

EXERCISE - O

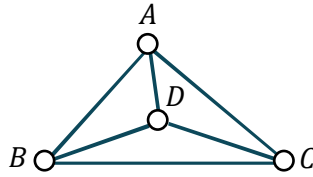
SINGLE CORRECT TYPE QUESTIONS

1. The value of ${}^{50}C_4 + \sum_{r=1}^6 {}^{56-r}C_3$ is
 (A) ${}^{56}C_4$ (B) ${}^{56}C_3$ (C) ${}^{55}C_3$ (D) ${}^{55}C_4$ **MPC002**
2. At an election, a voter may vote for any number of candidates, not greater than the number to be elected. There are 10 candidates and 4 are to be elected. If a voter votes for at least one candidates, then the number of ways in which he can vote is
 (A) 385 (B) 1110 (C) 5040 (D) 6210 **MPC003**
3. The set $S = \{1, 2, 3, \dots, 12\}$ is to be partitioned into three sets A, B, C of equal size. Thus, $A \cup B \cup C = S, A \cap B = B \cap C = C \cap A = \phi$, then number of ways to partition S are-
 (A) $\frac{12!}{3!(3!)^4}$ (B) $\frac{12!}{(4!)^3}$ (C) $\frac{12!}{(3!)^4}$ (D) $\frac{12!}{3!(4!)^3}$ **MPC004**
4. The number of integers greater than 6000 that can be formed, using the digits 3,5,6,7 and 8 without repetition, is :
 (A) 120 (B) 72 (C) 216 (D) 192 **MPC005**
5. From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on a shelf so that the dictionary is always in the middle. Then the number of such arrangements is :
 (A) At least 750 but less than 1000 (B) At least 1000
 (C) Less than 500 (D) At least 500 but less than 750 **MPC006**
6. There are two urns. Urn A has 3 distinct red balls and urn B has 9 distinct blue balls. From each urn two balls are taken out at random and then transferred to the other. The number of ways in which this can be done is:
 (A) 3 (B) 36 (C) 66 (D) 108 **MPC007**
7. If the letters of the word 'SACHIN' are arranged in all possible ways and these words are written out as in dictionary, then the word 'SACHIN' appears at serial number
 (A) 602 (B) 603 (C) 600 (D) 601 **MPC001**
8. The number of points, having both co-ordinates as integers, that lie in the interior of the triangle with vertices $(0, 0)$, $(0, 41)$ and $(41, 0)$ is :
 (A) 820 (B) 780 (C) 901 (D) 861 **MPC008**

Permutations and Combinations

9. There are 10 points in a plane, out of these 6 are collinear. If N is the number of triangles formed by joining these points, then:
 (A) $N > 190$ (B) $N \leq 100$ (C) $100 < N \leq 140$ (D) $140 < N \leq 190$
MPC009
10. Let T_n be the number of all possible triangles formed by joining vertices of an n -sided regular polygon. If $T_{n+1} - T_n = 10$, then the value of n is :
 (A) 7 (B) 5 (C) 10 (D) 8
MPC012
11. Assuming the balls to be identical except for difference in colours, the number of ways in which one or more balls can be selected from 10 white, 9 green and 7 black balls is :
 (A) 879 (B) 880 (C) 629 (D) 630
MPC010
12. Let A and B be two sets containing 2 elements and 4 elements respectively. The number of subsets of $A \times B$ having 3 or more elements is
 (A) 256 (B) 220 (C) 219 (D) 211
MPC011
13. A 5 digit number divisible by 3 is to be formed using the numerals 0,1,2,3,4 & 5 without repetition. The total number of ways this can be done is -
 (A) 3125 (B) 600 (C) 240 (D) 216
MPC013
14. Number of ways in which 9 different toys can be distributed among 4 children belonging to different age groups in such a way that distribution among the 3 elder children is even and the youngest one is to receive one toy more is-
 (A) $\frac{(5!)^2}{8}$ (B) $\frac{9!}{2}$ (C) $\frac{9!}{3!(2!)^3}$ (D) none of these
MPC014
15. The number of ways in which we can arrange n ladies & n gentlemen at a round table so that 2 ladies or 2 gentlemen may not sit next to one another is -
 (A) $(n-1)!(n-2)!$ (B) $(n)!(n-1)!$
 (C) $(n+1)!(n)!$ (D) none of these
MPC015
16. The number of way in which 10 identical apples can be distributed among 6 children so that each child receives atleast one apple is -
 (A) 126 (B) 252 (C) 378 (D) none of these
MPC016
17. The number of ways in which a mixed double tennis game can be arranged from amongst 9 married couple if no husband & wife plays in the same game is -
 (A) 756 (B) 3024 (C) 1512 (D) 6048
MPC017
18. Number of different words that can be formed using all the letters of the word "DEEPMALA" if two vowels are together and the other two are also together but separated from the first two is
 (A) 960 (B) 1200 (C) 2160 (D) 1440
MPC018

19. A road network as shown in the figure connect four cities. In how many ways can you start from any city (say A) and come back to it without travelling on the same road more than once?



- (A) 8 (B) 12 (C) 9 (D) 16

MPC019

20. Sum of all the numbers that can be formed using all the digits 2, 3, 3, 4, 4, 4 is -
 (A) 22222200 (B) 11111100 (C) 55555500 (D) 20333280

MPC020

MULTIPLE CORRECT TYPE QUESTIONS

21. Lines $y = x + i$ & $y = -x + j$ are drawn in $x - y$ plane such that $i \in \{1,2,3,4\}$ & $j \in \{1,2,3,4,5,6\}$. If m represents the total number of squares formed by the lines and n represents the total number of triangles formed by the given lines & x -axis, then correct option/s is/are-
 (A) $m + n = 50$ (B) $m - n = 2$ (C) $m + n = 48$ (D) $m - n = 4$

MPC052

22. The combinatorial coefficient $C(n, r)$ is equal to
 (A) number of possible subsets of r members from a set of n distinct members.
 (B) number of possible binary messages of length n with exactly r 1's.
 (C) number of non decreasing $2 - D$ paths from the lattice point $(0, 0)$ to (r, n) .
 (D) number of ways of selecting r things out of n different things when a particular thing is always included plus the number of ways of selecting ' r ' things out of n , when a particular thing is always excluded.

MPC053

23. There are 10 questions, each question is either True or False. Number of different sequences of incorrect answers is also equal to
 (A) Number of ways in which a normal coin tossed 10 times would fall in a definite order if both Heads and Tails are present.
 (B) Number of ways in which a multiple choice question containing 10 alternatives with one or more than one correct alternatives, can be answered.
 (C) Number of ways in which it is possible to draw a sum of money with 10 coins of different denominations taken some or all at a time.
 (D) Number of different selections of 10 indistinguishable things taken some or all at a time.

MPC054

24. Number of ways in which 3 numbers in A.P. can be selected from $1, 2, 3, \dots, n$ is :
 (A) $\left(\frac{n-1}{2}\right)^2$ if n is even (B) $\frac{n(n-2)}{4}$ if n is odd
 (C) $\frac{(n-1)^2}{4}$ if n is odd (D) $\frac{n(n-2)}{4}$ if n is even

MPC055

25. The combinatorial coefficient ${}^{n-1}C_p$ denotes
- (A) the number of ways in which n things of which p are alike and rest different can be arranged in a circle.
 - (B) the number of ways in which p different things can be selected out of n different thing if a particular thing is always excluded.
 - (C) number of ways in which n alike balls can be distributed in p different boxes so that no box remains empty and each box can hold any number of balls.
 - (D) the number of ways in which $(n-2)$ white balls and p black balls can be arranged in a line if black balls are separated, balls are all alike except for the colour.

MPC056

26. The maximum number of permutations of $2n$ letters in which there are only a 's & b 's, taken all at a time is given by:

- (A) ${}^{2n}C_n$
- (B) $\frac{2}{1} \cdot \frac{6}{2} \cdot \frac{10}{3} \dots \frac{4n-6}{n-1} \cdot \frac{4n-2}{n}$
- (C) $\frac{n+1}{1} \cdot \frac{n+2}{2} \cdot \frac{n+3}{3} \cdot \frac{n+4}{4} \dots \frac{2n-1}{n-1} \cdot \frac{2n}{n}$
- (D) $\frac{2^n \cdot [1 \cdot 3 \cdot 5 \dots (2n-3)(2n-1)]}{n!}$

MPC057

COMPREHENSION TYPE QUESTIONS

Paragraph for Question No. 27 to 29

Let p be a prime number and n be a positive integer, then exponent of p in $n!$ is denoted by $E_p(n!)$ and is given by

$$E_p(n!) = \left[\frac{n}{p} \right] + \left[\frac{n}{p^2} \right] + \left[\frac{n}{p^3} \right] + \dots + \left[\frac{n}{p^k} \right]$$

Where $p^k < n < p^{k+1}$

and $[x]$ denotes the integral part of x .

If we isolate the power of each prime contained in any number N , then N can be written as

$$N = 2^{\alpha_1} 3^{\alpha_2} 5^{\alpha_3} 7^{\alpha_4} \dots$$

where α_i are whole numbers.

On the basis of above information, answer the following questions:

27. The exponent of 7 in ${}^{100}C_{50}$ is -
- (A) 0
 - (B) 1
 - (C) 2
 - (D) 3
- MPC061
28. The number of zeros at the end of 108! is -
- (A) 10
 - (B) 13
 - (C) 25
 - (D) 26
- MPC062
29. The exponent of 12 in 100! is -
- (A) 32
 - (B) 48
 - (C) 97
 - (D) none of these
- MPC063

MATRIX MATCH TYPE QUESTION

Answer Q.30, Q.31 and Q.32 by appropriately matching the information given in the three columns of the following table

Column 1, 2 & 3 consists of different words, number of selection of 3 letters from the word and number of arrangements of 3 letters from the word respectively.

Column-1	Column-2	Column-3
(I) DREAM	(i) 70	(P) 60
(II) DEDICATION	(ii) 10	(Q) 399
(III) POWERFUL	(iii) 77	(R) 336
(IV) COMBINATION	(iv) 56	(S) 378

30. Which of the following is a correct combination?

- (A) (I) (i) (P) (B) (III) (iv) (R) (C) (II) (ii) (S) (D) (IV) (ii) (Q)

MPC058

31. Which of the following is correct combination?

- (A) (III) (iv) (S) (B) (III) (i) (R) (C) (IV) (iii) (Q) (D) (I) (ii) (R)

MPC059

32. Which of the following is correct combination?

- (A) (I) (ii) (S) (B) (II) (i) (Q) (C) (III) (iv) (R) (D) (IV) (iii) (R)

MPC060

EXERCISE - S

1. An examination paper consists of 12 questions divided into parts *A* & *B*. Part – *A* contains 7 questions & Part-*B* contains 5 questions. If a candidate is required to attempt 8 questions selecting atleast 3 from each part, then number of maximum ways can the candidate select the questions are **MPC024**
2. Let 5 boys & 4 girls sit in a straight line. If the number of ways in which they can be seated if 2 girls are together & the other 2 are also together but separated from the first 2 are *N*, then sum of digits of *N* is **MPC025**
3. There are 2 women participating in a chess tournament. Every participant played 2 games with the other participants. The number of games that the men played between themselves exceeded by 66 as compared to the number of games that the men played with the women. If number of participants & the total number of games played in the tournament are *M* and *N* respectively, then value of (*M* + *N*) is **MPC026**
4. Find the ratio ${}^{20}C_r$ to ${}^{25}C_r$ when each of them has the greatest value possible. **MPC029**
5. Let P_n denotes the number of ways in which three people can be selected out of '*n*' people sitting in a row, if no two of them are consecutive. If $P_{n+1} - P_n = 15$ then the value of '*n*' is **MPC021**
6. The number of positive integral solutions of the equation $x_1x_2x_3 = 60$ is **MPC022**
7. Total number of even divisors of 2079000 which are divisible by 15 are **MPC023**
8. If the sum of all numbers greater than 10000 formed by using the digits 0, 1, 2, 4, 5 & no digit being repeated in any number, is *N*, then sum of digits of *N* is **MPC027**
9. Let the number of ways in which the letters of the word 'MUNMUN' can be arranged so that no two alike letters are together are *N*, then value of *N* is **MPC028**
10. If number of integral solutions for the equation; $x + y + z + w = 29$ when $x > 0, y > 1, z > 2$ & $w \geq 0$ is equal to *N*, then find the value of $\frac{N}{100}$? **MPC030**
11. Six persons *A, B, C, D, E* and *F* are to be seated at a circular table. The number of ways this can be done if *A* must have either *B* or *C* on his right and *B* must have either *C* or *D* on his right is - **MPC049**
12. 5 Indian & 5 American couples meet at a party & shake hands. If no wife shakes hands with her own husband & no Indian wife shakes hands with a male, then the number of hand shakes that takes place in the party is - **MPC050**
13. The number of ways of choosing a committee of 2 women & 3 men from 5 women & 6 men, if Mr. *A* refuses to serve on the committee if Mr. *B* is a member & Mr. *B* can only serve, if Miss *C* is the member of the committee, is - **MPC051**

EXERCISE - JEE (Main) PYQ

1. The number of four-digit numbers strictly greater than 4321 that can be formed using the digits 0,1,2,3,4,5 (repetition of digits is allowed) is : [JEE (Main) 2019]
 (1) 288 (2) 306 (3) 360 (4) 310 MPC041
2. 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 : [JEE (Main) 2019]
 (1) $m = n = 78$ (2) $n = m - 8$ (3) $m + n = 68$ (4) $m = n = 68$ MPC042
3. Some identical balls are arranged in rows to form an equilateral triangle. The first row consists of one ball, the second row consists of two balls and so on. If 99 more identical balls are added to the total number of balls used in forming the equilateral triangle, then all these balls can be arranged in a square whose each side contains exactly 2 balls less than the number of balls each side of the triangle contains. Then the number of balls used to form the equilateral triangle is :- [JEE (Main) 2019]
 (1) 190 (2) 262 (3) 225 (4) 157 MPC091
4. The number of natural numbers less than 7,000 which can be formed by using the digits 0,1,3,7,9 (repetition of digits allowed) is equal to : [JEE (Main) 2019]
 (1) 250 (2) 374 (3) 372 (4) 375 MPC092
5. Let $n > 2$ be an integer. Suppose that there are n Metro stations in a city located along a circular path. Each pair of stations is connected by a straight track only. Further, each pair of nearest stations is connected by blue line, whereas all remaining pairs of stations are connected by red line. If the number of red lines is 99 times the number of blue lines, then the value of n is : [JEE (Main) 2020]
 (1) 199 (2) 101 (3) 201 (4) 200 MPC043
6. 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 : [JEE (Main) 2020]
 (1) 1500 (2) 2255 (3) 3000 (4) 2250 MPC044
7. If the number of five digit numbers with distinct digits and 2 at the 10th place is $336k$, then k is equal to : [JEE (Main) 2020]
 (1) 8 (2) 6 (3) 4 (4) 7 MPC093
8. If the letters of the word 'MOTHER' be permuted and all the words so formed (with or without meaning) be listed as in a dictionary, then the position of the word 'MOTHER' is _____. [JEE (Main) 2020]
MPC094
9. If the digits are not allowed to repeat in any number formed by using the digits 0, 2, 4, 6, 8, then the number of all numbers greater than 10,000 is equal to _____. [JEE (Main) 2021]
MPC095

10. There are 5 students in class 10, 6 students in class 11 and 8 students in class 12. If the number of ways, in which 10 students can be selected from them so as to include at least 2 students from each class and at most 5 students from the total 11 students of class 10 and 11 is $100k$, then k is equal to.
[JEE (Main) 2021]
MPC096
11. The sum of all 3-digit numbers less than or equal to 500, that are formed without using the digit "1" and they all are multiple of 11, is _____.
[JEE (Main) 2021]
MPC097
12. The sum of all the 4-digit distinct numbers that can be formed with the digits 1, 2, 2 and 3 is:
[JEE (Main) 2021]
 (1) 26664 (2) 122664 (3) 122234 (4) 22264
MPC098
13. The letters of the word 'MANKIND' are written in all possible orders and arranged in serial order as in an English dictionary. Then the serial number of the word 'MANKIND' is _____.
[JEE (Main) 2022]
MPC099
14. There are ten boys B_1, B_2, \dots, B_{10} and five girls G_1, G_2, \dots, G_5 in a class. Then the number of ways of forming a group consisting of three boys and three girls, if both B_1 and B_2 together should not be the members of a group, is _____.
[JEE (Main) 2022]
MPC100
15. Let S be the set of all passwords which are six to eight characters long, where each character is either an alphabet from $\{A, B, C, D, E\}$ or a number from $\{1, 2, 3, 4, 5\}$ with the repetition of characters allowed. If the number of passwords in S whose at least one character is a number from $\{1, 2, 3, 4, 5\}$ is $\alpha \times 5^6$, then α is equal to _____.
[JEE (Main) 2022]
MPC101
16. The total number of four digit numbers such that each of the first three digits is divisible by the last digit, is equal to _____.
[JEE (Main) 2022]
MPC102
17. The number of ways, in which 5 girls and 7 boys can be seated at a round table so that no two girls sit together, is
[JEE (Main) 2023]
 (1) $126(5!)^2$ (2) $7(360)^2$ (3) 720 (4) $7(720)^2$
MPC103
18. A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is _____.
[JEE (Main) 2023]
MPC104
19. The number of numbers, strictly between 5000 and 10000 can be formed using the digits 1,3,5,7,9 without repetition, is
[JEE (Main) 2023]
 (1) 6 (2) 12 (3) 120 (4) 72
MPC105
20. If the number of words, with or without meaning, which can be made using all the letters of the word MATHEMATICS in which C and S do not come together, is $(6!)k$, then k is equal to
[JEE (Main) 2023]
 (1) 1890 (2) 945 (3) 2835 (4) 5670
MPC106

EXERCISE - JEE (Advanced) PYQ

1. A pack contains n cards numbered from 1 to n . Two consecutive numbered cards are removed from the pack and the sum of the numbers on the remaining cards is 1224. If the smaller to the numbers on the removed cards is k , then $k - 20 =$ **[JEE (Advanced) 2013]**
MPC107
2. Let $n_1 < n_2 < n_3 < n_4 < n_5$ be positive integers such that $n_1 + n_2 + n_3 + n_4 + n_5 = 20$. The number of such distinct arrangements $(n_1, n_2, n_3, n_4, n_5)$ is **[JEE (Advanced) 2014]**
MPC108
3. Let $n \geq 2$ be an integer. Take n distinct points on a circle and join each pair of points by a line segment. Colour the line segment joining every pair of adjacent points by blue and the rest by red. If the number of red and blue line segments are equal, then the value of n is **[JEE (Advanced) 2014]**
MPC109
4. Six cards and six envelopes are numbered 1, 2, 3, 4, 5, 6 and cards are to be placed in envelopes so that each envelope contains exactly one card and no card is placed in the envelope bearing the same number and moreover the card numbered 1 is always placed in envelope numbered 2. Then the number of ways it can be done is - **[JEE (Advanced) 2014]**
(A) 264 (B) 265 (C) 53 (D) 67
MPC110
5. Let n be the number of ways in which 5 boys and 5 girls can stand in a queue in such a way that all the girls stand consecutively in the queue. Let m be the number of ways in which 5 boys and 5 girls can stand in a queue in such a way that exactly four girls stand consecutively in the queue. Then the value of $\frac{m}{n}$ is **[JEE (Advanced) 2015]**
MPC111
6. A debate club consists of 6 girls and 4 boys. A team of 4 members is to be selected from this club including the selection of a captain (from among these 4 member) for the team. If the team has to include at most one boy, then the number of ways of selecting the team is **[JEE (Advanced) 2016]**
(A) 380 (B) 320 (C) 260 (D) 95
MPC064
7. Words of length 10 are formed using the letters $A, B, C, D, E, F, G, H, I, J$. Let x be the number of such words where no letter is repeated; and let y be the number of such words where exactly one letter is repeated twice and no other letter is repeated. Then, $\frac{y}{9x} =$ **[JEE (Advanced) 2017]**
MPC065
8. Let $S = \{1, 2, 3, \dots, 9\}$. For $k = 1, 2, \dots, 5$, let N_k be the number of subsets of S , each containing five elements out of which exactly k are odd. Then $N_1 + N_2 + N_3 + N_4 + N_5 =$ **[JEE (Advanced) 2017]**
(A) 125 (B) 252 (C) 210 (D) 126
MPC066

9. The number of 5 digit numbers which are divisible by 4, with digits from the set $\{1, 2, 3, 4, 5\}$ and the repetition of digits is allowed, is. **[JEE (Advanced) 2018]**

MPC067

10. Let X be a set with exactly 5 elements and Y be a set with exactly 7 elements. If α is the number of one-one functions from X to Y and β is the number of onto functions from Y to X , then the value of $\frac{1}{5!} (\beta - \alpha)$ is _____. **[JEE (Advanced) 2018]**

MPC068

11. In a high school, a committee has to be formed from a group of 6 boys $M_1, M_2, M_3, M_4, M_5, M_6$ and 5 girls G_1, G_2, G_3, G_4, G_5 .

- (i) Let α_1 be the total number of ways in which the committee can be formed such that the committee has 5 members, having exactly 3 boys and 2 girls.
- (ii) Let α_2 be the total number of ways in which the committee can be formed such that the committee has at least 2 members, and having an equal number of boys and girls.
- (iii) Let α_3 be the total number of ways in which the committee can be formed such that the committee has 5 members, at least 2 of them being girls.
- (iv) Let α_4 be the total number of ways in which the committee can be formed such that the committee has 4 members, having at least 2 girls and such that both M_1 and G_1 are **NOT** in the committee together.

List - I

- P. The value of α_1 is
- Q. The value of α_2 is
- R. The value of α_3 is
- S. The value of α_4 is

List - II

- 1. 136
- 2. 189
- 3. 192
- 4. 200
- 5. 381
- 6. 461

[JEE (Advanced) 2018]

The correct option is :

- (A) $P \rightarrow 4; Q \rightarrow 6, R \rightarrow 2; S \rightarrow 1$
- (B) $P \rightarrow 1; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 3$
- (C) $P \rightarrow 4; Q \rightarrow 6, R \rightarrow 5; S \rightarrow 2$
- (D) $P \rightarrow 4; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 1$

MPC069

12. Five person A, B, C, D and E are seated in a circular arrangement. 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 persons seated in adjacent seats get different coloured hats is **[JEE (Advanced) 2019]**

MPC070

13. An engineer is required to visit a factory for exactly four days during the first 15 days of every month and it is mandatory that **no** two visits take place on consecutive days. Then the number of all possible ways in which such visits to the factory can be made by the engineer during 1–15 June 2021 is _____. **[JEE (Advanced) 2020]**

MPC071

14. In a hotel, four rooms are available. Six persons are to be accommodated in these four rooms in such a way that each of these rooms contains at least one person and at most two persons. Then the number of all possible ways in which this can be done is **[JEE (Advanced) 2020]**
MPC072
15. Let
 $S_1 = \{(i, j, k) : i, j, k \in \{1, 2, \dots, 10\}\}$
 $S_2 = \{(l, j) : 1 \leq l < j + 2 \leq 10, l, j \in \{1, 2, \dots, 10\}\}$,
 $S_3 = \{(i, j, k, l) : 1 \leq i < j < k < l, i, j, k, l \in \{1, 2, \dots, 10\}\}$.
 and
 $S_4 = \{(i, j, k, l) : i, j, k \text{ and } l \text{ are distinct elements in } \{1, 2, \dots, 10\}\}$.
 If the total number of elements in the set S_r is n_r , $r = 1, 2, 3, 4$, then which of the following statements is (are) **TRUE?** **[JEE (Advanced) 2021]**
 (A) $n_1 = 1000$ (B) $n_2 = 44$ (C) $n_3 = 220$ (D) $\frac{n_4}{12} = 420$
MPC088
16. The number of 4-digit integers in the closed interval [2022, 4482] formed by using the digits 0, 2, 3, 4, 6, 7 is. **[JEE (Advanced) 2022]**
MPC089
17. Consider 4 boxes, where each box contains 3 red balls and 2 blue balls. Assume that all 20 balls are distinct. In how many different ways can 10 balls be chosen from these 4 boxes so that from each box at least one red ball and one blue ball are chosen? **[JEE (Advanced) 2022]**
 (A) 21816 (B) 85536 (C) 12096 (D) 156816
MPC090
18. Let X be the set of all five digit numbers formed using 1,2,2,2,4,4,0. For example, 22240 is in X while 02244 and 44422 are not in X . Suppose that each element of X has an equal chance of being chosen. Let p be the conditional probability that an element chosen at random is a multiple of 20 given that it is a multiple of 5. Then the value of $38p$ is equal to **[JEE (Advanced) 2023]**
MPC112

JEE (Main) Practice Paper

(This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.)

SECTION-A

- This section contains **TWENTY** questions.
 - Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
 - For each question, darken the bubble corresponding to the correct option in the ORS.
 - For each question, marks will be awarded in one of the following categories:
Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1 in all other cases.
-
1. Consider the five points comprising of the vertices of a square and the intersection point of its diagonals. How many triangles can be formed using these points ?
 (1) 4 (2) 6 (3) 8 (4) 10
MPC113
 2. The kindergarten teacher has 25 kids in her class. She takes 5 of them at a time, to zoological garden as often as she can, without taking the same 5 kids more than once. Then the number of visits, the teacher makes to the garden exceeds that of a kid by :
 (1) ${}^{25}C_5 - {}^{24}C_5$ (2) ${}^{24}C_5$ (3) ${}^{24}C_4$ (4) none
MPC114
 3. Three vertices of a convex n sided polygon are selected. If the number of triangles that can be constructed such that none of the sides of the triangle is also the side of the polygon is 30, then the polygon is a
 (1) Heptagon (2) Octagon (3) Nonagon (4) Decagon
MPC115
 4. If the letters of the word "VARUN" are written in all possible ways and then are arranged as in a dictionary, then the rank of the word VARUN is :
 (1) 98 (2) 99 (3) 100 (4) 101
MPC116
 5. Number of 5 digit numbers which are divisible by 5 and each number containing the digit 5, digits being all different is equal to $k(4!)$, the value of k is
 (1) 84 (2) 168 (3) 188 (4) 208
MPC117
 6. A rack has 5 different pairs of shoes. The number of ways in which 4 shoes can be chosen from it, so that there will be no complete pair is :
 (1) 1920 (2) 200 (3) 110 (4) 80
MPC118
 7. Number of ways in which 8 people can be arranged in a line if A and B must be next each other and C must be somewhere behind D , is equal to
 (1) 10080 (2) 5040 (3) 5050 (4) 10100
MPC119

8. Number of 5 digit numbers divisible by 25 that can be formed using only the digits 1, 2, 3, 4, 5 & 0 taken five at a time is
 (1) 2 (2) 32 (3) 42 (4) 52 **MPC120**
9. In a unique hockey series between India & Pakistan, they decide to play on till a team wins 5 matches. The number of ways in which the series can be won by India, if no match ends in a draw is :
 (1) 126 (2) 252 (3) 225 (4) none **MPC121**
10. Number of permutations of 1, 2, 3, 4, 5, 6, 7, 8 and 9 taken all at a time, such that the digit 1 appearing somewhere to the left of 2
 3 appearing to the left of 4 and
 5 somewhere to the left of 6, is
 (e.g. 815723946 would be one such permutation)
 (1) $9 \cdot 7!$ (2) $8!$ (3) $5! \cdot 4!$ (4) $8! \cdot 4!$ **MPC122**
11. A team of 8 students goes on an excursion, in two cars, of which one can seat 5 and the other only 4. If internal arrangement inside the car does not matter then the number of ways in which they can travel, is
 (1) 91 (2) 182 (3) 126 (4) 3920 **MPC123**
12. There are $(p + q)$ different books on different topics in Mathematics. ($p \neq q$)
 If L = The number of ways in which these books are distributed between two students X and Y such that X get p books and Y gets q books.
 M = The number of ways in which these books are distributed between two students X and Y such that one of them gets p books and another gets q books.
 N = The number of ways in which these books are divided into two groups of p books and q books then,
 (1) $L = M = N$ (2) $L = 2M = 2N$ (3) $2L = M = 2N$ (4) $L = M = 2N$ **MPC124**
13. The number of ways in which 8 distinguishable apples can be distributed among 3 boys such that every boy should get atleast 1 apple & atmost 4 apples is $K \cdot {}^7P_3$ where K has the value equal to
 (1) 14 (2) 66 (3) 44 (4) 22 **MPC125**
14. There are six periods in each working day of a school. Number of ways in which 5 subjects can be arranged if each subject is allotted at least one period and no period remains vacant is
 (1) 210 (2) 1800 (3) 360 (4) 3600 **MPC126**
15. Number of positive integral solutions satisfying the equation $(x_1 + x_2 + x_3)(y_1 + y_2) = 77$, is
 (1) 150 (2) 270 (3) 420 (4) 1024 **MPC127**

Permutations and Combinations

16. If n identical dice are rolled, then number of possible out comes are.
- (1) 6^n (2) $\frac{6^n}{n!}$ (3) ${}^{(n+5)}C_5$ (4) None of these
- MPC128**
17. Number of ways in which a pack of 52 playing cards be distributed equally among four players so that each have the Ace, King, Queen and Jack of the same suit, is
- (1) $\frac{36! \cdot 4!}{(9!)^4}$ (2) $\frac{36!}{(9!)^4}$ (3) $\frac{52! \cdot 4!}{(13!)^4}$ (4) $\frac{52!}{(13!)^4}$
- MPC129**
18. Seven person P_1, P_2, \dots, P_7 initially seated at chairs C_1, C_2, \dots, C_7 respectively. They all left their chairs simultaneously for hand wash. Now in how many ways they can again take seats such that no one sits on his own seat and P_1 sits on C_2 and P_2 sits on C_3 ?
- (1) 52 (2) 53 (3) 54 (4) 55
- MPC130**
19. Given six line segments of length 2, 3, 4, 5, 6, 7 units, the number of triangles that can be formed by these segments is
- (1) ${}^6C_3 - 7$ (2) ${}^6C_3 - 6$ (3) ${}^6C_3 - 5$ (4) ${}^6C_3 - 4$
- MPC131**
20. Find the number of all rational number $\frac{m}{n}$ such that
- (i) $0 < \frac{m}{n} < 1$, (ii) m and n are relatively prime (iii) $mn = 25!$
- (1) 256 (2) 128 (3) 512 (4) None of these
- MPC132**

SECTION-B

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4, if only correct answer is given.
 Zero Marks : 0, if no answer is given.
 Negative Marks : -1 for incorrect answer

1. Number of five digits numbers divisible by 3 that can be formed using the digits 0, 1, 2, 3, 4, 7 and 8 if, each digit is to be used atmost one is N then $\left(\frac{N}{8}\right)$ is equal to

MPC133

2. The sides AB , BC & CA of a triangle ABC have 3, 4 & 5 interior points respectively on them. If the number of triangles that can be constructed using these interior points as vertices is k , then $\binom{k}{5}$ is equal to
MPC134
3. Seven different coins are to be divided amongst three persons. If no two of the persons receive the same number of coins but each receives atleast one coin & none is left over, then the number of ways in which the division may be made is k , then $\binom{k}{10}$ is equal to.
MPC135
4. The number of integers which lie between 1 and 10^6 and which have the sum of the digits equal to 12 is N then $(N-6000)$ is equal to
MPC136
5. In a hockey series between team X and Y , they decide to play till a team wins '10' match. Then the number of ways in which team X wins is $\frac{{}^{20}C_m}{2}$ then m is equal to
MPC137
6. The number of permutations which can be formed out of the letters of the word "SERIES" taking three letters together is
MPC138
7. A box contains 6 balls which may be all of different colours or three each of two colours or two each of three different colours. The number of ways of selecting 3 balls from the box (if ball of same colour are identical) is
MPC139
8. The number of ways selecting 8 books from a library which has 10 books each of Mathematics, Physics, Chemistry and English, if books of the same subject are alike, is $(N^2 - 4)$ then N is equal to
MPC140
9. Let P_n denotes the number of ways in which three people can be selected out of ' n ' people sitting in a row, if no two of them are consecutive. If, $P_{n+1} - P_n = 15$ then the value of ${}^n C_2$ is :
MPC160
10. Number of cyphers at the end of ${}^{2002}C_{1001}$ is
MPC141

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-I

- This section contains **SIX** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.

Zero Marks : 0 If none of the bubbles is darkened.

Negative Marks : -1 In all other cases

1. A bouquet from 11 different flowers is to be made so that it contains not less than three flowers. Then the number of different ways of selecting flowers to form the bouquet.
 (A) 1972 (B) 1952 (C) 1981 (D) 1947

MPC142

2. If $\alpha = x_1x_2x_3$ and $\beta = y_1y_2y_3$ be two three digit numbers, then the number of pairs of α and β that can be formed so that α can be subtracted from β without borrowing.
 (A) $55 \cdot (45)^2$ (B) $45 \cdot (55)^2$ (C) $36 \cdot (45)^2$ (D) 55^3

MPC143

3. 'n' digits positive integers formed such that each digit is 1, 2, or 3. How many of these contain all three of the digits 1, 2 and 3 atleast once ?
 (A) $3(n-1)$ (B) $3^n - 2 \cdot 2^n + 3$ (C) $3^n - 3 \cdot 2^n - 3$ (D) $3^n - 3 \cdot 2^n + 3$

MPC144

4. $X = \{1, 2, 3, 4, \dots, 2017\}$ and $A \subset X ; B \subset X ; A \cup B \subset X$ here $P \subset Q$ denotes that P is subset of $Q(P \neq Q)$. Then number of ways of selecting unordered pair of sets A and B such that $A \cup B \subset X$.
 (A) $\frac{(4^{2017} - 3^{2017}) + (2^{2017} - 1)}{2}$ (B) $\frac{(4^{2017} - 3^{2017})}{2}$
 (C) $\frac{4^{2017} - 3^{2017} + 2^{2017}}{2}$ (D) None of these

MPC145

5. The number of ways in which 15 identical apples & 10 identical oranges can be distributed among three persons, each receiving none, one or more is:
 (A) 5670 (B) 7200 (C) 8976 (D) 7296

MPC146

6. Two variants of a test paper are distributed among 12 students. Number of ways of seating of the students in two rows so that the students sitting side by side do not have identical papers & those sitting in the same column have the same paper is:

(A) $\frac{12!}{6! \cdot 6!}$ (B) $\frac{(12)!}{2^5 \cdot 6!}$ (C) $(6!)^2 \cdot 2$ (D) $12! \times 2$

MPC147

SECTION-II

- This section contains **SIX** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If only (all) the correct option(s) is (are) chosen.

Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, both of which are correct options.

Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2 In all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

7. The number of ways in which 10 students can be divided into three teams, one containing 4 and others 3 each, is

(A) $\frac{10!}{4!3!3!}$ (B) 2100 (C) ${}^{10}C_4 \cdot {}^5C_3$ (D) $\frac{10!}{6!3!3!} \cdot \frac{1}{2}$

MPC148

8. If letters of the word 'SAMANVAYA' are arranged around a circle then number of permutations is

$\frac{n!}{x! y!}$, then possible value of $x^2 + y^2 - n$ is -

(A) 13 (B) 12 (C) 8 (D) 9

MPC149

9. The number of five digit numbers that can be formed using all the digits 0, 1, 3, 6, 8 which are -

(A) divisible by 4 is 30

(B) greater than 30,000 and divisible by 11 is 12

(C) smaller than 60,000 when digit 8 always appears at ten's place is 6

(D) between 30,000 and 60,000 and divisible by 6 is 18.

MPC150

10. All the 7 digit numbers containing each of the digits 1, 2, 3, 4, 5, 6, 7 exactly once and not divisible by 5 are arranged in the increasing order. Then -
 (A) 1800th number in the list is 3124567 (B) 1897th number in the list is 4213567
 (C) 1994th number in the list is 4312567 (D) 2001th number in the list is 4315726
MPC151
11. If a, b, c, d are prime numbers such that $a^2 - b^2 = c$ & $d = b + c$, then sum of all the 4 digit numbers formed by using the digits a, b, c, d without repetition is -
 (A) 112233 (B) 113322
 (C) an even number divisible by 11 (D) an odd number divisible by 11
MPC152
12. If $31! 33! 35!$ is divisible by $2^m (m \in N)$, then value of m can be :-
 (A) 69 (B) 79 (C) 89 (D) 99
MPC153

SECTION-III

- This section contains **THREE** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3 if only the bubble corresponding to the correct answer is darkened.
Zero Marks : 0 in all other cases.

Comprehension # 1 (Q. No. 13 - 14)

16 players $P_1, P_2, P_3, \dots, P_{16}$ take part in a tennis tournament. Lower suffix player is better than any higher suffix player. These players are to be divided into 4 groups each comprising of 4 players and the best from each group is selected for semi-finals.

13. Number of ways in which they can be divided into 4 equal groups if the players P_1, P_2, P_3 and P_4 are in different groups, is :
 (A) $\frac{(11)!}{36}$ (B) $\frac{(11)!}{72}$ (C) $\frac{(11)!}{108}$ (D) $\frac{(11)!}{216}$
MPC154
14. Number of ways in which these 16 players can be divided into four equal groups, such that when the best player is selected from each group, P_6 is one among them, is $(k) \frac{12!}{(4!)^3}$. The value of k is :
 (A) 36 (B) 24 (C) 18 (D) 20
MPC155

Comprehension # 2 (Q. No. 15 - 16)

Consider the number $N = 2910600$. On the basis of above information, answer the following questions :

15. Total number of divisors of N , which are divisible by 15 but not by 36 are -
(A) 92 (B) 94 (C) 96 (D) 98

MPC156

16. Total number of ways, in which the given number can be split into two factors such that their highest common factor is a prime number is equal to -
(A) 16 (B) 32 (C) 48 (D) 64

MPC157**Comprehension # 3 (Q. No. 17 - 18)**

2 American men; 2 British men; 2 Chinese men and one each of Dutch, Egyptian, French and German persons are to be seated for a round table conference.

17. If the number of ways in which they can be seated if exactly two pairs of persons of same nationality are together is $p(6!)$, then find $\frac{p}{100}$.
(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{4}{5}$ (D) $\frac{6}{5}$

MPC158

18. If the number of ways in which only American pair is adjacent is equal to $q(6!)$, then find.
(A) $\frac{16}{25}$ (B) $\frac{18}{25}$ (C) $\frac{21}{25}$ (D) $\frac{23}{25}$

MPC159

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A	A	B	D	B	D	D	B	B	B
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	A	C	D	C	B	A	C	D	B	A
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	A,B	A,B,D	B,C	C,D	B,D	A,B,C,D	A	C	B	B
Que.	31	32								
Ans.	C	C								

EXERCISE - S

1.	420	2.	9	3.	169	4.	420	5.	8
6.	54	7.	108	8.	36	9.	30	10.	26
11.	18	12.	135	13.	124				

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	1	1	2	3	4	1	309	96	238
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	7744	1	1492	1120	7073	1086	1	72	4	4

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	5	7	5	C	5	A	5	D	625	119
Que.	11	12	13	14	15	16	17	18		
Ans.	C	30	495	1080	A,B,D	569.00	A	31		

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	3	2	3	3	2	4	2	3	1	1
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	3	3	4	2	3	3	1	2	1	1
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	93	41	63	62	10	42	31	13	28	1

JEE (Advanced) Practice Paper

Section-I	Q.	1	2	3	4	5	6
	A.	C	B	D	A	C	D
Section-II	Q.	7	8	9	10	11	12
	A.	B,C	C,D	A,B,D	B,D	B,C	A,B,C
Section-III	Q.	13	14	15	16	17	18
	A.	C	D	C	C	B	A