps such that the persons seated in adjacent seats get different coloured caps, is MHT CET 2023 (13 May Shift 1)

Options:

A. 30

B. 15

C. 60

D. 40

Answer: A

Solution:

There are 5 caps and 3 colours.

$\therefore$ At least one colour will get repeated. As adjacent caps should be of different colours, no colour can repeat thrice.

$\therefore$ Exactly two colours will repeat twice.

∴ Colour of the caps are selected in 3 ways as follows:

Red-Red-Green-Green-Blue, Red-Red-Green-Blue-Blue, Red-Green-Green-Blue-Blue.

Now, while distributing the caps from above combinations, we choose any one of the 5 persons and give single colour cap. And remaining four caps can be distributed in alternate colour sequence, clock-wise or anticlock-wise.

This can be done in 5×2 ways.

∴ Required number of ways $= 3 \times 5 \times 2 = 30$

Question32

The number of words that can be formed by using the letters of the word CALCULATE such that each word starts and ends with a consonant, are MHT CET 2023 (12 May Shift 2)

Options:

A. $5 \times 7!$

B. $\frac{9!}{8}$

C. $\frac{5\times7!}{2}$

D. $20 \times 7!$

Answer: C

Solution:

Word CALCULATE has 9 letters.

Out of which ' C ' repeats 2 times,

'A' repeats 2 times,

' L ' repeats 2 times,

'E', 'U' and ' T ' repeats once.

$\therefore$ There are 5 consonants and 4 vowels.

Two consonants out of 5 can take start and end position of the word in $^5P_2$ ways.

And remaining 7 letters can take remaining 7 positions in 7 ! ways.

Also, 'C', 'A' and ' L ' repeats twice each.

$\therefore$ The required number of words that can be formed $= \frac{5p_2 \times 7!}{2! \times 2! \times 2!} = \frac{5 \times 4 \times 3! \times 7!}{3! \times 2 \times 2 \times 2} = \frac{5 \times 7!}{2}$

Question33

If T_n denotes the number of triangles which can be formed using the vertices of regular polygon of n sides and $\mathrm{T}_{\mathrm{n}+1} - \mathrm{T}_{\mathrm{n}} = 21$, then $\mathrm{n} =$
MHT CET 2023 (12 May Shift 1)

Options:

A. 5

B. 7

C. 6

D. 4

Answer: B

Solution:

According to the given condition, $\mathrm{T}_{\mathrm{n}} = {}^{\mathrm{n}}\mathrm{C}_3$

$$\therefore \quad \mathrm{T}_{\mathrm{n}+1} - \mathrm{T}_{\mathrm{n}} = 21 \Rightarrow {}^{\mathrm{n}+1}\mathrm{C}_3 - {}^{\mathrm{n}}\mathrm{C}_3 = 21$$

Note that $\mathrm{n}=7$ satisfies the above condition.$\therefore$ Option (B) is correct.

Question34

Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards. Then mean of number of tens is MHT CET 2023 (11 May Shift 2)

Options:

A. $\frac{1}{13}$

B. $\frac{1}{169}$

C. $\frac{2}{13}$

D. $\frac{4}{169}$

Answer: C

Solution:

Probability of getting ten $=\frac{4}{52}=\frac{1}{13}$

$\therefore$ Probability of getting a card without ten $=\frac{12}{13}$

Let random variable X denotes the number of tens.

$\therefore$ Possible values of X are $0,1,2$

Consider following probability distribution table.

$\mathrm{X}=x$	0	1	2
$\mathrm{P}(\mathrm{X}=x)$	$\frac{12}{13}\times\frac{12}{13}$	$\frac{1}{13}\times\frac{12}{13}+\frac{12}{13}\times\frac{1}{13}$	$\frac{1}{13}\times\frac{1}{13}$

∴ Required mean

$$= 0 + 1 \times \left(\frac{12}{13 \times 13} + \frac{12}{13 \times 13}\right) + 2 \times \left(\frac{1}{13} \times \frac{1}{13}\right)$$
$$= \frac{24}{169} + \frac{2}{169}$$
$$= \frac{26}{169}$$
$$= \frac{2}{13}$$

Question35

The teacher wants to arrange 5 students on the platform such that the boy B_1 occupies second position and the girls G_1 and G_2 are always adjacent to each other, then the number of such arrangements is MHT CET 2023 (11 May Shift 2)

Options:

A. 24

B. 12

C. 8

D. 16

Answer: C

Solution:

There are 5 positions. Given that B_1 occupies 2^{nd} position

$\therefore$ B_1 can be arranged in 1 way. As G_1 and G_2 are always together, none of them can take 1^{st} position.

$\therefore$ G_1, G_2 and one of the remaining students can be arranged on $3^{rd}, 4^{th}$ and 5^{th} position when G_1 and G_2 are always together in $2! \times 2!$ Ways.

And remaining 2 students can be arranged in 2 ! Ways.

$\therefore$ The required number of arrangements

$$= 2! \times 2! \times 2!$$
$$= 8$$

Question36

Five students are to be arranged on a platform such that the boy B_1 occupies the second position and such that the girl G_1 is always adjacent to the girl G_2. Then, the number of such possible arrangements is MHT CET 2023 (11 May Shift 1)

Options:

A. 4

B. 7

C. 8

D. 6

Answer: C

Solution:

There are 5 positions. Given that B_1 occupies 2^{nd} position

$\therefore$ B_1 can be arranged in 1 way. As G_1 and G_2 are always together, none of them can take 1^{st} position.

$\therefore$ G_1, G_2 and one of the remaining students can be arranged on 3^{rd}, 4^{th} and 5^{th} position when G_1 and G_2 are always together in $2! \times 2!$ Ways.

And remaining 2 students can be arranged in 2 ! Ways.

$\therefore$ The required number of arrangements

$$= 2! \times 2! \times 2!$$
$$= 8$$

Question37

A group consists of 8 boys and 5 girls, then the number of committees of 5 persons that can be formed, if committee consists of at least 2 girls and at most 2 boys, are MHT CET 2023 (10 May Shift 1)

Options:

A. 300

B. 320

C. 321

D. 322

Answer: C

Solution:

A committee of 5 is to be formed from 8 boys and 5 girls so that it consists of at least 2 girls and at most 2 boys.Total number of ways

$$= (\text{ Five girls }) + (4 \text{ girls })(1 \text{ boy }) + (3 \text{ girls }) (2 \text{ boys })$$
$$= {}^{5}C_5 + {}^{5}C_4 \times {}^{8}C_1 + {}^{5}C_3 \times {}^{8}C_2$$
$$= 1 + (5 \times 8) + (10 \times 28)$$
$$= 1 + 40 + 280$$
$$= 321$$

Question38

A linguistic club of a certain Institute consists of 6 girls and 4 boys. A team of 4 members to be selected from this group including the selection of a Captain (from among these 4 members) for the team. If the team has to include atmost one boy, the number of ways of selecting the team is MHT CET 2023 (09 May Shift 2)

Options:

A. 95

B. 260

C. 320

D. 380

Answer: D

Solution:

Case I: No boy is included. Selecting 4 girls from 6 girls $= {}^6C_4$

Selecting 1 captain from selected members $= {}^4C_1$ Total number of ways $= {}^6C_4 \times {}^4C_1 = 60$

Case II: One boy is included.

Selecting 3 girls and 1 boy from given members $= {}^6C_3 \times {}^4C_1$.

Selecting 1 captain from the selected members $= {}^4C_1$.

Total Number of ways $= {}^6C_3 \times {}^4C_1 \times {}^4C_1 = 320$.

Total Number of ways $= 320 + 60 = 380$.

Question39

If at the end of certain meeting, everyone had shaken hands with everyone else, it was found that 45 handshakes were exchanged, then the number of members present at the meeting, are MHT CET 2023 (09 May Shift 1)

Options:

A. 10

B. 15

C. 20

D. 21

Answer: A

Solution:

Let ' n ' be the number of members in the meeting. $\therefore$ Total number of handshakes $= {}^{n}C_2$. $\therefore$ ${}^{n}C_2 = 45$

$$\frac{n!}{2!(n-2)!} = 45$$

$$\frac{n(n-1)(n-2)!}{2\times(n-2)!} = 45$$

$$n(n-1) = 90$$

$$\therefore \quad n^2 - n - 90 = 0$$

$$n = 10 \text{ or } n = -9 \text{ (not possible)}$$

$$\therefore \quad n = 10$$

Question40

A man P has 7 friends, 4 of them are ladies and 3 are men, His wife Q also has 7 friends, 3 of them are ladies and 4 are men. Assume P and Q have no common friends. Then the total number of ways in which P and Q together can throw a party inviting 3 ladies and 3 men, so that 3 friends of each of P and Q are in this party, is ______
MHT CET 2022 (11 Aug Shift 1)

Options:

A. 468

B. 485

C. 484

D. 469

Answer: B

Solution:

P[7]		Q[7]		number of ways
L (4)	M (3)	L (3)	M (4)	
3	0	0	3	${}^4C_3 \times {}^3C_0 \times {}^3C_0 \times {}^4C_3 = 16$
2	1	1	2	${}^4C_2 \times {}^3C_1 \times {}^3C_1 \times {}^4C_2 = 324$
1	2	2	1	${}^4C_1 \times {}^3C_2 \times {}^3C_2 \times {}^4C_1 = 144$
0	3	3	0	${}^4C_0 \times {}^3C_0 \times {}^3C_0 \times {}^4C_0 = 1$

Total number of ways $= 485$

Question41

Number of ways, in which 6 men and 5 women can sit at a round table, if no two women sit together, are MHT CET 2022 (10 Aug Shift 1)

Options:

A. $5! \times 4!$

B. $6! \times 5!$

C. 30

D. $7! \times 5!$

Answer: B

Solution:

6 men can be seated around a round table in 5! ways

Now, 5 women can be seated in 6 places in 6 ! ways

Hence total number of ways is $6! \times 5!$

Question42

There are 6 periods in each working day of a school. The number of ways one can arrange 5 subjects such that each is allowed at least one period, is MHT CET 2022 (08 Aug Shift 2)

Options:

A. 1800

B. 725

C. 720

D. 5

Answer: A

Solution:

First of all we can choose the subject which is to be repeated twice in $^5C_1$ ways

Now 6 subjects with one repeation can be arranged among 6 periods in

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

Hence, total number of ways $^5C_1 \times \frac{6!}{2!} = 1800$

Question43

A round table conference is to be held amongst 20 countries. If two particular delegates wish to sit together, then such arrangements can be done in ways. MHT CET 2022 (07 Aug Shift 1)

Options:

A. $2 \times (18)!$

B. $\frac{19!}{2!}$

C. $18!$

D. $19! \times 2!$

Answer: A

Solution:

We consider two particular delegates as single unit now 19 units can be arranged around a round table in 18! ways and the two delegates can be arranged mutually in 2 ! waysHence the required number of ways is $2 \times (18\,!)$

Question44

If a question paper consists of 11 questions divided into two section I and II. Section I consist of 6 questions and section II consists of 5 question, then the number of different ways can student select 6 questions, taking at least 2 questions from each section, is MHT CET 2022 (06 Aug Shift 2)

Options:

A. 350

B. 225

C. 275

D. 425

Answer: D

Solution:

Section-I	Section-II	No. of ways
2	4	${}^6C_2 \times {}^5C_4 = 15 \times 5 = 75$
3	3	${}^6C_3 \times {}^5C_3 = 20 \times 10 = 200$
4	2	${}^6C_4 \times {}^5C_2 = 15 \times 10 = 150$

$$\text{Total } = 425$$

Question45

The number of different 9 digit number that can be formed, from the digits of the number 445577888 by rearranging its digits, so that the odd digits occupy even positions, are MHT CET 2022 (06 Aug Shift 1)

Options:

A. 120

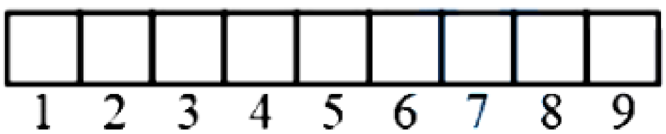
B. 60

C. 180

D. 36

Answer: B

Solution:



ways

and remaing five even digits $4, 4, 8, 8, 8$ can be arranged in 5 places in $\frac{5}{23}$

Hence total no of ways $= \frac{|4}{|2L2} \times \frac{5}{223} = 6 \times 10 = 60$

Question46

The number of ways in which the letters of the word MACHINE can be arranged such that the vowels may occupy only odd positions, is MHT CET 2022 (05 Aug Shift 2)

Options:

A. 288

B. 625

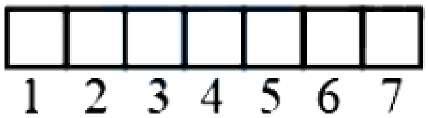
C. 576

D. 1152

Answer: C

Solution:

MACHINE



A, I, E (3 vowels)

M, C, H, N (4 consonants)

There are 4 odd places. So, three vowels can be arranged in four places in 4_{P3} ways and 4 consonants can be arranged in remaining four places in 4_{P4} ways.

Hence total number of ways = $4_{P3} \times 4_{P4} = 576$

Question47

It is required to seat 5 men and 4 women in a row so that the men occupy odd places. Then the number of arrangements that are possible is MHT CET 2022 (05 Aug Shift 1)

Options:

A. 144

B. 362880

C. 2880

D. 1140

Answer: C

Solution:

$\frac{M}{1}\ \frac{W}{2}\ \frac{M}{3}\ \frac{W}{4}\ \frac{M}{5}\ \frac{W}{6}\ \frac{M}{7}\ \frac{W}{8}\ \frac{M}{9}$

5 men can be seated in 5 odd places in $5_{P_5} = 120$ ways and 4 women can be seated in remaining 4 places in $4_{P_4} = 24$ ways $\Rightarrow$ Total possible arrangements $= 120 \times 24 = 2880$

Question48

A committee of 5 is to be formed out of 6 men and 4 ladies. The number of ways this can be done, when at most 2 ladies are include, is MHT CET 2021 (24 Sep Shift 2)

Options:

A. 240

B. 186

C. 60

D. 120

Answer: B

Solution:

The committee can be formed in following ways:(5 men), (4 men, 1 lady) , (3 men, 2 ladies)

$$\therefore \text{ Number of was } = \left({}^{6}C_{5}\right) + \left({}^{6}C_{4} \times {}^{4}C_{1}\right) + \left({}^{6}C_{3} \times {}^{4}C_{2}\right)$$
$$= (6) + (15 \times 4) + (20 \times 6) = 6 + 60 + 120 = 186$$

Question49

Out of 7 consonants and 4 vowels, the number of words consisting of 3 consonants and 2 vowels are MHT CET 2021 (23 Sep Shift 2)

Options:

A. 3300

B. 210

C. 120

D. 25200

Answer: D

Solution:

We have to choose 3 consonants and 2 vowels from 7 consonants and 4 vowels.$\therefore$ Number of words $= \left({}^{7}C_{3}\right) \times \left({}^{4}C_{2}\right) \times 5!$
$= \frac{7!}{3!4!} \times \frac{4!}{2!2!} \times 5! = 25200$

Question50

The numbers can be formed using the digit $1, 2, 3, 4, 3, 2, 1$ so that odd digits always occupy odd places in ——— ways. MHT CET 2021 (22 Sep Shift 2)

Options:

A. 9

B. 18

C. 6

D. 3

Answer: B

Solution:

We have 4 odd digits i.e. 1,1,3,3 and 3 even digits i.e. 2,2, 4 In a 7 digit number, there are 4 odd and 3 even places.So number of possible ways $= \frac{4!}{2!2!} \times \frac{3!}{2!} = 18$

Question51

A polygon has 44 diagonals. Then the number of sides of the polygon are MHT CET 2021 (22 Sep Shift 1)

Options:

A. 11

B. 12

C. 10

D. 13

Answer: A

Solution:

Number of diagonals of ' n ' sided polygons $= {}^nC_2 - n$

$$\begin{aligned}
&\therefore {}^nC_2 - n = 44 \\
&\frac{n!}{2!(n-2)!} - n = 44 \Rightarrow n(n-1) - 2n = 88 \\
&\therefore n^2 - 3n - 88 = 0 \Rightarrow (n-11)(n+8) = 0 \\
&\Rightarrow n = 11 \ldots [n \in N]
\end{aligned}$$

Question52

For a set of five true or false questions, no student has written the all correct answers and no two students have given the same sequence of answers. The maximum number of students in the class for this to be possible is MHT CET 2021 (21 Sep Shift 2)

Options:

A. 30

B. 31

C. 32

D. 16

Answer: B

Solution:

Each of the five questions can be solved in two ways.$\therefore$ Maximum number of wrong answers.

$$= (2 \times 2 \times 2 \times 2 \times 2) - 1 = 31$$

Question53

The number of ways in which 8 different pearls can be arranged to from a necklace is MHT CET 2021 (21 Sep Shift 1)

Options:

A. 40320

B. 5040

C. 2520

D. 1260

Answer: C

Solution:

Number of necklaces formed from 8 different pearls

$$= \frac{(8-1)!}{2} = 7 \times 6 \times 5 \times 4 \times 3 = 2520$$

Question54

If $\frac{n!}{2!(n-2)!}$ and $\frac{n!}{4!(n-4)!}$ are in the ratio $2:1$, then $n =$ MHT CET 2021 (20 Sep Shift 2)

Options:

A. 6

B. 4

C. 5

D. 3

Answer: C

Solution:

Given: $\frac{n!}{2!(n-2)!} : \frac{n!}{4!(n-4)!} = 2 : 1$

$$\binom{n}{2} : \binom{n}{4} = 2 : 1 \Rightarrow \frac{\binom{n}{2}}{\binom{n}{4}} = 2$$

$$\frac{\frac{n(n-1)}{2}}{\frac{n(n-1)(n-2)(n-3)}{24}} = 2 \Rightarrow \frac{12}{(n-2)(n-3)} = 2$$

$$(n-2)(n-3) = 6 \Rightarrow n^2 - 5n + 6 = 6 \Rightarrow n(n-5) = 0$$

✅ Final Answer: $\boxed{n = 5}$

Question55

All the letters of the word' ABRACADABRA' are arranged in different possible ways. Then the number of such arrangements in which the vowels are together is MHT CET 2021 (20 Sep Shift 1)

Options:

A. 1200

B. 1240

C. 1220

D. 1260

Answer: D

Solution:

The word ABRACADABRA hasA: 5 times, B: 2 times, R: 2 times, C, D: 1 time each When all vowels are together, we have to arrange 7 elements. $\therefore$ No. of arrangements $\frac{7!}{2!2!} = 1260$

Question56

All letters of the word 'CEASE' are arranged randomly in a row, then the probability that two E are found together is MHT CET 2012

Options:

A. $\frac{7}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{5}$

D. $\frac{1}{5}$

Answer: D

Solution:

Sample space arrangement for the word 'CEASE' $= 5\,!$

$$\text{Here, } \mathrm{E} \rightarrow 2, \mathrm{C} \rightarrow 1,\ \mathrm{A} \rightarrow 1,\ \mathrm{S} \rightarrow 1$$

Now, consider 2E as one character, so that arranging for four letters $= 4!$ ways $\therefore$ Required probability $= \frac{4!}{5!} = \frac{1}{5}$

Question57

Three numbers are selected randomly between 1 to 20 . Then, the probability that they are consecutive numbers will be MHT CET 2012

Options:

A. $\frac{7}{190}$

B. $\frac{3}{190}$

C. $\frac{5}{190}$

D. $\frac{1}{3}$

Answer: B

Solution:

Number of sample space for selecting three numbers between 1 to $20={ }^{20} C_3$Number of ways that they are consecutive numbers $=18 . \therefore$ Required probability

$$
\begin{aligned}
& =\frac{18}{20} C_3=\frac{18 \times 3 \times 2}{20 \times 19 \times 18} \\
& =\frac{3}{190}
\end{aligned}
$$

Question58

If the four positive integers are selected randomly from the set of positive integers, then the probability that the number $1,3,7$ and 9 are in the unit place in the product of 4 -digit, so selected is MHT CET 2012

Options:

A. $\frac{7}{625}$

B. $\frac{2}{5}$

C. $\frac{5}{625}$

D. $\frac{16}{625}$

Answer: D

Solution:

The number of digits on unit place of any number $=10 \therefore$

$$
n(S)=10
$$

The necessary condition for becoming the digits $1,3,5$ or 7 at the unit place of product of four numbers that the digits $1,3,5$ or 7 at unit place of every number.

$$\therefore \quad n(A) = 4$$
$$\therefore \quad P(A) = \frac{4}{10} = \frac{2}{5}$$

So, required $y = \left(\frac{2}{5}\right)^4 = \frac{16}{625}$
