PERMUTATIONS & COMBINATIONS

SYNOPSIS

FUNDAMENTAL PRINCIPLE (OR) COUNTING PRINCIPLE:

- If an operation can be performed in 'm' different ways and another operation in 'n' different ways then these two operations can be performed one after the other in 'mn' ways.
- If an operation can be performed in 'm' different ways and another operation in 'n' different ways then either of these two operations can be performed in 'm + n' ways (provided only one has to be done).
  NOTE: This principle can be extended to any number of operations.

FACTORIAL 'n' :

- The continuous product of first 'n' natural numbers is called factorial n and is denoted by n! (or) $\angle n$
  i.e., n! = 1 x 2 x 3 x .... (n-1) x n
  n! = n [(n-1)!]
- 0! = 1 6! = 720
  1! = 1 7! = 5040
  2! = 2 8! = 40320
  3! = 6 9! = 362880
  4! = 24 10! = 3628800
  5! = 120 $2n! = 2^n . n! . [1.3.5 ... (2n-1)]$

PERMUTATIONS:

- An arrangement that can be formed by taking some or all of a finite set of things (or objects) is called a **Permutation**.
  Order of the things is very important in case of permuation.
- A permutation is said to be a **Linear Permutation** if the objects are arranged in a line. A linear permutation is simply called as a permutation.
- A permutation is said to be a **Circular Permutation** if the objects are arranged in the form of a circle (a closed curve).
- The number of (linear) permutations that can be formed by taking r things at a time from a set of n dissimilar things ($r \le n$) is denoted by ${}^nP_r$ or P(n, r).
- The number of permutations of n dissimilar things taken r at a time is equal to the number of ways of filling of r blank places arranged in a row by n dissimilar things.
- ${}^nP_r = n(n-1)(n-2) \ldots (n-r+1) = \frac{n!}{(n-r)!}$
- The number of permutations of n dissimilar things taken all at a time is ${}^nP_n = n!$.
- ${}^nP_r = {}^{(n-1)}P_r + r . {}^{(n-1)}P_{r-1}$ or ${}^nP_r + r . {}^nP_{r-1} = {}^{(n+1)}P_r$
- ${}^nP_r = n\ {}^{(n-1)}P_{(r-1)} = n(n-1) . {}^{(n-2)}P_{(r-2)}$ etc.
- $\frac{{}^nP_r}{{}^nP_{r-1}} = (n - r + 1)$.
- The number of injections (one one functions) that can be defined from a set containing r elements into a set containing n elements is ${}^nP_r$.
- The number of bijections (one one onto functions) that can be defined from a set containing n elements onto a set containing n elements is n!.

NUMBER OF PERMUTATIONS UNDER CERTAIN CONDITIONS :

- Number of permutations of n different things, taken r at a time, when a particular thing is to be always included in each arrangement, is $r.{}^{n-1}P_{r-1}$
- Number of permutations of n different things, taken r at a time, when a particular thing is never taken in each arrangement is ${}^{n-1}P_r$
- Number of permutations of n different things, taken all at a time, when m specified things always come together is m!.(n - m + 1) !
- Number of permutations of n different things, taken all a time when m specified things never come together is n! - [m! . (n - m + 1)!]
- The number of permutations of 'n' dissimilar things taken 'r' at a time when 'k' particular things never occur is ${}^{(n-k)}P_r$.
- The number of permutations of 'n' dissimilar things taken 'r' at a time when k (<r) particular things always occur is ${}^{(n-k)}P_{(r-k)} . {}^rP_k$.
- The number of ways in which m (first type of different) things and n (second type of different) things ($m + 1 \ge n$) can be arranged in a row so that no two things of second type come together is $m!\ {}^{(m+1)}P_n$.
- The number of ways in which m (first type of different) things and n (second type of different) things can be arranged in a row so that all the second type of thing come together is n! (m+1)!.

- The number of ways in which n (first type of different) things and n-1 (second type of different) things can be aranged in a row so that no two things of same type come together is n! (n-1)!.
- The number of ways in which n (first type of different) things and n (second type of different) things can be arranged in a row alternatively is 2 . n! . n!.
  To arrange boys and girls in a row alternately, they should be equal in number or with difference 1. Other wise it is not possible to arrange them alternately in a row.
- The number of permutations of n dissimilar things taken r at a time when repetition of things is allowed any number of times n^r.
- The number of permutations of n different things, taken not more than r at a time, when each thing may occur any number of times $= n + n^2 + n^3 + ... + n^r = \frac{n(n^r - 1)}{n-1}$
- The number of permutations of n different things taken not more than r at a time $= {}^nP_1 + {}^nP_2 + {}^nP_3 + ... + {}^nP_r$

SUM OF THE NUMBERS:

- Sum of the numbers formed by taking all the given n digits (excluding 0) is (Sum of all the n digits) x (n-1)! x (111 ... n times).
- Sumof the numbers formed by taking all the given n digits (including 0) is (sum of all the n digits)[(n-1)! x (111 .... n times) - (n-2)! (111 .... (n-1) times)]
- Sum of all the r-digit numbers formed by taking the given n digits (excluding 0) is (sum of all the n digits) x ${}^{(n-1)}P_{r-1}$ x (111 ...... r times).
- Sum of all the r-digit numbers formed by taking the given n digits (including 0) is (sum of all the n digits) [${}^{(n-1)}P_{r-1}$ x (111 .... r times) - ${}^{(n-2)}P_{r-2}$ x (111 ... (r-1) times)].

PERMUTATIONS OF SIMILAR THINGS:

- The number of permutations of n things taken all at a time when p of them are all alike and the rest are all different is $\frac{n!}{p!}$
- If p things are alike of one kind, q things are alike of a second kind, r things are alike of a third kind, then the number of permutations found with p + q + r things is $\frac{(p+q+r)!}{p!\ .\ q!\ .\ r!}$

CIRCULAR PERMUTATIONS:

- The number of circular permutations of 'n' dissimilar things taken 'r' at a time is $\frac{{}^np_r}{r}$
- The number of circular permutations of 'n' dissimilar things taken all at a time is (n-1)!.
- The number of circular permutations of n things taken r at a time in one direction $\frac{{}^np_r}{2r}$.
- The number of circular permutations of 'n' dissimilar things in clock-wise direction = Number of permutations in anticlock-wise direction $= \frac{(n-1)!}{2}$
- The number of ways in which 'n' dissimilar things can be arranged in a circular manner such that no one will have same neighbours in any two arrangements is $\frac{(n-1)!}{2}$
- The number of ways in which m (first type of different) things and n (second type of different) things, $(m \geq n)$ can be arranged in a circle so that no two things of second kind come together is (m-1)! ${}^mP_n$.
- The number of ways in which m (first type of different) things and n (second type of different) things can be arranged in a circle so that all the second type of things come together is m! n!.
- The number of ways in which m (first type of different) things and n (second type of different) things, $(m \geq n)$ can be arranged in the form of garland so that no two things of second kind come together is $\frac{(m-1)!\ {}^mp_n}{2}$
- The number of ways in which m (first type of different) things and n (second type of different) things an be arranged in an form of a garland so that all the second type of things come together is m! n! / 2.

COMBINATIONS:

- A selection that can be formed by taking some or all of a finite set of things (or objects) is called a Combination.
- Formation of a combination by taking r elements from a finite set A means picking up an r element subset of A.
  In case of combination, order of the objects is not important.
- The number of combinations of n dissimilar things taken r at a time is equal to the number of r element subsets of a set containing n elements.

- The number of combinations of n dissimilar things taken r at a time is denoted by

$^{n}C_r$ or C (n, r) or $C\binom{n}{r} or \binom{n}{r}$.

- $^{n}C_r = \dfrac{n!}{r!\,(n-r)!}$

$$= \frac{^{n}p_r}{r!} = \frac{n(n-1)(n-2)\ldots(n-r+1)}{1.2.3\ldots r}$$

- $^{n}C_r = {}^{n}C_{n-r}$
- $^{n}C_r + {}^{n}C_{r-1} = {}^{(n+1)}C_r$
- If $^{n}C_r = {}^{n}C_s$ then r = s or r+s = n.
- $\dfrac{^{n}C_r}{^{n-1}C_{r-1}} = \dfrac{n}{r}$, $\dfrac{^{n}C_r}{^{n-2}C_{r-2}} = \dfrac{n(n-1)}{r(r-1)}$ etc.
- - $\dfrac{^{n}C_r}{^{n}C_{r-1}} = \dfrac{n-r+1}{r}$
  - $\dfrac{^{n}C_r}{^{(n-1)}C_r} = \dfrac{n}{n-r}$
- If $^{n}C_r$ is greatest, then
  - $r = \dfrac{n}{2}$ when n is even,
  - $r = \dfrac{n-1}{2}$ or $\dfrac{n+1}{2}$ when n is odd
- $^{m}C_0 \,.\, {}^{n}C_r + {}^{m}C_1 \,.\, {}^{n}C_{r-1} + {}^{m}C_2 \,.\, {}^{n}C_{r-2} + \ldots$ $\ldots + {}^{m}C_{r-1} \,.\, {}^{n}C_1 + {}^{m}C_r \,.\, {}^{n}C_0 = {}^{m+n}C_r$.
- The number of combinations of n things taken r at a time in which
  - s particular things will always occur is $^{(n-s)}C_{r-s}$
  - s particular things will never occur is $^{n-s}C_r$
  - s particular things always occur and p particular things never occur is $^{(n-p-s)}C_{r-s}$.
  - n different objects are in a row. The number of ways of selecting r objects at a time so that no two of these r objects are consecutive is $^{(n-r+1)}C_r$

DISTRIBUTION OF THINGS INTO GROUPS:

- Number of ways in which (m+n) items can be divided into two unequal groups containing m and n items is $^{m+n}C_m = \dfrac{(m+n)!}{m!\,n!}$
- The number of ways in which mn different items can be divided equally into m groups, each containing n objects and the order of the groups is not important is $\left(\dfrac{(mn)!}{(n!)^m}\right)\dfrac{1}{m!}$
- The number of ways in which mn different items can be divided equally into m groups, each containing n objects and the order of groups is important, is $\left[\left(\dfrac{(mn)!}{(n!)^m}\right)\dfrac{1}{m!}\right] m! = \dfrac{(mn)!}{(n!)^m}$
- • The number of ways in which (m + n + p) things can be divided into three different groups of m, n and p things respectively is $\dfrac{(m+n+p)!}{m!.n!.p!}$

  The required number of ways of dividing 3n things into three groups of n each

  $= \dfrac{1}{3!}.\dfrac{(3n)!}{n!\,.\,n!\,.\,n!}$

  • When the order of groups has importance then required number of ways = (3n)! / $(n!)^3$.

DIVISION OF IDENTICAL OBJECTS INTO GROUPS:

- The total number of ways of dividing n identical items among r persons, each one of whom, can receive 0, 1, 2, or more items ($\le$ n) is $^{n+r-1}C_{r-1}$ (OR) The total number of ways of dividing n identical objects into r groups, if blank groups are allowed, is $^{n+r-1}C_{r-1}$.
- The total number of ways of dividing n identical items among r persons, each one of whom receives at least one item is $^{n-1}C_{r-1}$ (OR) The number of ways in which in identical items can be divided into r groups such that blank groups are not allowed, is $^{n-1}C_{r-1}$.

  NOTE: The number of combinations of n things taken r at a time when repetitions are allowed = the number of combinations of (n + r - 1) things taken r at a time when repetitions are not allowed.
- The number of positive integral solutions of the equation $x_1 + x_2 + x_3 + \ldots + x_r = n$ is $^{n-1}C_{r-1}$.
- The number of non-negative integral solutions of the equation

  $x_1 + x_2 + x_3 + \ldots + x_r = n$ is $^{n+r-1}C_{r-1}$.
- The number of ways of choosing r objects from p objects of one kind, q objects of second kind, and so on is the coefficient of x^r in the expansion $(1 + x + x^2 + \ldots + x^p)(1 + x + x^2 + \ldots + x^q)\ldots$

- The number of ways of choosing r objects from p objects of one kind, q objects of second kind, and so on, such that one object of each kind may be included is the coefficient of x^r in the expansion $(x + x^2 + ... + x^p)(x + x^2 + ... + x^q)...$

TOTAL NUMBER OF COMBINATIONS :

- The total number of combinations of $(p_1 + p_2 + ... p_k)$ things taken any number at a time when p_1 things are alike of one kind, p_2 things are alike of second kind, ... p_k things are alike of kth kind, is $(p_1 + 1)(p_2 + 1) .... (p_k + 1)$.
- The total number of combinations of $(p_1+p_2+...p_k)$ things taken one or more at a time when p_1 things are alike of one kind, p_2 things are alike of second kind, ... p_k things are alike of kth kind, is $(p_1 + 1)(p_2 + 1) ... (p_k + 1) - 1$.
- The total number of combinations of n different things taken any number at a time is 2^n.
- The total number of combinations of n different things taken one or more at a time is $2^n - 1$.
- Let $N = p_1^{\alpha_1}.p_2^{\alpha_2}.p_3^{\alpha_3}...... p_k^{\alpha_k}$ where $p_1, p_2, p_3, ... p_k$ are different primes and $a_1, a_2, a_3, ... a_k$ are natural numbers then
  - The total number of divisors of N including 1 and N = $(a_1 + 1)(a_2 + 1)(a_3 + 1) .... (a_k + 1)$
  - The total number of divisors of N excluding 1 and N = $(a_1 + 1)(a_2 + 1)(a_3 + 1) .... (a_k + 1) - 2$
  - The total number of divisors of N excluding either 1 or N = $(a_1 + 1)(a_2 + 1)(a_3 + 1) .... (a_k + 1) - 1$
  - The sum of all divisors

    $$=\left(\frac{p_1^{\alpha_1+1}-1}{p_1-1}\right)\left(\frac{p_2^{\alpha_2+1}-1}{p_2-1}\right)......\left(\frac{p_k^{\alpha_k+1}-1}{p_k-1}\right)$$
  - The number of ways in which N can be resolved as a product of two factors

    $\frac{(\alpha_1+1)(\alpha_2+1).....(\alpha_k+1)}{2}$; if N is not a perfect square

    $\frac{(\alpha_1+1)(\alpha_2+1).....(\alpha_k+1)+1}{2}$; if N is a perfect square
  - For every numbr N, 1 and itself (N) are always divisors. These two are called trivial divisors and other divisors are called Non-trivial divisors.

DE-ARRANGEMENT:

- The number of ways in which exactly r letters can be placed in wrongly addressed envelopes when n letters are putting in n addressed envelopes is

$$^nP_r\left[1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+......+(-1)^r\frac{1}{r!}\right].$$

- The number of ways in which n different letters can be put in their n addressed envelopes so that all the letters are in the wrong envelopes

$$= n!\left[1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}+......+(-1)^r\frac{1}{r!}\right].$$

- A number is divisible by 2, if the last digit is even.
- A number is divisible by 3, if the sum of the digits in the number is divisible by 3.
- A number is divisible by 4, if the number formed by its last two digits is divisible by 4.
- A number is divisible by 5, if the last digit is either 0 or 5.
- A number is divisible by 6, if the number is divisible by 2 and 3.
- A number is divisible by 7, if the difference between twice the digit in the units place and the number formed by the other digits is either 0 or a multilple of 7.
  Example : 504,5719
- A number is divisible by 8, if the number formed by the last three digits is divisible by 8.
  Example : 2192,9128
- A number is divisible by 9, if the sum of its digits is divisible by 9.
  Example : 6453, 8640
- A number is divisible by 10, if the last digit is 0.
- A number is divisible by 11, if the sum of the digits in the odd places and the sum of the digits in the even places are equal or differ by a multiple of 11.
  Example : 209, 3564,

IMPORTANT RESULTS TO REMEMBER:

- If a polygon has 'n' sides then the number of diagonals in it is $^nC_2$ - n (or) $\frac{n(n-3)}{2}$.
- In a plane there are 'n' points and no three of which are collinear except 'k' points which lie on a line. Then
  i) No. of st. lines that can be formed by joining them = $^nC_2 - {}^kC_2 + 1$.
  ii) No. of triangles that can be formed by joining them = $^nC_3 - {}^kC_3$.
- If a set of 'm' parallel lines are intersected by another set of 'n' parallel lines then the number of parallelograms that can be formed = $(^mC_2).(^nC_2)$

- Number of rectangles of any size in a square of n x n is $\sum_{r=1}^{n} r^3$ and number of squares of any size is $\sum_{r=1}^{n} r^2$.
- In a rectangle of n x p (n < p) number of rectangles of any size is $\frac{np}{4}$ (n+1) (p+1) and number of squares of any size is $\sum_{r=1}^{n}$ (n+1-r) (p+1-r).
- Number of rectangles on a chess board (including squares) = 1296
- Number of squares on a chess board (exclusively squares) = 204
- Number of rectangles on a chess board which are not squares = 1092.
- n straight lines are drawn in the plane such that no two lines are parallel and no three lines are concurrent. Then the number of parts into which these lines divide the plane is equal to $1 + \frac{n(n+1)}{2}$.
- The number of triangles whose angular points are at the angular points of a given polygon of n sides, but none of whose sides are the sides of the polygon is $\frac{1}{6}$ n(n-4) (n-5).
- There are n straight lines in a plane, no two of which are parallel and no three passes through the same point. Their points of intersection are joined. Then the number of fresh lines thus introduced is $\frac{1}{8}$ n(n - 1) (n - 2) (n - 3).
- The number of ways in which n different things can be aranged into r different groups is ${}^{n+r-1}P_n$ or n! . ${}^{n-1}C_{r-1}$ according as blank group are or are not admissible.
- The number of ways in which n different things can be distributed into r different groups is $r^n - {}^rC_1 (r-1)^n + {}^rC_2 (r-2)^n - ... + (-1)^{n-1}\ {}^nP_{r-1}$. Here blank groups are not allowed.
- The number of ways in which n identical things can be distributed into r different group is ${}^{n+r-1}C_{r-1}$ or ${}^{n-1}C_{r-1}$ according as blank group are or are not admissible.
- The number of ways in which n identical things can be distributed into r groups so that no group contains less than l things and more than m things (l < m) is coefficient of x^n in the expansion of $x^{lr} (1 - x^{m-l+1})^r (1 - x)^{-r}$.
- Coefficient of x^r in the expansion of $(1-x)^{-n}$ is ${}^{n+r-1}C_r$
- • The number of ways of answering one or more of n questions is $2^n - 1$.
  • The number of ways of answering one or more of n questions when each question have an alternative is $3^n - 1$.
  • The number of ways of answering all of n questions when each question have an alternative is 2^n.
- n letters are being kept in n addressed envelopes. The number of ways that exactly one letter will go wrong is 0.
- The number of ways of selecting r objects out of n identical objects is 1.
- If n points on the circumference of a cicle are given, then
  - number of straight lines = ${}^nC_2$.
  - number of triangles = ${}^nC_3$
  - number of quadrilaterals = ${}^nC_4$ ....so on.

EXERCISE
LEVEL- I

COUNTING PRINCIPLE, FACTORIAL:

1. A student has 5 pants and 8 shirts. The number of ways in which he can wear the dress in different combinations is
   1) ${}^8P_5$ 2) ${}^8C_5$ 3) 8! x 5! 4) 40
2. An automobile dealer provides motor cycles and scooters in three body patterns and 4 different colours each. The number of choices open to a customer is
   1) ${}^5C_3$ 2) ${}^4C_3$ 3) 4 x 3 4) 4 x 3 x 2
3. There are 5 doors to a lecturer room. The number of ways that a student can enter the room and leave it by a different door is
   1) 20 2) 16 3) 19 4) 21
4. In a class there are 10 boys and 8 girls. The teacher wants to select either a boy or a girl to represent the class in a function. The number of ways the teacher can make this selection.
   1) 18 2) 80 3) ${}^{10}P_8$ 4) ${}^{10}C_8$

5. 15 buses fly between Hyderabad and Tirupathi. The number of ways can a man go to Tirupathi from Hyderabad by a bus and return by a different bus is

1) 15 2) 150 3) 210 4) 225

6. There are 8 types of pant pieces and 9 types of shirt pieces with a man. The number of ways a pair (1 pant, 1 shirt) can be stitched by the tailor to him is

1) 17 2) 56 3) 64 4) 72

7. (2n + 1) (2n + 3) (2n + 5) ..... (4n - 1) =

1) $\frac{(4n)!}{2^n(2n!)^2}$ 2) $\frac{(4n)!n!}{(2n!)^2}$

3) $\frac{(4n)!n!}{2^n(2n!)^2}$ 4) $\frac{(4n)!n!}{2^n(2n)!}$

8. The value of 1 + 1.1! + 2.2! + 3.3! + ... + n.n! is

1) (n+1)! + 1 2) (n-1)! + 1

3) (n+1)! - 1 4) (n+1)!

9. $\frac{1}{3.1!}+\frac{1}{4.2!}+\frac{1}{5.3!}+....\infty=$

1) 1 2) 2 3) 1/2 4) 3

9(a). $\sum_{r=1}^{n}\left(r^2+1\right)\left(r!\right)=$

1. $\left(n+1\right)!$ 2. $\left(n+2\right)!-1$

3. $n\left(n+1\right)!$ 4. $n\left(n-1\right)!$

10. The product of n consecutive natural numbers is always divisible by

1) 4n! 2) 3n! 3) 2n! 4) n!

10 (a).The remainder obtained when 1!+2!+......100! is devisible by 240 is

1. 153 2. 154 3. 155 4. 156

10(b) The remainder obtained when 1!+2!+......49! is devisible by 20 is

1. 13 2. 33 3. 12 4. 11

PROBLEMS ON ^nP_r

11. If $^nP_4 : {}^nP_5 = 1 : 2$ then n =

1) 4 2) 5 3) 6 4) 7

12. If $^{(2n+1)}P_{n-1} : {}^{(2n-1)}P_n = 3 : 5$ then n=

1) 4 2) 5 3) 6 4) 7

13. If $^{20}P_r : {}^{20}P_{r-1} = 15 : 1$ then r =

1) 6 2) 7 3) 8 4) 9

14. If $^{n-1}P_3 : {}^{n+1}P_3 = 5 : 12$ then n =

1) 6 2) 7 3) 8 4) 9

15. If $^{n+1}P_5 : {}^nP_6 = 2 : 7$ then n =

1) 8 2) 9 3) 10 4) 11

16. If $^9P_5 + 5.\,{}^9P_4 = {}^{10}P_r$ then r =

1) 4 2) 5 3) 6 4) 7

17. If $^{12}P_r = 1320$ then r =

1) 2 2) 3 3) 4 4) 5

18. If $^nP_r = 3024$ then (n, r) =

1) (8, 4) 2) (8, 3) 3) (9, 3) 4) (9, 4)

19. If $^nP_r = 5040$ then (n, r) =

1) (9, 4) 2) (10, 4) 3) (11, 3) 4) (11, 4)

SEATING ARRANGEMENTS & BOOK ARRANGEMENTS

20. The number of ways in which 5 Boys and 5 Girls can be arranged in a row so that no two girls are together is

1) 10! 2) 5! 6! 3) $(5!)^2$ 4) $2(5!)^2$

21. The number of ways in which 5 boys and 5 girls can be arranged in a row so that no two girls and no two boys are together is

1) $2(5!)^2$ 2) $(5!)^2$ 3) 5! 6! 4) 10!

22. The number of ways in which 6 Boys and 5 Girls can sit in a row so that no two girls and no two boys are together is

1) 2(5! . 6!) 2) $2(5!)^2$ 3) 5! . 6! 4) $(6!)^2$

23. The number of ways in which 6 Boys and 5 Girls can sit in a row so that all the girls may be together is

1) 6! 5! 2) 6! $^7P_5$ 3) $(6!)^2$ 4) 7! 5!

24. There are 25 railway stations between Nellore and Hyderabad. The number of different kinds of single second class tickets to be printed so as to enable a passenger to travel from the station to another is

1) $^{25}P_2$ 2) $^{26}P_2$ 3) $^{27}P_2$ 4) $^{28}P_2$

25. The number of ways in which 20 white balls and 19 black balls be arranged in a row. So that no two balls of the same colour come together is

1) 20! $^{21}P_{19}$ 2) 20!19! 3) $(20!)^2$ 4) (21)! $^{20}C_{19}$

26. The number of ways in which 10 books can be arranged in a row such that two specified books are side by side is

1) $\frac{10!}{2!}$ 2) 9! 3) 9! 2! 4) $\frac{9!}{2!}$

27. The number of ways in which the candidates A_1, A_2, ... A_{10} can be ranked if A_1 and A_2 are next to each other is

1) 9! 2! 2) 9! 3) $\frac{10!}{2!}$ 4) $\frac{9!}{4!}$

28. The number of ways in which the candidates A_1, A_2, ..., A_{10} can be ranked if A_1 is always above A_2 is

1) 9! 2! 2) 9! 3) $\frac{10!}{2}$ 4) 10!

29. The number of ways in which 6 Telugu, 4 Hindi and 3 English books be placed in a row on a shelf so that the books on the same subject remain together is

1) 6! 4! 3! 2) 3! 6! 4! 3!

3) $\frac{13!}{6!\,4!\,3!}$ 4) $\frac{13!}{6!\,4!\,3!\,3!}$

30. The number of ways of arranging 6 players to throw the hand ball so that the oldest player may not throw first is

1) 720 2) 600 3) 120 4) 480

31. There are eight question papers, then the number of ways that the best and the worst are always together is

1) 6! 2! 2) 7! 2! 3) $\frac{8!}{2!}$ 4) 8! 2!

32. m men and n women are to be seated in a row so that no two women sit together. If m>n, then the number of ways in which they can be seated is

1) m! n! 2) m! ${}^{m}P_{n}$

3) n! ${}^{m}P_{n}$ 4) m! ${}^{m+1}P_{n}$

33. The number of different signals can be given by using any number of flags from 4 flags of different colours is

1) 24 2) 256 3) 64 4) 60

34. If a number of books can be arranged in a linear shelf in 5040 ways, the number of books is

1) 7 2) 8 3) 6 4) 9

35. The number of ways can 4 men, 3 boys, 2 women be seated in a row so that the men, the boys and the women are not seperated is

1) 4! 3! 2! 2) $(4!)^2$ 3! 2!

3) 4! $(3!)^2$ 2! 4) 4! 3! $(2!)^2$

36. A, B C are three persons among 7 persons who speak at a function. The number of ways in which it can be done if 'A' speaks before 'B' and 'B' speaks before 'C' is

1) 820 2) 830 3) 840 4) 850

37. There are 10 white and 10 black balls marked 1,2,3 ..... 10. The number of ways in which we can arrange these balls in a row in such a way that neighbouring balls are of different colours is

1) 10! 9! 2) 20! 3) $(10!)^2$ 4) $2(10!)^2$

38. Two persons entered a Railway compartment in which 7 seats were vacant. The number of ways in which they can be seated is

1) 30 2) 42 3) 720 4) 360

39. The number of ways in which 10 candidates A_1, A_2, A_3, A_4 .... A_{10} can be ranked if A_1 is just above A_2 then the number of ways are

1) 9! 2! 2) 10! 3) 10! 2! 4) 9!

40. Three Men have 4 coats 5 waist Coats, and 6 caps. The number of ways they can wear them is

1) ${}^{15}P_3$ 2) $4^3 5^3 6^3$ 3) ${}^{4}P_{3}\,{}^{5}P_{3}\,{}^{6}P_{3}$ 4) 180

41. 5 boys are to be arranged in a row. It two particular boys desire to sit in end places, the number of possible arrangements is

1) 60 2) 120 3) 240 4) 12

42. There are 8 floors on a building including the ground floor. If 4 persons enter the lift in the ground floor the number of ways in which they get down the lift if no two persons come out of the lift at the same floor is

1) ${}^{7}C_{4}$ 2) 7^4 3) ${}^{7}P_{4}$ 4) 4^7

43. The number of ways in which 6 boys and 6 girls are arranged in a row so that no two boys and no two girls sit together and always row start with the boy is

1) $(6!)^2$ 2) ${}^{7}P_{6}$ 6! 3) 7! 5! 4) ${}^{7}P_{6}$ 7!

44. The number of permutations of n dissimilar things taken 'r' at a time, in which a particular thing always occur is ....

1) ${}^{(n-1)}P_{(r-1)}$ 2) $(r)\,{}^{(n-1)}P_{(r-1)}$

3) $r.\,{}^{(n-1)}P_{r}$ 4) $r!\,{}^{(n-1)}P_{(r-1)}$

45. The ways in which the time table for Monday be completed if there must be 5 lessons that day (Algebra, Geometry, Calculus, Trigonometry, Vectors) and Algebra and Geometry must not immediately follow each other are

1) 72 2) 5! 3) 3 5!/2 4) 6!

ENGLISH LETTERS ARRANGEMENT (WITHOUT REPETITION)

46. Number of permutations that can be formed with the letters of the word "TRIANGLE" is

1) 8! 2) $\frac{8!}{2!}$ 3) $\frac{8!}{3!}$ 4) $\frac{8!}{(2!)^2}$

47. In above problem, of these the number which begin with T is

1) 8! 2) $\frac{7!}{2!}$ 3) 7! 4) 6!

48. The number of permutations that can be made out of the letters of the word "EQUATION" which start with a consonant and end with a consonant is

1) 2! 6! 2) 3! 6! 3) 3! 5! 4) 2! 5!

49. The number of words that can be formed using any number of letters of the word "KANPUR" is

1) 720 2) 1956 3) 360 4) 370

50. The number of words that can be formed using all the letters of the word "KANPUR" when the vowels are in even places is

1) 144 2) 36 3) 24 4) 48

51. The number of permutations that can be made out of the letters of the word "ENTRANCE" so that the two 'N's are always together is

1) $\frac{7!}{(2!)^2}$ 2) 7! 3) $\frac{7!}{2!}$ 4) $\frac{7!}{(2!)^3}$

52. The number of permutations of four letter words obtained from the letters of the word "ARTICLE" is

1) 4! 2) $\frac{7!}{4!}$ 3) ${}^7P_4$ 3! 4) ${}^7P_4$

53. In above problem, of these the number which contain 'A' is

1) 120 2) 240 3) 360 4) 480

54. The number of permutations that can be made from the letters of the word "HOTEL" so that the vowels may occupy the even places is

1) 2 2) 6 3) 12 4) 36

55. The letters of the word "LOGARITHM" are arranged in all possible ways. The number of arrangements in which the relative positions of the vowels and consonants are not changed is

1) 4320 2) 720 3) 4200 4) 3420

56. In above problem, the number of arrangements in which the three vowels come together is

1) 7! 2) 7! . 2! 3) 7! 3! 4) 7! 4!

57. The number of words that can be formed from the letters of the word "INTERMEDIATE" in which the vowels are never together is

1) 6! . ${}^7P_6$ 2) $\frac{6!}{2!}\cdot\frac{{}^7p_6}{2!\,3!}$ 3) $\frac{6!.{}^7p_6}{2!\,3!}$ 4) $\frac{(7!)\,{}^7p_6}{2!\,5!}$

58. The number of ways in which the letters of the word "INSURANCE" be arranged so that the vowels are never separated is

1) 4320 2) 8640 3) 21600 4) 10300

59. The number of ways that the letters of the word "NELLORE" be arranged so that 'N' and 'R' are always together is

1) 360 2) 720 3) 1260 4) 2520

60. The number of ways in which the letters of the word "HEXAGON" be arranged so that the consonants may always occupy the odd places is

1) 24 2) 144 3) 360 4) 720

61. The letters of the word "RANDOM" are arranged in all possible ways. The number of arrangements in which there are 2 letters between R and D is

1) 36 2) 48 3) 144 4) 72

62. The number of ways one can arrange words with the letters of the word "MADHURI" so that always vowels occupy the beginning, middle and end places is

1) 7! 2) ${}^3C_3\cdot{}^4P_3$ 3) 3 . ${}^4C_4$ 4) 3! 4!

63. The number of permutations that can be formed with the letters of the word "SRINATHDUBE". So that a vowel occupies the central place is

1) 10! 2) 4 . 10! 3) 4! . 7! 4) 7! . 10!

64. The number of permutations that canbe made from the letters of the word "SUNDAY" without beginning with 'S' or without ending with 'Y' is

1) 696 2) 624 3) 604 4) 504

65. The number of ways in which the letters of the word "VALEDICTORY" be arranged so that the vowels may never be separated is

1) 7! 4! 2) 8! 4! 3) 7! ${}^8P_4$ 4) 4! 3!

66. The letters of the word "FLOWER" are taken 4 at a time and arranged in all possible ways. The number of arrangements which begin with 'F' and end with 'R' is

1) 20 2) 18 3) 14 4) 12

NUMBERS ARRANGEMENT

(WITHOUT REPETITION)

67. The number of three digit numbers that can be formed with 1, 2, 3, 5, 7 so that no digit being repeated in any number is

1) 6 2) 20 3) 60 4) 120

68. The number of three digit odd numbers that can be formed with 1, 2, 3, 4, 5 is

1) 36 2) 60 3) 24 4) 53

69. The number of three digit numbers that can be formed with 1, 2, 4, 5, 6, 7 so that any digit may be repeated is

1) 120 2) 6^3 3) 360 4) 720

70. The number of four digit odd numbers that can be formed with 1, 2, 3, 4, 5, 6, 7, 8, 9 is

1) 4 . ${}^8P_3$ 2) 5 . ${}^8P_3$ 3) 4 . ${}^7P_3$ 4) 5 . ${}^7P_3$

71. The number of four digit numbers that can be formed with 0, 1, 2, 3, 4, 5 is

1) ${}^6P_4$ 2) 5 . ${}^6P_3$
3) ${}^6P_4$ - ${}^5P_4$ 4) ${}^6P_4$ - ${}^5P_3$

72. The number of five digit numbers that can be formed with 0, 1, 2, 3, 4, 5, 6, 7 is

1) ${}^8P_5$ - ${}^8P_4$ 2) ${}^8P_5$ - ${}^7P_3$
3) ${}^8P_5$ - ${}^7P_4$ 4) ${}^8P_5$ - ${}^6P_3$

73. The number of four digit even numbers that can be formed with 0, 1, 2, 3, 7, 8 is

1) 180 2) 175 3) 160 4) 156

74. The number of five digit numbers that can be formed with 0, 1, 2, 3, 5 so that no digit being repeated in any number is

1) 96 2) 120 3) 24 4) 58

75. The number of five digit numbers that can be formed with 0, 1, 2, 3, 5 which are divisible by 5 is

1) 24 2) 42 3) 48 4) 60

76. The number of five digit numbers that can be formed with 0, 1, 2, 3, 5 which are divisible by 25 is
1) 42 2) 24 3) 10 4) 38

77. The number of Nine digit numbers that can be formed with different digits is
1) 9 . 8! 2) 8 . 9! 3) 9 . 9! 4) 10!

78. The number of four digit odd numbers that can be formed with 1, 2, 3, 4, 5, 6, 7, 8, 9 so that any digit may be repeated is
1) $5 . {}^9P_3$ 2) $4 . {}^9P_3$ 3) 9999 4) $5 . 9^3$

79. The number of 4 digit numbers that can be formed with 0, 1, 2, 3, 5 which are divisible by 2 or 5 is
1) 84 2) 60 3) 120 4) 53

80. The number of numbers between 3000 and 4000 which are divisible by 5, formed by using the digits 3, 4, 5, 6, 7, 8 is
1) 12 2) 24 3) 60 4) 120

80 a. I : The number of five digit numbers that canbe formed with 0, 1, 2, 3, 5, which are divisible by 5 is 18.
II : The sum of all four digit numbers that can be formed with 1, 2, 3, 4 so that no digit being repeated in any number is 66660.
which of the above statements is true?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

81. The number of three digit numbers of the form xyz where x>y>z is
1) 120 2) 720 3) 600 4) 100

82. A 5 digit number divisible by 3 is to be formed using the digits 0, 1, 2, 3, 4, 5 without repetition. The total number of ways this can be done is
1) 120 2) 96 3) 216 4) 220

83. The number of 4 digit numbers formed using the digits 1, 2, 3, 4, 5, 6, 7 which are divisible by 4 is
1) 100 2) 150 3) 200 4) 250

84. If repetitions are allowed, the number of numbers consisting of 4 digits and divisible by 5 and formed out of 0, 1, 2, 3, 4, 5, 6 is
1) 220 2) 240 3) 370 4) 588

85. The number of four digit odd numbers that can be formed so that no digit being repeated in any number is
1) 2240 2) 2420 3) 2440 4) 2520

85. a. Assetion(A): The number of quadratic expressions with the coefficients drawn from the set {0,1,2,3} is only 48 but not 64.
Reason(R): The coefficient of x^2 in the quadratic expression $ax^2 + bx + c$ can not be '0'.
1) Both A and R are true and r is the correct explanation of A
2) Both A and R are true and R is not correct explanation of R
3) A is true but R is false
4) A is false but R is true.

SUM OF NUMBERS

86. The sum of all the four digit numbers that can be formed with 1, 2, 3, 4 so that no digit being repeated in any number is
1) 66660 2) 66480 3) 64440 4) 65520

87. The sum of all the four digit numbers that can be formed with 0, 2, 3, 5 is
1) 66660 2) 66480 3) 64440 4) 65520

88. The sum of the digits in the units place of all the 4 digit numbers formed by using the digits 3, 4, 5, 6 is
1) 107 2) 108 3) 109 4) 110

89. The sum of all the numbers which are greater than 10000 formed by the digits, 1, 3, 5, 7, 9 is
1) 66600 2) 666600
3) 6666600 4) 66666600

90. The sum of all possible numbers consisting of three digits formed out 1, 2, 3, 4, 5, no digit being repeated in any number is
1) 19980 2) 99900 3) 39960 4) 39900

91. The sum of all 4 digited numbers that can be formed with the digits 1, 2, 3, 4, 5, 6 is
1) 1260 x 1111 2)1800 x 111
3) 1800 x 1111 4) 720 x 111

92. The sum of the digits at the ten's place of all the numbers formed with the help of 3, 4, 5, 6 taken all at a time is
1) 432 2) 108 3) 36 4) 18

RANK

93. The letters of the word "LABOUR" are permuted in all possible ways and the words thus formed are arranged as in a dictionary the rank of the word "LABOUR" is
1) 240 2) 241 3) 242 4) 243

94. The letters of the word "DANGER" are permuted in all possible ways and the words thus formed are arranged as in a dictionary. The rank of the word "DANGER" is
1) 132 2) 133 3) 134 4) 135

95. The letters of the word "RACE" are arranged in all possible ways and the words thus formed are arranged in a dictionary. The rank of the word "CARE" is
1) 7 2) 8 3) 9 4) 10

96. The letters of the word "TOSS" are permuted in all possible ways and the words thus formed are arranged as in a dictionary, the rank of the word "TOSS" is
1) 19 2) 10 3) 9 4) 8

96. a. The letters of the following words are arranged and words thus formed are kept as in dictionary. Then arrange the following ranks in descending order.
A : SITA B : RAMU C : TEA D : BUT
1) DCBA 2) ABDC 3) ABCD 4) BACD

96.b. The letters of the following words are arranged and words thus formed are kept as in dictionary then match the ranks of the following words.

Word	Rank
A) LATE	1) 23
B) TOSS	2) 10
C) MIRROR	3) 21
D) RACE	4) 19
	5) 14

	A	B	C	D
1)	5	2	1	3
2)	3	2	1	4
3)	5	2	1	4
4)	5	3	1	4

97. All the numbers that can be formed using all the digits 1, 2, 3, 4 are arranged in the increasing order of magnitude. The rank of the number 3241 is
1) 14 2) 15 3) 16 4) 56

98. All the numbers that can be formed using the digits, 1, 2, 3, 4 are arranged in the increasing order in magnitude. The rank of the number 3241 is
1) 56 2) 16 3) 55 4) 15

99. All the numbers that can be formed using the digits 1, 2, 3, 4, 5 are arranged in the decreasing order of magnitude. The rank of 34215 is
1) 58 2) 62 3) 96 4) 128

100. If all permutations of the letters of the word "AGAIN" are arranged as in dictionary, then fiftieth word is
1) NAAGI 2) NAGAI 3) NAAIG 4) NAIAG

PERMUTATIONS IF OBJECT REPEATED

101. There are four post boxes in a locality. The number of ways in which a person can post five letters is
1) 5! 2) 4! 3) 5^4 4) 4^5

102. There are 'mn' letters and n post boxes. The number of ways in which these letters can be posted is
1) $(mn)^n$ 2) $(mn)^m$ 3) m^{mn} 4) n^{mn}

103. There are 3 letters and 4 letter boxes in an area. The number of ways of posting 3 letters if all the three letters are not posted in the same letter box is
1) 60 2) 61 3) 62 4) 63

103 a.I. The no.of ways in which 4 letters can be posted in 5 letter boxes in 4^5 ways.
II. The no.of ways that the 3 letters can be posted in 4 boxes so that all the 3 letters are not posted in the same box is 60.
Which of the above statement is correct?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

104. The number of ways that 5 prizes be distributed among 4 boys while each boy is eligible for any number of prizes is
1) 5^4 2) 4^5 3) 20 4) 10

105. n bit strings are made by filling the digits 0 or 1. The number of strings in which there are exactly k zeros with not two 0's consecutive is
1) ${}^{(n-k)}C_k$ 2) ${}^{(n-k+1)}C_k$
3) ${}^{(n-k-1)}C_k$ 4) ${}^{(n+k)}C_k$

106. A telegraph post has 5 arms, each arm is capable of four distinct positions including the position of rest. The total number of signals that can be made is
1) 625 2) 1023 3) 1024 4) 930

107. The number of permutations of n disimilar things taken not more than 'r' at a time, when each thing may occur any number of times is
1) $\frac{n(n^r-1)}{n-1}$ 2) $\frac{n(n^n-n^r)}{n-1}$
3) ${}^nP_1 + {}^nP_2 + ... + {}^nP_r$ 4) $\frac{n(n-1)^r}{n-1}$

108. The number of permutations of n different things taken more than 'r' at a time when each thing may be repeated is
1) $\frac{n(n^r-1)}{n-1}$ 2) $\frac{n(n^n-n^r)}{n-1}$
3) ${}^nP_r + {}^nP_{r+1} + ... + {}^nP_n$ 4) $\frac{n(n-r)}{n-1}$

108 a.I : The no.of permutations of n different things taken any no.of things at a timeis ${}^nP_n$ (repetition not allowed)
II. The no.of permutations of n different things taken any no.of things at a time is
${}^nP_1 + {}^nP_2 + {}^nP_3 + ... + {}^nP_n$ (repetition not allowed)
Which of the above statements is correct?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

108. b.I : The number of ways that 5 prizes be distributed among 4 boys while each boy is eligible for any number of prizes is 4^5
II : The number of ways in which 5 Boys and 5 Girls can be arranged in a row so that no two girls are together is 5!.6!
Which of the above statements is correct?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

109. The number of 5 digit telephone numbers obtained from the digits 1, 2, 3, 4, 5 is
1) 5! 2) 5.5! 3) 5^5 4) 5.5^5

110. There are 3 candidates for a post and one is to be selected by the votes of 7 men. The number of ways in which votes can be given is
1) 7^3 2) 3^7 3) 7^2 4) $^7P_3$

111. A man has 3 servants. The number of ways in which he can send invitation cards to 6 of his friends through the servants is
1) 3^6 2) 6^3 3) $\frac{6!}{3!}$ 4) $^6P_3$

112. The number of unsuccessful attemps that can be made by a thief to open a number lock having 3 rings in which each rings contains 6 numbers is
1) 205 2) 200 3) 210 4) 215

113. The number of ways of wearing 6 different rings to 5 fingers is
1) 5^6 2) 6^5 3) 5^5 4) 6^6

114. How many 10 digit numbers can be written by using the digits 1 and 2?
1) $^{10}P_2$ 2) $^{10}C_2$ 3) 2^{10} 4) 100

115. The number of numbers formed out of 1, 2, 3, 4 without repetition are
1) 24 2) 6 3) 64 4) 23

116. If there be 2 kinds of balls red and black and atleast 4 of each kind, the number of ways a ball can be put in each of 4 different boxes is
1) 1 2) 8 3) 6 4) 16

117. The maximum number of persons in a country in which no two persons have an identical set of teeth assuming that there is no person without a tooth is
1) 2^{32} 2) 2^{32} - 1 3) 32! 4) 32!-1

LETTER REPETITION IN WORD

118. The number of permutations of the letters of the word "ENGINEERING" is
1) $\frac{11!}{3!\,2!}$ 2) $\frac{11!}{(3!\,2!)^2}$ 3) $\frac{11!}{(3!)^2\,.\,2!}$ 4) $\frac{11!}{3!(2!)^2}$

119. The number of permutation that can be made out of the letters of the word "MATHEMATICS"
i) When all vowels come together is
1) $\frac{8!\,.\,4!}{2!}$ 2) $\frac{8!\,.\,4!}{(2!)^2}$ 3) $\frac{7!\,.\,4!}{2!}$ 4) 7! 4!
ii) When no two vowels come together is
1) $7!\,^8P_4$ 2) $\frac{7!}{2!\,2!}\cdot{}^8p_4$ 3) $\frac{7!\,.\,^8p_4}{(2!)^3}$ 4) $7!\,\frac{^8p_4}{2!}$
iii) When the relative positions of vowels and consonants remain unaltered is
1) 3 . 7! 2) 2 . 7! 3) 7! 4) 4 . 7!

120. The number of ways in which the letters of the word "PROPORTION" is arranged without changing the relative positions of the vowels and consonants is
1) 720 2) 4! . 6! 3) $\frac{4!}{2!}\,.\,6!$ 4) $\frac{4!\,6!}{2!\,2!}$

121. The number of ways in which the letters of the word "SUCCESSFUL" be arranged such that
i) the 'S's will come together is
1) 8! 2) $\frac{8!}{2!}$ 3) $\frac{8!}{2!\,2!}$ 4) $\frac{8!}{2!\,2!\,2!}$
ii) No two 'S's will come together is
1) $\frac{7!}{2!\,2!}$ 2) $\frac{7!}{2!\,2!}\,.\,^8P_3$ 3) $^8P_3$ 4) $\frac{7!}{2!\,2!}\,\frac{^8P_3}{3!}$
iii) The 'S's and 'U's will come together is
1) 7! 2) $\frac{7!}{2!}$ 3) $\frac{7!}{2!\,2!}$ 4) $\frac{7!}{2!\,2!\,2!}$

122. The letters of the word "INDEPENDENCE" are arranged in all possible ways
i) Of these the number of words in which the 'D's come together is
1) 11! 2) $\frac{11!}{4!}$ 3) $\frac{11!}{4!\,3!}$ 4) $\frac{11!}{4!\,3!\,2!}$
ii) The number of words in which the 'D's do not come together is
1) $\frac{10!}{4!\,3!}$ 2) $\frac{10!}{4!\,3!}\cdot\frac{^{10}P_2}{2!}$
3) $\frac{10!}{4!\,3!}\cdot{}^{10}P_2$ 4) $\frac{10!}{4!\,3!}\cdot\frac{^{11}P_2}{2!}$

123. The number of numbers greater than or equal to 1000 but less than 4000 that can be formed with 0, 1, 2, 3, 4 so that any digit may be repeated is
1) 374 2) 375 3) 120 4) 360

124. The number of numbers lying between 10 and 1000 that can be formed with 0, 2, 3, 4, 5, 6 so that no digit being repeated in any number is
1) 100 2) 125 3) 120 4) 240

125. The number of different numbers greater than 1000000 that can be formed with the digits 2, 3, 0, 3, 4, 2, 3 is
1) 60 2) 120 3) 360 4) 230

126. The number of different numbers that can be formed by using all the digits 1, 2, 3, 4,3, 2, 1 so that odd digits always occupy the odd places is
1) 6 2) 72 3) 60 4) 18

127. In a watch shop there are 14 types of wall clocks. Each type has four pieces. The number of ways in which they can be arranged in a row is
1) $\frac{56!}{14!}$ 2) $\frac{56!}{(14!)^4}$ 3) $\frac{56!}{(4!)^{14}}$ 4) $\frac{56!}{(13!)^3}$

128. There are 3 copies of each of 4 different books. The number of ways that they can be arranged in a shelf is

1) $\frac{12!}{(4!)^4}$ 2) $\frac{12!}{(4!)^3}$ 3) $\frac{12!}{(3!)^3}$ 4) $\frac{12!}{(3!)^4}$

129. The number of ways of arranging the letters 'AAAAABBBCCCDEEF' in a row, if the letters 'C' are separated from one another is

1) $\frac{12!}{5!\,3!\,2!}$ 2) $\frac{13!}{10!\,3!}$

3) $\frac{12!}{5!\ 3!\ 2!}\cdot\frac{13!}{10!\ 3!}$ 4) $\frac{12!}{5!\,3!\,2!}+\frac{13!}{10!\,3!}$

130. With 10 different letters, 5 letter words are formed. Then the number of words which have atleast one letter repeated is

1) 10^5 2) ${}^{10}P_5$ 3) $10^5 - {}^{10}P_5$ 4) 5^{10}

131. The number of ways of permuting the letters of the word "CONTINUE" so that the order of the vowels is not changed is

1) 820 2) 840 3) 860 4) 880

132. Number of ways of permuting the letters of the word "ENGINEERING" so that the order of the vowels is not changed is

1) ${}^{11}P_5$ 2) $\frac{11!}{5!}$ 3) $\frac{11!}{2!\,5!}$ 4) $\frac{{}^{11}P_5}{2}$

133. The number of ways in which 6 '+' and 4 '-' signs can be arranged in a line such that no two '-' signs come together is

1) 35 2) 120 3) 720 4) 610

134. The number of ways in which all the letters of the word "INTEGRATION" can be arranged so that all vowels are always in the beginning of the word is

1) $\frac{6!\ 5!}{(2!)^3}$ 2) $\frac{7!\,4!}{2!}$ 3) 7! . 4! 4) $\frac{7!}{(2!)^2}$

135. How many numbers greater than 50000 can be formed with the digits 1, 1, 5, 9, 0 ?

1) 12 2) 18 3) 24 4) 32

136. The number of different numbers each of six digits that can be formed by using the digits 1,2,1,0,2,2 is

1) 600 2) 120 3) 100 4) 50

137. The number of five digit numbers formed using the digits 0, 2, 2, 4, 4, 5 which are greater than 40,000 is

1) 84 2) 90 3) 72 4) 60

CIRCULAR PERMUTATION

138. The number of ways in which 7 persons can be arranged around a circle is

1) 360 2) 720 3) 5040 4) 1440

139. The number of ways in which 7 men and 4 women are to be seated at a round table so that no two women are to sit together is

1) $6!\,{}^{7}P_4$ 2) $7!\,{}^{7}P_4$ 3) $6!\,{}^{8}P_4$ 4) $7\,{}^{6}P_4$

140. The number of ways in which 8 boys be seated at a round table so that two particular boys are next to each other is

1) 8! 2! 2) 7! 2! 3) 6! 2! 4) 6!

141. A round table conference is to be held between 20 deligates of 20 countries. The number of ways in which they can be seated if two particular deligates are always to sit together is

1) 19! 2! 2) 18! 2! 3) 18! 4) 19!

142. The number of ways in which 7 men be seated at a round table so that two particular men are not side by side is

1) 2400 2) 120 3) 360 4) 480

143. The number of ways in which 4 men and 4 women are to sit for a dinner at a round table so that no two men are to sit together is

1) 576 2) 144 3) 36 4) 120

144. The number of ways in which 5 men, 5 women and 12 children can sit around a circular table so that the children are always together is

1) 4! 4! 12! 2) 11! 12!
3) 10! 12! 4) $(12!)^2$

145. 20 persons are invited for a party then the number of ways in which they and the host be seated at a round table is

1) 20! 2) 21! 3) 22! 4) 2.20!

146. 20 persons are invited for a party. The different number of ways in which they can be seated at a circular table with two particular persons seated on a either side of the host is

1) 19! 2! 2) 18! 2! 3) 20! 2! 4) 18! 3!

147. The number of ways in which 5 boys and 3 girls can sit around a table so that all the girls are not to come together is

1) 4020 2) 4120 3) 4220 4) 4320

148. The number of ways in which 5 boys and 4 girls to sit around a table so that all the boys sit together is

1) 576 2) 720 3) 2880 4) 1440

149. The number of ways in which 8 red roses and 5 white roses of different sizes can be made out to form a garland so that no two white roses come together is

1) $\frac{8!}{2}\,.\,{}^{8}P_5$ 2) $\frac{7!}{2}\,.\,{}^{8}P_5$ 3) $\frac{7!}{2}\,.\,{}^{9}P_5$ 4) $7!\,{}^{4}P_3$

150. The number of ways that a garland can be made out of 6 red and 4 white roses of different sizes, so that all the white roses come together is

1) 8640 2) 4320 3) 720 4) 360

151. The number of ways in which necklace can be formed with 8 red, 11 black and 12 green coloured beeds is

1) $\frac{31!}{8!\ 11!\ 12!}$ 2) $\frac{31}{2!\ 8!\ 11!\ 12!}$

3) $\frac{30!}{2!\ 8!\ 11!\ 12!}$ 4) $\frac{31!}{2!\ 8!\ 11!\ 12!}$

152. The number of circular permutations of 7 dissimilar things taken 5 at a time is
1) 2520 2) 1260 3) 500 4) 504

153. The number of ways in which 20 differently coloured flowers be strung in the form of a garland is
1) 19! 2) $\frac{19!}{2!}$ 3) 20! 4) 21!

154. The number of ways in which 7 men can sit at a round table so that all shall not have the same neighbours in any two arrangements is
1) 360 2) 720 3) 700 4) 300

155. The number of ways in which 5 boys and 5 girls are arranged so that a girl should sit in between two boys around a table is
1) 5! 5! 2) 5! 4! 3) 9! 4) 10!

156. The no. of ways in which 6 gentlemen and 3 ladies be seated round a table so that every gentleman may have a lady by his side is ...
1) 1440 2) 720 3) 240 4) 480

156 a. Assertion(A): The no.of circular permutations of 7 persons taken 4 at a time is $\frac{^7P_4}{4}$
Reason(R): The no.of circular permutations of n different things taken r at a time is $\frac{^nP_r}{r}$
1. A is true and R is false
2. A is fgalse and R is true
3. Both A and R are true
4. Both A and R are false

156.b. There are 4 boys and 3 girls. Arrange the following in ascending order.
a. Number of ways to arrange them in a row
b. Number of ways to arrange them around a table
c. Number of ways to arrange them in a row such that no two girls are together.
d. Number of ways to arrange them around a table such that all 3 girls are together.
1) d, c, b, a 2) d, b, c, a
3) a, b, c, d 4) a, c, b, d

PROBLEMS ON ^nC_r

157. If $^nC_3 = {^nC_9}$ then $^nC_2$ =
1) 66 2) 132 3) 72 4) 98

158. If $^{15}C_{3r} = {^{15}C_{r+3}}$ then r =
1) $\frac{3}{2}$ 2) 3 3) 4 4) 5

159. If $^{2n}C_3 : {^nC_2} = 44 : 3$ then n =
1) 6 2) 7 3) 8 4) 9

160. If $^{n+2}C_8 : {^{n-2}P_4} = 57 : 16$ then n =
1) 17 2) 18 3) 19 4) 20

161. If $^nC_3 : {^{2n-1}C_2} = 8 : 15$ then n =
1) 5 2) 6 3) 7 4) 8

162. If $^nC_{r-1} = 36$, $^nC_r = 84$, $^nC_{r+1} = 126$ then (n, r) =
1) (9, 6) 2) (9, 5) 3) (9, 3) 4) (9, 2)

163. The value of 1 x 3 x 5 .... (2n-1) 2^n =
1) $\frac{(2n)!}{2^n}$ 2) $\frac{(2n)!}{n!}$ 3) $\frac{n!}{(2n)!}$ 4) 2n

164. The value of expressions $^{47}C_4 + \sum_{i-1}^{5} {^{(52-i)}C_3} =$
1) $^{52}C_4$ 2) $^{52}C_3$ 3) $^{53}C_4$ 4) $^{53}C_3$

165. $^{22}C_5 + \sum_{i-1}^{4} {^{(26-i)}C_4} =$
1) $^{27}C_5$ 2) $^{27}C_4$ 3) $^{26}C_4$ 4) $^{26}C_5$

165 a. Matching Type questions:
Match the following :

A) ^nP_r	1) $^{n+1}C_r$
B) ^nC_r	2) $\frac{n!}{(n-r)!.r!}$
C) $^nC_r + {^nC_{r-1}}$	3) $^nC_r r!$
D) $\frac{^nC_r}{^nC_{r-1}}$	4) $\frac{r}{n-r+1}$
	5) $\frac{n-r+1}{r}$

	A	B	C	D
1)	3	2	1	4
2)	3	2	1	5
3)	3	2	4	5
4)	3	4	1	5

165 b. Match the following :

A) $^nC_0 + {^nC_1} + {^nC_2} + ... + {^nC_n}$	1) $^{(n+1)}P_r$
B) $\frac{^nP_r}{^nP_{(r-1)}}$	2) 2^n
C) $^nP_r + r.{^nP_{(r-1)}}$	3) $^{(n+1)}P_{(r+1)}$
D) ^nP_n	4) $n-r+1$
	5) $n!$

	A	B	C	D
1.	2	4	1	5
2.	1	4	2	5
3.	2	4	5	1
4.	1	3	5	2

CONDITIONS ON COMBINATION
COMMITTEE SELECTIONS

166. A man has 12 friends of whom 8 are relatives. How many ways he can invite 7 friends such that 5 of them are relatives is
1) 330 2) 333 3) 336 4) 340

167. Out of 7 men and 4 women a committee of 5 is to be formed. The number of ways in which this can be done so as to include 2 women is
1) 210 2) 220 3) 230 4) 240
168. Out of 7 men and 4 women a committee of 5 is to be formed. The number of ways in which this can be done so as to include atleast 2 women is
1) 210 2) 301 3) 294 4) 84
169. out of 10 boys and 5 girls a committee of 7 is to be selected. The number of ways in which this can be done when there is a majority of boys is
1) 4572 2) 4570 3) 5680 4) 5790
170. A candidate is required to answer 7 out of 12 questions which are divided into two equal groups and he is not permitted to answer more than 5 questions from each group. The number of different ways in which he can choose 7 questions is
1) 560 2) 920 3) 1200 4) 780
171. A team of 11 players has to be choosen from the groups consisting of 6 and 8 players respectively. The number of ways of selecting them so that each selection contains atleast 4 players from the first group is
1) 120 2) 280 3) 344 4) 244
172. The number of ways in which a team of 11 players can be selected from 22 players including 2 of them and excluding 4 of them is
1) ${}^{16}C_6$ 2) ${}^{16}C_7$ 3) ${}^{16}C_8$ 4) ${}^{20}C_7$
173. The number of ways a cricket 11 be chosen out of 15 players of whom 6 are bowlers if the team consists of atleast 5 bowlers ?
1) 630 2) 504 3) 126 4) 526
174. From 15 players the number of ways of selecting 6 so as to exclude a particular player is
1) ${}^{14}C_5$ 2) ${}^{15}C_6$ 3) ${}^{15}C_5$ 4) ${}^{14}C_6$
175. The number of ways that a volley ball 6 can be selected out of 10 players so that 2 particular players are excluded is
1) 56 2) 55 3) 27 4) 28
176. The number of ways that a volley ball 6 can be selected out of 10 players so that 2 particular players are included is
1) 72 2) 70 3) 68 4) 66
177. The number of ways in which a student can choose 5 courses out of 9 courses if 2 courses are compulsory is
1) 32 2) 33 3) 34 4) 35
178. A committee of 5 is to be formed from 6 boys and 5 girls. The number of ways that the committee can be formed so that the committee contains atleast one boy and one girl is
1) 440 2) 445 3) 450 4) 455
179. 153 games were played at a chess tournament with each contestant playing once against each of the others. The number of participants is
1) 16 2) 17 3) 18 4) 19
180. The number of ways in which a committee consisting of 6 men and 3 women may be formed from a group of 10 men and 6 women is
1) ${}^{16}C_9$ 2) ${}^{10}C_6$ 3) ${}^{6}C_3$ 4) ${}^{10}C_4 \cdot {}^{6}C_3$
180 a.I : Out of 7 men and 4 women a committee of 5 is to be formed. The number of ways in which this can be done so as to include exactly 2 women is 210.
II : So as to include atleast 2 women is 301.
which of the above statements is true?
1) only I 2) only II
3) Both I and II 4) Neither I nor II
181. From 7 boys and 4 girls a committee of 6 is to be formed. The number of ways in which the selection can be done when the committee contains exactly two girls is
1) 210 2) 220 3) 371 4) 480
182. From 7 boys and 4 girls a committee of 6 is to be formed. The number of ways in which the selection can be done when the committee contains atleast two girls is
1) 210 2) 220 3) 371 4) 480
183. In a shelf there are 10 English and 8 Telugu books. The number of ways in which 6 books can be chosen if a particular English book is excluded and a particular Telugu book is excluded is
1) ${}^{9}C_3 \cdot {}^{7}C_3$ 2) ${}^{16}C_6$ 3) ${}^{9}C_3 \cdot {}^{8}C_3$ 4) ${}^{18}C_8$
184. The number of different ways in which a committee of 4 be formed out of 6 Asians, 3 Europeans and 4 Americans if the committee is to have atleast one from each of the 3 regional groups is
1) 320 2) 340 3) 360 4) 380
185. Every body in a room shakes hands with every body else only once. If the total number of hand shakes is 66 then number of persons in the room is
1) 11 2) 12 3) 13 4) 14
186. There are 10 balls of different colours. In how many ways is it possible to select 7 of them so as to include the red ball ?
1) 80 2) 82 3) 84 4) 90
187. There are 10 balls of different colours. In how many ways is it possible to select 7 of them so as to exclude the white and the black ball ?
1) 8 2) 7 3) 16 4) 20
188. If the selection is to consist of either all males or all females then the number of ways of selecting 10 clerks from 22 males and 17 female applicants is
1) ${}^{22}C_{10}$ 2) ${}^{17}C_{10}$ 3) ${}^{22}C_{10} + {}^{17}C_{10}$ 4) ${}^{20}C_3$

189. The number of combinations of 2n things taken 'n' at a time when n of the 2n things are alike and the rest different is

1) ${}^{2n}C_0 + {}^{2n}C_1 + {}^{2n}C_2 + ... + {}^{2n}C_n$

2) $\frac{(2n)!}{n!}$ 3) $\frac{(2n)!}{(n!)^2}$ 4) 2^n

190. There were two women participating in a chess tournament. Every participant played two games with the other participants. the number of games that the men played between themselves proved to exceed by 66 the number of games that the men played with the women. The number of participants is

1. 6 2. 11 3. 13 4. 10

191. A box contains 2 white, 3 black and 4 red balls. (Balls are of different sizes). In how many ways can 3 balls be drawn from the box if atleast one black ball is to be included in the draw?

1) 84 2) 64 3) 60 4) 120

192. 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 63 then n =

1) 3 2) 4 3) 5 4) 6

193. In a library there are (2n+1)books. If a student selects atleast (n+1) books in 256 ways then the number of books in the library is

1) 7 2) 8 3) 9 4) 6

194. A set contains (2n+1) elements. The number of subsets of this set which contains more then 'n' elements is

1) 2^{n-1} 2) 2^n 3) 2^{n+1} 4) 2^{2n}

195. A is a set containing n elements. A subset P of A is chosen. The set A is reconstructed by replacing the elements of P.A subset Q of A is again chosen. The number of ways of choosing P and Q so that $P \cap Q = \phi$ is

1) 3^n 2) 3^{2n} 3) 2^{2n} 4) 2^n

196. In a shelf there are 8 English, 6 Telugu books. The number of ways can 6 books be chosen if there is no restriction in the choice of books is

1) ${}^{18}C_6$ 2) ${}^{14}C_6$ 3) ${}^8C_3.{}^6C_3$ 4) ${}^{10}C_6$

197. The number of products that can be formed with 8 prime numbers is

1) 247 2) 252 3) 5 4) 248

198. In an examination, a student is to choose any 8 questions from a set of 12. If the questions 1 and 3 are compulsory then he can select the questions in

1) 210 ways 2) 495 ways
3) 615 ways 4) 200 ways

199. Mr. A has x children by his first wife and Ms. B hax x+1 children by her first husband. They amrry and have children of their won. The whole family has 10 children. Assuming that two children of the same parents do not fight, the maximum number of fights that can take place among the children is

1) 33 2) 35 3) 38 4) 34

200. ${}^xC_7 - {}^xC_5 = 0$ then x =

1) 7 2) 5 3) 12 4) 10

200 a. Arrange the following values of n in ascending order.

A : ${}^nP_5 = {}^nP_6 \Rightarrow n =$

B : ${}^nC_{12} = {}^nC_8 \Rightarrow n =$

C : ${}^nC_{(n-3)} = 10 \Rightarrow n =$

D : ${}^{(n+1)}P_5 : {}^nP_6 = 1:2 \Rightarrow n =$

1) CABD 2) CADB 3) ACDB 4) DBAC

200.b. Observe the following Lists

List - I	List - II
A. ${}^nC_r + {}^nC_{r-1} =$	1. ${}^{n+1}P_r$
B. $\frac{{}^nP_r}{{}^nP_{r-1}} =$	2. $\frac{n-r+1}{r}$
C. ${}^nP_r + {}^{r.n}P_{r-1} =$	3. $n-r+1$
D. $\frac{{}^nC_r}{{}^nC_{r-1}} =$	4. $n+r-1$
	5. ${}^{n+1}C_r$

The correct match is

	A	***B***	***C***	***D***
1)	5	3	2	1
2)	5	3	1	2
3)	2	4	3	1
4)	5	4	2	1

201. Ten students are participating in a race. The number of ways the first three places can be won is

1) 3 2) ${}^{10}C_3$ 3) ${}^{10}P_3$ 4) ${}^{10}P_4$

202. From a company of 20 soldiers any 5 are placed on guard, each batch to watch 5 hours. For what length of time in hours can different batches be selected?

1) ${}^{29}C_5$ 2) ${}^{20}P_5$ 3) ${}^{20}C_5$ x 5 4) ${}^{20}P_5$ x 5

POINTS, LINES & CHESS BOARD PROBLEMS

203. The number of diagonals in a hexagon is

1) 10 2) 9 3) 8 4) 7

204. The number of diagonals in an octagon is

1) 8 2) 40 3) 20 4) 32

205. A polygon has 35 diagonals. The number of its sides are

1) 8 2) 9 3) 10 4) 11

206. The polygon in which the number of diagonals is equal to the number of sides is

1) Pentagon 2) Hexagon
3) Octagon 4) Decagon

206 a. Arrange the following values in ascending order.
A : No.of diagonals of a polygon with 10 sides
B : No.of squares (exclusively squares) in a chess board
C : No.of ways in which 4 boys and six girls sit alternately in a row
D : No.of sides of a figure in which no.of sides is equal to no.of diagonals.
1) BADC 2) DCAB 3) CDBA 4) CDAB

207. There are 12 points in a plane out of which 7 are in a straight line. The number of straight lines formed by joining all these points is
1) 45 2) 46 3) 47 4) 48

208. There are 10 points in a plane out of which 6 are collinear. The number of triangle formed by joining all these points is
1) 70 2) 80 3) 90 4) 100

209. If m parallel lines in a plane are intersected by n parallel lines then number of parallelograms formed is
1) $\frac{m!\,n!}{(2!)^2}$ 2) $\frac{m!\,n!}{(m-2)!(n-2)!}$
3) $\frac{m!\,n!}{(2!)^2(m-2)!(n-2)!}$ 4) $\frac{(m+n)!}{(m+n-2)!\,2!}$

210. The number of rectangles on a chess board is
1) 1296 2) 204 3) 1292 4) 200

211. The number of squares on a chess board is
1) 1296 2) 204 3) 1292 4) 200

211a. If given n points are on the circuference of a circle then observe the following Lists:

List = I	**List - II**
A. Number of straight lines	i. $2^n - 1$
B. Number of diagonals in an n-sided closed polygon	ii. ${}^nC_4$
C. Number of triangles	iii. ${}^nC_2 - n$
D. Number of quadrilaterals	iv. ${}^nC_3$
	v. ${}^nC_2$

The correct Match for List - I from List - II is

	A.	*B.*	*C.*	*D.*
1.	iii	i	iv	ii
2.	v	iv	iii	ii
3.	v	iii	iv	ii
4.	i	iii	ii	iv

212. The sides AB, BC, CA of a triangle ABC have 3, 4 and 5 interior points respectively on them. The number of triangles that can be formed using these points as vertices is
1) 205 2) 220 3) 225 4) 230

213. A parallelogram is cut by two sets of m lines parallel to the sides. The number of parallelograms thus formed is
1) $\frac{m^2}{4}$ 2) $\frac{(m+1)^2}{4}$
3) $\frac{(m+2)^2}{4}$ 4) $\frac{(m+1)^2\,(m+2)^2}{4}$

214. The number of triangles formed by joining all the vertices in a decagon is
1) 100 2) 110 3) 120 4) 130

215. There are 10 straight lines in a plane no two of which are parallel and no three are concurrent. The points of intersection are joined, then the number of fresh lines formed are
1) 630 2) 615 3) 730 4) 600

216. There are 15 lines terminating at a point. The number of angles formed is
1) 105 2) 120 3) 125 4) 120

216 a. Arrange the maximum number of points of intersection of the following in ascending order
A. 8 Circles B. 8 straight lines
C. 4 circles and 4 straight lines
D. 3 circles and 5 straight lines
1) D, C, B, A 2) B,A, C, D
3) A, B, C, D 4) B, D, C, A

217. The straight lines L_1, L_2, L_3 are parallel and lie in the same plane. A total number of m points are taken on L_1. n points on L_2 and K points on L_3. Then maximum number of triangles formed with vertices at these points are
1) ${}^{m+n+k}C_3$ 2) ${}^{m+n+k}C_3 - ({}^mC_3 + {}^nC_3 + {}^kC_3)$
3) $({}^mC_3 + {}^nC_2 + {}^kC_3)$
4) ${}^mC_2 . {}^nC_2 + {}^nC_1 . {}^kC_2 + {}^nC_2 . {}^mC_1$

218. There are 'p' points in space of which 'q' points are coplanar. Then the number of planes formed is
1) ${}^pC_3 - {}^qC_3$ 2) ${}^pC_3 - {}^qC_3 + 1$
3) ${}^pC_2 - {}^qC_2$ 4) ${}^pC_3 - {}^qC_2$

219. If a line segment be cut at n points, then the number of line segments formed is
1) n(n+3) 2) $\frac{n(n-3)}{2}$
3) $\frac{(n+2)(n+1)}{2}$ 4) n

220. The number of rectangles which are not squares having common side in a chess board is
1) ${}^8C_2 \times {}^8C_2 - 8^2$ 2) ${}^8C_2 \times {}^8C_2 - S8^2$
3) ${}^9C_2 \times {}^9C_2 - 8^2$ 4) ${}^9C_2 \times {}^9C_2 - S8^2$

221. How many straight lines can be drawn by joining 10 points on a circle ?
1. ${}^{55}C_8 \times {}^5C_2$ 2. ${}^8C_3 \times {}^5C_3$ 3. 344 4. 45

222. The greatest number of points of intersection of 8 lines and 4 circles is
1. 64 2. 92 3. 104 4. 96

223. In a plane there are 37 straight lines, of which 13 pass through the point A and 11 pass through the point B. Besides, no three lines pass through one point, no line passes through both points A and B, and no two are parallel. Then the number of intersection points the lines have is equal to
1. 535 2. 601 3. 728 4. 548

224. The number of way of selecting two squares on chess board such that they have a side in common is
1) 224 2) 112 3) 56 4) 68

225. The number of ways of selecting 3 squares on a chess board which lies on a diagonal of max. length is
1) 112 2) 56 3) 224 4) 138

226. The number of triangles whose vertices are at the vertices of an octagon but none of whose sides happen to come from the sides of the octagon is
1. 24 2. 52 3. 48 4. 16

227. In a polygon no three diagonals are concurrent. If the total number of points of intersection of diagonals interior to the polygon is 35 and the number of diagonals is 'x', number of sides is 'y' then (y, x) =
1) (5, 5) 2) (6, 9) 3) (5, 20) 4) (7, 14)

DISTRIBUTION OF THINGS

228. The number of ways in which 16 things can be divided into 3 groups containing 5, 5, 6 things is
1) $\frac{16!}{(5!)^2 6!}$ 2) $\frac{16!}{5!\,6!}$
3) $\frac{16!}{2!\,(5!)^2\,6!}$ 4) $\frac{16!}{5!\,6!\,x\,3}$

229. If 3n articles can be divided into 3 equal groups in 280 ways then n =
1) 2 2) 3 3) 4 4) 5

230. The number of ways in which 4n things can be divided into 4 equal parts is
1) $\frac{(4n)!}{4!\,(n!)^4}$ 2) $\frac{(4n)!}{(n!)^4}$ 3) $\frac{(4n)!}{4^n}$ 4) $\frac{(4n)!}{4!\,n!}$

231. The number of ways in which 52 ards can be divided into 4 sets of 13 each is
1) $\frac{52!}{(13!)^4}$ 2) $\frac{52!}{4!\,(13!)^4}$ 3) $\frac{52!}{4^{13}}$ 4) $\frac{52!}{13!\,4^{13}}$

232. The number of ways in which 52 cards can be divided among 4 players so that each may have 13 is
1) $\frac{52!}{(13!)^4}$ 2) $\frac{52!}{4^{13}}$ 3) $\frac{52!}{4!\,(13!)^4}$ 4) $\frac{52!}{13!\,4^{13}}$

233. The number of ways in which 'mn' students can be distributed equally among n sections is
1) $(mn)^n$ 2) $\frac{(mn)!}{m!}$ 3) $\frac{(mn)!}{(m!)^n}$ 4) $\frac{(mn)!}{(n!)^m}$

234. The number of ways of dividing 15 books into 3 groups of 3, 4, 8 books respectively is
1) $\frac{15!}{2!\,3!\,4!\,8!}$ 2) $\frac{15!}{(3!)^2\,4!\,8!}$
3) $\frac{15!}{4!\,8!}$ 4) ${}^{15}C_3 \,.\, {}^{12}C_4 \,.\, {}^8C_8$

235. 15 Passengers are to travel by a double decked bus which can acomidate 5 in upper deck and 10 in lower deck. The number of ways that the passengers are distributed is
1) 3000 2) 3003 3) 3006 4) 3009

236. At an election 3 wards of a town are canvassed by 4, 5 and 3 men respectively. If 20 men volunteer the number of ways they can be alloted to the different wards is
1) $\frac{20!}{3!\,4!\,5!}$ 2) $\frac{12!}{3!\,4!\,5!}$
3) $\frac{20!}{3!\,4!\,5!\,8!}$ 4) $\frac{12!}{3!\,4!\,5!\,8!}$

237. The number of ways can a pack of 52 cards be divided into 4 sets, three of them having 17 cards each and fourth just one card is
1) $\frac{52!}{(17!)^3}$ 2) $\frac{52!}{3.(17!)^3}$
3) $\frac{52!}{3!(17!)^3}$ 4) $\frac{52!}{3!^3\,(17!)}$

237 a.I. The no.of ways of dividing 15 different objects into 3 equal groups is $\frac{15!}{5!5!5!}$
II. The no.of ways in which52 cards can be distributed among 4 persons equally is $\frac{52!}{(13!)^4\,.4!}$
Which of the above statement is correct?
1) Only I 2) Only II
3) Both I and II 4) Neither I nor II

238. The number of ways a pack of 52 cards can be divided among four players in 4 sets, three of them having 17 cards each and the fourth one just 1 card is
1) $\frac{52!}{(17!)^3}$ 2) $\frac{52!}{3.(17!)^3}$
3) $\frac{52!}{3!(17!)^3}$ 4) $\frac{52!}{3!^3\,(17!)}$

239. The number of ways in which 12 balls can be divided between two friends, one receiving 8 and the other 4, is
1) $\frac{12!}{8!\,4!}$ 2) $\frac{12!\,2!}{8!\,4!}$ 3) $\frac{12!}{8!\,4!\,2!}$ 4) $\frac{12!}{4!}$

240. The number of ways can 5 things be divided between A and B so that each receive at least one thing is
1) 30 2) 60 3) 20 4) 80

241. The number of ways in which a pack of 52 cards of four different suits be distributed equally among 4 players so that each may have ace, king, queen and knave of the same suit is
1) $\frac{4!(36!)}{(9!)^4}$ 2) $\frac{36!}{(9!)^4}$ 3) $\frac{2(36!)}{(9!)^4}$ 4) $\frac{3(36!)}{(9!)^4}$

242. The number of ways in which '2n' persons may be distributed betwen two table around which they are to be seated is
1) $\frac{2n!}{n!}$ 2) $\frac{2n!}{(n!)^2}$ 3) 2n! 4) 2.(2n!)

242 a.I : The number of ways in which 52 cards can be divided among 4 players so that each may have 13 is $\frac{(52)!}{(13!)^4.4!}$

II : The number of ways in which 52 cards can be divided into 4 sets of 13 each is $\frac{(52)!}{(13!)^4}$

Which of the above statements is true?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

TOTAL COMBINATIONS

243. If the total number of combinations of n different things taken one or more at a time is 127 then n=
1) 6 2) 7 3) 8 4) 9

244. In the intermediate examination, a candidate has to pass in each of the 6 subjects, the number of ways that he can fail is
1) 60 2) 61 3) 62 4) 63

245. A basket contains 4 Orranges, 5 Apples, 6 Mangoes. The number of ways a person make selection of fruits from the basket is
1) 209 2) 210 3) 211 4) 212

246. A question paper contains 5 questions each having an alternative. The number of ways that a student can answer one or more questions is
1) 31 2) 242 3) 243 4) 32

247. Given 5 different green 4 different blue, and 3 different red dyes. The number of combinations of dyes that can be choosen taking atleast one green and one blue dye is
1) 3680 2) 3690 3) 3700 4) 3720

248. How many different sums can be formed with the following coins. A rupee, a 50 paise, a 25 paise, a 10 paise, and a 5 paise.
1) 30 2) 31 3) 32 4) 33

249. The number of ways of selecting atleast one red ball from a bag containing 4 identical red balls and 5 identical black balls is
1) 20 2) 21 3) 23 4) 24

250. These are 10 lamps in a hall. Each one of them can be switched on independently. The number of ways in which the hall can be illuminated is
1) 1020 2) 1022 3) 1023 4) 1024

250 a. Observe the following Lists

List = I	List - II
A. The number of ways of answering one or more of n questions	i. $\frac{{}^nP_r}{2r}$
B. The number of ways of answering one or more of n questions is when each question has an alternative is	ii. 2^n-1
C. The number of circular permutations of n different things taken r at a time is	iii. $\frac{{}^nP_r}{r}$
D. The number of circular permutations of n things taken r at a time inone direction is	iv. 3^n-1
	v. 2^n

The correct match is

	A.	B.	C.	D.
1.	ii	iv	i	iii
2.	ii	iii	i	iv
3.	iii	ii	i	iv
4.	iv	iii	ii	i

251. A shopkeeper has 3 diferent books of mathematics and 5 different books of physics. The number of ways in which one can buy atleast one book of each subject is
1) 255 2) 217 3) 256 4) 216

252. There are 10 true-false questions. The number of ways in which they can be answered is
1) 10! 2) 2^{10} 3) 10 4) 10^2

253. There are 'n' different books and 'p' copies of each in a library. The number of ways in which one or more than one book can be selected is
1) $p^n + 1$ 2) $(p+1)^n - 1$
3) $(p+1)^n - p$ 4) p^n

253.a.I: The total number of ways in which a selection can be made of $p+q+r$ things of which p are all alike, q all alike, r all alike is $(p+1)(q+1)(r+1)-1$

II : The number of permutations of 'n' things taken together when 'p' of the things are alike of one kind, 'q' of them alike of a second kind, 'r' of them alike of a third kind and the rest all different is $\frac{n!}{p!q!r!3!}$

which of the above statement is true?

1) only I 2) only II
3) Both I and II 4) Neither I nor II

254. In a cross word puzzle 20 words are to be guessed of which 8 words have each an alternative solution also. The number of possible solutions will be
1) ${}^{20}P_8$ 2) ${}^{20}C_8$ 3) 512 4) 256

NUMBER OF DIVISORS, SUM OF DIVISORS

255. The number of positive divisors of 768 is
1) 17 2) 18 3) 19 4) 20

256. The number of positive factors of 2520 excluding unity is
1) 48 2) 45 3) 46 4) 47

257. The number of positive divisors of 1512 excluding unity and itself is
1) 32 2) 31 3) 30 4) 48

258. The sum of divisors of $2^5.3^4$ is
1) $\frac{2^5-1}{2-1}.\frac{3^4-1}{3-1}$ 2) $\frac{2^6-1}{2-1}.\frac{3^5-1}{3-1}$
3) $\frac{2^4-1}{2-1}.\frac{3^3-1}{3-1}$ 4) $2^5.\ 3^4$

259. The number of non trivial divisors of 2160 is
1) 40 2) 39 3) 38 4) 18

259 a.Arrange the following values in ascending order.
A : no.of divisors of 24
B : no.of divisors of 12
C : no.of divisors of 72
D : no.of divisors of 120
1) BACD 2) DCAB 3) BADC 4) ABCD

259 b.Assertion(A): The number of positive divisors of $2^5\ 3^6\ 7^3$ is 168
Reason(R): The number of positive devisinons of $x^n\ \ y^m\ z^r$ (here x, y and z are prime numbers) is $(x+3)(y+4)(z-4)$
1) Both A and R are true and r is the correct explanation of A
2) Both A and R are true and R is not correct explanation of R
3) A is true but R is false
4) A is false but R is true.

PERMUTATION WITH COMBINATION

260. 18 guests have to be seated half on each side of a long table. 4 particular guests desire to sit on one particular side and 3 others on the other side. Determine the number of ways in which the sitting arrangements can be made
1) $(9!)^2$ 2) ${}^{11}C_4\ (9!)^2$
3) ${}^{11}C_3\ (9!)^2$ 4) ${}^{11}C_5\ (9!)^2$

261. In how many ways can 12 boys be seated on two benches x, y 6 on each bench if two of them A,B are to sit on bench x and C,D on the bench y
1) ${}^{8}C_4\ .\ 6!\ .\ 6!$ 2) ${}^{8}C_6\ .\ 6!\ .\ 6!$
3) 6! 6! 4) ${}^{8}C_4\ .\ 6!$

262. A boat crew consisting of 8 men 3 of whom can only row on one side and 2 only on the other. The number of ways in which the crew can be arranged is
1) 576 2) 1152 3) 1728 4) 1512

263. A man invites 10 friends to a party and places 5 at one table and 5 at another table, the tables being round. The number of ways in which he can arrange the friends is
1) $(4!)^2$ 2) ${}^{10}C_5\ (4!)^2$
3) ${}^{10}C_5\ (5!)^2$ 4) 4!

264. There are 20 boys in section A. 25 boys in section B. To form a cricket team consisting of 11 players 6 are selected from section A and 5 boys from section B. The number of ways of arranging the batting order is
1) ${}^{20}C_6\ .\ {}^{25}C_5$ 2) ${}^{20}C_6\ .\ {}^{25}C_5.11!$
3) ${}^{45}C_{11}\ .\ 11!$ 4) $11!\ .\ {}^{35}C_3$

265. The number of permutations of the letters of the word 'INDEPENDENCE' taken 4 at a time so that all the 4 are different is
1) 24 2) 120 3) 240 4) 360

266. The number of permutations of the letters of the word 'PROPORTION' taken 4 at a time so that 3 are alike and one is different is
1) 15 2) 20 3) 25 4) 120

267. The number of different words which can be formed by taking 4 letters at a time out of the letters of the word 'EXPRESSION' is
1) 2090 2) 2190 3) 2454 4) 2354

268. The number of different combinations that can be formed out of the letters of the word 'INFINITE' taken four at a time is
1) 20 2) 22 3) 24 4) 120

269. Eight chairs are numbered 1 to 8. Two women and three men wish to occupy one chair each. First the women choose the chairs from among the chairs marked 1 to 4, then the men select the chairs from among the remaining. The number of possible arrangements is
1) ${}^{4}P_2\ .\ {}^{6}P_3$ 2) ${}^{6}C_3\ .\ {}^{4}C_2$ 3) ${}^{4}C_2\ .\ {}^{4}P_3$ 4) ${}^{4}P_2\ .\ {}^{4}P_3$

270. If there are 5 periods in each working day of a school, then find the number of ways that you can arrange 4 subjects during the working day.
1) 220 2) 240 3) 260 4) 280

271. A seven digit number in which every digit is always greater that the immediately preceding digit is formed. The number of ways in which this can be done is
1) ${}^{10}C_7$ 2) ${}^{10}P_7$ 3) ${}^{9}P_7$ 4) 36

272. At a circular table there are n places.If all the places are vacant then the no.of ways of arranging a person is
1) n 2) $(n-p-s)_{C_{(r-p)}}.r!$
3) $\lfloor n$ 4. $\lfloor n-1$

272 a.I : The no.of 3 digit numbers of the form xyz where x>y>z is 1.
II : The no.of 3 digit numbers of the form xyz. Where x>y>z is ${}^{10}C_3 3!$
Which of the above statement is correct?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

273. There are 5 English, 4 Sanskrit and 3 Telugu books. Two books from each group are to be arranged in a shelf. The number of possible arrangements is
1) (180) 6! 2) (12) 7!
3) 7! 4) 180

274. The crew of an 8 oar boat is to be choosen from Twelve Men, of whom 3 can row on stroke side only. The number of ways the crew can be arranged is
1) ${}^{9}c_4 . {}^{8}c_4$ 2) ${}^{9}c_4 {}^{8}c_4 4! . 4!$
3) ${}^{12}C_8 {}^{9}c_4 .4!.4!$ 4) ${}^{12}c_4 {}^{8}c_4 .4!.4!$

275. The number of permutations of n things taken r at a time if 3 particular things always occur is
1) $\frac{(n-3)!}{(n-r)!}$ r(r-1)(r-2) 2) $\frac{(n-3)!}{(r-3)!}$
3) $\frac{(n-3)!}{(n-r)!}$ x 3 4) $\frac{(n-3)!}{(r-2)!}$

PROBLEMS ON SYNOPSIS 64, 65

276. The number of ways of selecting 10 balls out of an unlimited number of white, red, blue and green balls is
1) 286 2) 280 3) 120 4) 720

277. The number of quadratic expressions with the coefficients drawn from the set {0, 1, 2, 3} is
1) 27 2) 36 3) 48 4) 64

278. In how many ways can 3 sovereigns be given away when there are 4 applicants and any applicant may have either 0, 1, 2 or 3 sovereigns?
1) 15 2) 20 3) 24 4) 48

279. The number of ways in which an examiner can assign 30 marks to 8 questions, giving not less than 2 makes to any question is
1) ${}^{21}C_7$ 2) ${}^{21}C_8$ 3) ${}^{30}C_7$ 4) ${}^{30}C_8$

280. The number of ways of distributing 15 things to 4 persons each receiving atleast two is
1) 120 2) 60 3) 28 4) 108

281. The number of ways in which 12 identical things can go into 5 purses no purse being empty is
1) ${}^{11}C_5$ 2) ${}^{12}C_5$ 3) ${}^{11}C_4$ 4) ${}^{12}C_4$

281 a. Assertion (A) :10 identical bals can be arranged in 4 places in ${}^{10}C_4$ ways
Reason (R):When things are identical, permutation becomes combination.
1. A is true and R is false
2. A is false and Ris true
3. Both A and R are true and R is the correct explanation of A
4. Both A and R are false.

282. I : In circular permutaions, actual positions of the objects are considered
II : In circular permutaions, just relative positions of the objects are considered
Which of the above is true
1) only II 2) only I
3) Both I and II 4) Neither I nor II

PROBLEMS ON DEARRANGEMENT

283. There are 5 letters and 5 addressed envelopes. The number of ways in which the letters can be placed in the envelopes so that
i) None of them goes into the right envelopeis
1) 9 2) 120 3) 44 4) 24
ii) Exactly three will go into the wrongly addressed envelopes is
1) 2 2) 10 3) 15 4) 20

284. There are seven greeting cards, each of a different colour and seven envelopes of the same seven colours. The number of ways in which the cards can be put in the envelopes so that exactly four of the cards go into the envelopes of the right colours is
1) 2 x ${}^{7}C_3$ 2) ${}^{7}C_3$
3) 3! x ${}^{4}C_3$ 4) 3! x ${}^{7}C_3$ x ${}^{4}C_3$

285. There are 3 letters and 3 addressed envelopes corresponding to them. The number of ways in which the letters be placed in the envelopes so that no letter is in the right envelope is
1) 2 2) 3 3) 4 4) 5

286. There are four balls of different colours and four boxes of colours same as those of the balls. The number of ways in which the balls, one each in a box could be placed such that a ball does not go to a box of its own colour is
1) 7 2) 8 3) 9 4) 20

286 a.I : 4 letters are placedin 4 addressed envelops randomly the no.of ways that all the letters will go wrong is 1.
II. The no.of ways that exactly one letter will go wrong is 1
Which of the above statement is correct?
1) only I 2) only II
3) Both I and II 4) Neither I nor II

287. At an election a voter may vote for any number of candidates not greater than the number to be choosen. There are 10 candidates and 5 members are to be chosen. The number of ways in which a voter may vote is
1) 630 2) 632 3) 637 4) 640

288. The number of ways of arranging the letters of the word EQUATION so that the order of the vowels and the order of the consonants is not changed is
1) ${}^{8}C_{3}.8!$ 2) ${}^{8}C_{3}$ 3) ${}^{8}P_{3}$ 4) ${}^{8}P_{3}$ 6!

289. A number of odd divisors of 128 is
1) 8 2) 7 3) 0 4) 1

290. In constructing a problem on vectors the components are drawn from $\{0,2,3,4,5\}$ the number of ways of getting the magintute of a vector as '5' is
1) 9 2) 16 3) 35 4) 26

291. 5 students (A,B,C,D,E) are to be arranged in a row so, that A occupies the 2nd position and B is always adjacent to 'c', the number of such arrangements is
1) 6 2) 4 3) 8 4) 2

KEY

1) 4	2) 4	3) 1	4) 1
5) 3	6) 4	7) 3	8) 4
9) 3	9a) 3	10) 4	10a) 1
10b) 1	11) 3	12) 1	13) 1
14) 3	15) 4	16) 2	17) 2
18) 4	19) 2	20) 2	21) 1
22) 3	23) 4	24) 3	25) 2
26) 3	27) 1	28) 3	29) 2
30) 2	31) 2	32) 4	33) 3
34) 1	35) 3	36) 3	37) 4
38) 2	39) 4	40) 3	41) 4
42) 3	43) 1	44) 2	45) 1
46) 1	47) 3	48) 2	49) 2
50) 1	51) 3	52) 4	53) 4
54) 3	55) 1	56) 3	57) 2
58) 2	59) 1	60) 2	61) 3
62) 4	63) 2	64) 4	65) 2
66) 4	67) 3	68) 1	69) 2
70) 2	71) 4	72) 3	73) 4
74) 1	75) 2	76) 3	77) 3
78) 4	79) 2	80) 1	80a) 2
81) 1	82) 3	83) 3	84) 4
85) 1	85a) 1	86) 1	87) 3
88) 2	89) 3	90) 1	91) 1
92) 2	93) 3	94) 4	95) 2
96) 2	96a) 3	96 b) 3	97) 3
98) 1	99) 1	100) 3	101) 4
102) 4	103) 1	103 a) 2	108b) 3
104) 2	105) 3	106) 2	107) 1
108) 2	108 a) 2	109) 3	110) 2
111) 1	112) 4	113) 1	114) 3
115) 3	116) 4	117) 2	118) 2
119) 4,3,1	120) 1	121) 3,4,2	122) 3,4
123) 2	124) 2	125) 3	126) 4
127) 3	128) 4	129) 3	130) 3
131) 2	132) 4	133) 1	134) 1
135) 3	136) 4	137) 2	138) 2
139) 1	140) 3	141) 2	142) 4
143) 2	144) 3	145) 1	146) 2
147) 4	148) 3	149) 2	150) 1
151) 3	152) 4	153) 2	154) 1
155) 2	156) 1	156 a) 3	156b)2
157) 1	158) 2	159) 1	160) 3
161) 4	162) 3	163) 2	164) 1
165) 4	165a) 2	165 b) 1	166) 3
167) 1	168) 2	169) 4	170) 4
171) 3	172) 2	173) 1	174) 4
175) 4	176) 2	177) 4	178) 4
179) 3	180) 4	180a) 3	181) 1
182) 3	183) 2	184) 3	185) 2
186) 3	187) 1	188) 3	189) 4
190) 3	191) 2	192) 1	193) 3
194) 4	195) 1	196) 2	197) 1
198) 1	199) 1	200) 3	200 a) 2
200 b) 2	201) 3	202) 3	203) 2
204) 3	205) 3	206) 1	206 a) 4
207) 2	208) 4	209) 3	210) 1
211) 2	211a) 3	212) 1	213) 4
214) 3	215) 1	216) 1	216 a) 4
217) 2	218) 2	219) 3	220) 4
221) 4	222) 3	223) 1	224) 2
225) 1	226) 4	227) 4	228) 3
229) 2	230) 1	231) 2	232) 1
233) 3	234) 4	235) 2	236) 3
237) 3	237 a) 4	238) 1	239) 2
240) 1	241) 1	242) 2	242a) 4
243) 2	244) 4	245) 1	246) 2

247) 4	248) 2	249) 4	250) 3
250 a) 1	251) 2	252) 2	253) 2
253 a) 1	254) 4	255) 2	256) 4
257) 3	258) 2	259) 3	259 a) 1
259b) 3	260) 4	261) 1	262) 3
263) 2	264) 2	265) 4	266) 2
267) 2	268) 2	269) 1	270) 2
271) 4	272) 2	272 a) 4	273) 1
274) 2	275) 1	276) 1	277) 3
278) 2	279) 1	280) 1	281) 3
281 a) 3	282) 1	283 i.3, ii. 4	284) 1
285) 1	286) 3		286 a) 4
287) 3	288) 2		289) 4
290) 1	291) 3		

HINTS

1. By fundamental theorem of Multiplication= 5 x 8
3. Enter in one of the 5 ways, leave remaining 4 ways. Refd. No. ways = 5 x 4 = 20
4. By fundamental theorem of addition
   10 + 8 = 18
5. 15 x 14 = 210
6. 8 x 9
7. (2n+1) (2n+3) (2n+5) .... (4n - 1)

$$\frac{(2n)!(2n+1)(2n+2)...(4n-1)(4n)}{(2n)!\,(2n+2)(2n+4)...4n}$$

$$\frac{(4n)!}{(2n)!\,2^n\,(n+1)(n+2)...(2n)}$$

$$\frac{(4n)!\;n!}{(2n)!2^n.n!\;(n+1)(n+2)...(2n)} = \frac{(4n)!\,n!}{2^n[(2n)!]^2}$$

8. n . n! = [(n+1) - 1] n! = (n+1)! - n!
   $\therefore$ 1+2! - 1! + ... + (n+1)! - n! = (n+1)!
9. $\frac{1}{3.1!}+\frac{1}{4.2!}+\frac{1}{5.3!}+ .... \infty$

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

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

10. n = 4
    2.3.4.5 = 120 is divisible by 4!
11. $\frac{n!}{(n-4)!}x\frac{(n-5)!}{n!}=\frac{1}{2}$

12 to 16

Apply $^nP_r = \frac{n!}{(n-r)!}$

17. 1) 12 x 11 $\neq$ 1320
    2) 12 x 11 x 10 = 1320
    So Ans is (2)
18. 3024 = 72x42 = 9 x 8 x 7 x 6 = $^9P_4$
20. 5 boys arranged in 5!
    Out of the 6 gaps 5 girls sit in $^6P_5$ way
    $\therefore$ 5! $^6P_5$
21. B G B G B G B G B G ---> $(5!)^2$
    G B G B G B G B G B ---> $(5!)^2$

    $2(5!)^2$
    ----
22. 5 girls arranged in 5!
    In 6 gaps, 6 boys arranged in 6! way
    No. of ways 6! 5!
24. Nellore + 25 + Hyderabad = 27
26. Two specified books = 1 object; they internally arranged in 2!
    So remaining 8 books + 1 object = 9 objects
    $\therefore$ 9! 2!
27. A_1, A_2 are takes as object, the internally arranged in 2!
    Remaining 8 objects + one object = 9 objects
28. A_1; A_2; ... A_{10} are arranged in 10! ways
    in these half of arrangements A_1 always above A_2
29. 6T + 4H + 3E = 3 objects
    3! 6! 4! 3!
31. Best + worst = 1 object ---> 2!
    $\therefore$ 7! 2!
34. n! = 5040
35. 4m + 3b + 3w = 3 objects
    3! 4! 3! 2!
37. 10 white balls are arranged in 10! ways
    10 black balls are arranged in 10! ways
    Starting white ball + starting black balls
    10! + 10!
    2 (20!)
38. $^7P_2$ = 7 x 6 = 42
39. $\frac{A_1\,A_2\,A_3\,A_4\,A_5\,A_6\,A_7\,A_8\,A_9\,A_{10}}{9!}$
40. Wearing of coats = $^4P_3$
    Wearing of waist coats = $^5P_3$
    Wearing of caps = $^6P_3$
41. x * * * x
    3! 2! = 12
42. $^{8-1}P_4 = {}^7P_4$
43. $B_1\,G_1\,B_2\,G_2\,B_3\,G_3\,B_4\,G_4\,B_5\,G_5\,B_6\,G_6$ = 6! 6!
45. x V x C x T x
    $^4P_2$. 3!
47. 8 letters are arranged in 8! ways

Remaining 7 letters arranged in 7! ways

48. 3 consonants occupy 2 ends in ${}^3P_2$ ways
remaining 6 letters occupy 6 places in 6! ways
Ans : ${}^3P_2 . 6! = 3! 6!$

49. ${}^6P_1 + {}^6P_2 + {}^6P_3 + {}^6P_4 + {}^6P_5 + {}^6P_6$

50. 1 2̲ 3 4̲ 5 6̲
2 vowels occupy 3 even plans to ${}^3P_2$ ways
remaining 4 places ocupy by letters in 4!
$\therefore$ Ans ${}^3P_2$ x 4!

54. 1 2 3 4 5
0 E
2! 3! = 12

57. 2I + 3E + 1A = 6
Set-I = 2I + 3F + 1A = 6
Set-II = NTRMPT = 6
Set-III Six letters arranged $\frac{6!}{2!}$ ways
of these 7 gaps 6 letters of set I
are arranged in $\frac{{}^7P_6}{2!\,3!}$ ways

58. $\frac{(IUAE)}{1\,object} + \frac{N,S,R,N,C,}{5\,objects} = 6$ objects
$\therefore \frac{6!}{2!}$ x 4!

59. $\frac{NR}{1} + \frac{E\,E\,L\,L\,O}{5} \quad \therefore \frac{6!}{2!\,2!}$ x 2!

61. R, D can be arranged in 2! ways. Arrange two letters from 4 letters in ${}^4P_2$ ways and let total of this is one unit with this and remaining are 3! ways
$\therefore$ Total = 2! . ${}^4P_2$. 3! ways

62. 3 vowels, 3 places = 3! remaining in 4!
Total = 3! 4!

63. ${}^4P_1$. 16!

65. 7 consonants + 4 vowels = 8 objects
8 objects arranged in 8! ways
4 vowels internal arrangement is 4!
Ans = 8! 4!

66. F * * R
${}^4P_2$ = 4 x 3 = 12

67. ${}^5P_2$ = 5 x 4 = 3

68. Units place filled with 1 or 3 or 5 in 3 ways
remaining two places filled in ${}^4P_2$ ways
$\therefore$ ${}^4P_2$ x 3

69. First place filled in 6 ways
Second place filled in 6 ways
Third place filled in 6 ways
Total = 6 x 6 x 6

75. Units place should be filled with 0 or 5 in 2 ways

If filled with 0
X X X X 0
remaining four gaps filled in 4! ways
If filled with 5
First place should not be filled with 0,
So it filled with remaining 3 letters in 3 ways
3 x 3! x 1
$\therefore$ 4! + 3 x 3! x 1 = 42

78. Units place filled with odd digit 1, 3, 5, 7, 9 in 5 ways
X X X *
9 9 9 5 = 9^3 X 5 ways

79. 3 * * 5
${}^4P_2$

81. Any selection of three digits from the ten digits 0, 1, 2, 3, ... 9 gives one number.
It is of ${}^{10}C_3$ ways

82. If a number divisible by 3, its sum of digits divisibile by 3
{0, 1, 2, 4, 5} or {1, 2, 3, 4, 5}

83. If number divisible by 4, last two digits divisible by 4
* * 1 2
* * 1 6
* * 2 4
* * 3 2
* * 64

87. Use synopsis from 30 to 33
for the problems 87 - 92

97. 3 2 4 1
1 2 3 4
2 (3!) + 2! + 1! = 16

98. No. of single digit numbers = 4
\+ No. of 2 digit numbers = ${}^4P_2$
\+ No. of 3 digits numbers = ${}^4P_3$
\+ above problem

99. 3 4 2 1 5
5 4 3 2 1
2(4!) + 1(3!) + 1(2!) + 1(1!) + 1 = 58

100. Rank of NAAGI is 49
50th rank word is next word i.e., NAAIG

101. One letter is posted in 4 ways
Two letters posted in 4^2 ways
⋮ ⋮
Five letters posted in 4^5 ways

103. Total - Posting in same box = 4^3 - 4 = 60

104. One prize is given in 4 ways
⋮
Five prizes given in 4^5 ways

106. 4^5 - 1 (rest)

111. To send one invitation there are 3 chances
So to send 6 invitations there are 3^6 chances

112. Total - 1 = 6 x 6 x 6 - 1

115. ${}^4P_1 + {}^4P_2 + {}^4P_3 + {}^4P_4$

116. 1 box in 2 ways

4 boxes in 2^4 ways

117. No. of teeth for person
= 32 the person can be either man or woman
= $2^{32}-1$ (none case is deleted)

118. E N G I N E E R I N G
3E; 3N; 2G; 2I repeated

No. of permutations = $\frac{11!}{3!\,3!\,2!\,2!}$

121. (i) $\frac{SSS}{1}$ + UCCEFUL

$\therefore$ No. of permutations = $\frac{8!}{2!\,2!}$

(ii) First arrange U C C E F U L in $\frac{7!}{2!\,2!}$ ways among these, there are 8 gaps arrange 3S's. In $\frac{^8P_3}{3!}$ ways

(iii) $\frac{SSS}{1}+\frac{UU}{1}+\frac{CCEFL}{5}$ = 7 objects

$\therefore$ Ans = $\frac{7!}{2!}$

124. Two digit Three digit
* * * * *
5 x 5 + 5 x 5 x 4

126. 1 2 3 4 5
6 7 * * *
*
Odd Even
$\frac{4!}{2!\,2!}$ $\frac{3!}{2!}$

127. 14 x 4 = 56 ---> $\frac{56!}{4!\,4!\ldots..14\ times}$

129. Other than C's are arranged in $\frac{12!}{5!\,3!\,2!}$ and

3C's are arranged in 13 gap in $\frac{^{13}P_3}{3!}$ ways

130. Atleast one letter repeated
= Total no. of words - no. of words with different letters = $10^5 - {}^{10}P_5$

133. * + * + * + *
+ * + * + *

6 +'s arranged in $\frac{6!}{6!}$ ways among them in 7 (*) gaps 4 - 's arranged in $\frac{^7P_4}{4!}$ ways

$$\therefore \frac{6!}{6!}\cdot\frac{^7P_4}{4!} = 35$$

134. First arrange vowels beginning, then arrange remaining letters.

137. x x x x x x x x
4 5
2 excluded = 4! 2 excluded = 4!/2
0 excluded = 4!/2 0 excluded = 4!/2
5 excluded = 4!/2 4 excluded = 4!/2
4 excluded = 4!/2

157. ${}^nC_r = {}^nC_s$ => n = r+s = 3+9 = 12
${}^{12}C_2 = 66$

163. 1.3.5 .... (2n-1) 2^n

$$= \frac{1.2.3.4.5\ldots\ldots(2n-1)2n.2^n}{2.4.6\ldots\ldots2n} = \frac{(2n)!}{2^n n!} \times 2^n$$

164. ${}^{47}C_4 + {}^{51}C_3 + {}^{50}C_3 + {}^{49}C_3 + {}^{48}C_3 + {}^{47}C_3 = {}^{52}C_4$
by applying ${}^nC_r + {}^nC_{r+1} = {}^{n+1}C_{r+1}$

166. Friends Relatives
4 8 ${}^4C_2$ ${}^8C_3$
2 5

167. Men Women
7 4
5
3 2
${}^7C_3 \cdot {}^4C_2 = 180$

168. Men Women
7 4
5
3 2 ---> ${}^7C_3 \cdot {}^4C_2$
2 3 ---> ${}^7C_2 \cdot {}^4C_3$
1 4 ---> ${}^7C_1 \cdot {}^4C_4$

170. G_1 G_2
6 6
7
5 2
4 3
3 4
2 5
${}^6C_5 \cdot {}^6C_2 + {}^6C_4 \cdot {}^6C_3 + {}^6C_3 \cdot {}^6C_4 + {}^6C_2 \cdot {}^6C_5$

185. ${}^nC_2 = 66$

186. ${}^{10-1}C_{7-1}$

189. x^n Coeff in $(1+x+x^2+\ldots.+x^n)(1+x)^n = 2^n$

190. Arrange 4 men on one side-I
Arrange 2 men on other side-II
In remaining 10 members, give 4 to side-I in ${}^{10}C_4$

Arrange total 8 members in 8! ways. Remaining six and 2 in side-II arrange in 8! ways.

$\therefore\ ^{10}C_4 \,.\, 8! \,.\, 8!$

191. $\dfrac{2W;\,3B;\,4R}{^6C_2\,.\,^3C_1 + {}^6C_1\,.\,^3C_2 + {}^6C_0\,.\,^3C_3}$

192. By verification
(i) n = 3; 2n + 1 = 7 => $^7C_1 + {}^7C_2 + {}^7C_3 = 63$
So Ans = (i)

193. $^{2n+1}C_{n+1} + {}^{2n+1}C_{n+2} + ... + {}^{2n+1}C_{2n+1} = 256$
Verify

196. 8 + 6 = 14
No restriction on selection of books = $^{14}C_6$

197. $^8C_2 + {}^8C_3 + {}^8C_4 + {}^8C_5 + {}^8C_6 + {}^8C_7 + {}^8C_8$

198. $^{12-2}C_{8-2}$

199. $4! + 4! + \dfrac{4!}{2!} = 60$

200. x = 7 + 5

201. Select 3 places from 10 places

202. Number of batches = $^{20}C_5$
each batch ---> 5 hours
Total $^{20}C_5$ x 5

203. $\dfrac{n(n-3)}{2}$ If n = 6 ---> $\dfrac{6x3}{2} = 9$

205. $\dfrac{n(n-3)}{2} = 35$ Verify

206. $n = \dfrac{n(n-3)}{2}$ => n = 5

207. $^{12}C_2 - {}^7C_2 + 1$

209. $^mC_2\,.\,^nC_2$

210. $^9C_2\,.\,^9C_2$

211. The number of squares
= No. of squares of area 1^2 or 2^2, ... or 8^2
$= \sum 8^2 = 12 \times 17 = 204$

212. $^{12}C_3 - (^3C_3 + {}^4C_3 + {}^5C_3)$

214. $^{10}C_3$

215. $\dfrac{n(n-1)(n-2)(n-3)}{8}$ put n = 10

216. Between any two intersecting lines an angles formed in $^{15}C_2$

217. Take all points, subtract collinear points

218. Total - Coplanar + 1

219. Total no. of points = 2 ends + n points = n+2 points
Line segments = $^{n+2}C_2$

224. $\dfrac{1}{2}$ (4 x 2 + 24 x 3 + 36 x 4) = 112

225. 2 . $^8C_3$ (diagonal of maximum length has 8 squares)

229. $\dfrac{3n!}{3!(n!)^3} = 280$

234. $\dfrac{15!}{3!\,4!\,8!} = \dfrac{15!}{12!\,3!}\ \dfrac{12!}{4!\,8!}\ \dfrac{8!}{8!\,(8-8)!}$
$= {}^{15}C_3\,.\,^{12}C_4\,.\,^8C_8$

235. $^{15}C_5$ or $^{15}C_{10}$

237. 17 + 17 + 17 + 1 = 52

$\dfrac{(52)!}{(17!)(17!)(17!)\,1!\,3!}$

239. $2!\ \dfrac{12!}{8!\,4!}$ Interchange

240. $^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5$

241. From 4 suits ---> $^4C_1$
16 cards are distributed
=> 36 are left over, 36 cards are distributed to 4 people = $\dfrac{4(36)!}{(9!)^4}$

242. $^{2n}C_n$

243. $2^n - 1 = 127$

244. $2^6 - 1$

245. (4+1) (5+1) (6+1) - 1

246. I question in 3 ways
II questions in 3 ways
III questions in 3 ways
Total = $3^5 - 1$

247. $(2^5 - 1)\,(2^4 - 1)\,.\,2^3$

248. (1+1) (1+1) (1+1) (1+1) (1+1) -1

250. $2^{10} - 1$

251. $(2^3 - 1)\,(2^5 - 1) = 217$

252. True + False = 2
2.2.2. ... 10 times = 2^{10}

253. (P+1) (P+1) .... n times - 1 =

254. Alternate solution to 8 words = 2^8

258. $\left(\dfrac{2^{5+1}-1}{2-1}\right)\left(\dfrac{3^{4+1}-1}{3-1}\right)$

259. $2160 = 2^4\,.\,3^3\,.\,5^1$
Non-trival factors = (4+1) (3+1) (1+1) - 2 = 38

260. 18 - (4+3) = 11
$^{11}C_5\,(5+4)!\ \ ^6C_6\,.\,(6+3)!$

261. 12 - (A+B+C+D) = 8
x ---> $^8C_4$ (2+4)!
y ---> $^4C_4$ (2+4)!

262. 8 - (3+2) = 3
Stroke side = $^3C_1$ (1+3)! and
Non-stroke side = $^4C_2$ (2+2)!

263. $^{10}C_5$ (5-1)! $^5C_5$ (5-1)!

265. I N D P E C ---> 6 different letters
$^6C_4$. 4! (select four, arrange them)

266. 3 alike = 3 O's = 1
1 different from {P, R, T, I, N} = ${}^5C_1$

$${}^5C_1 \cdot 1 \cdot \frac{4!}{3!}$$

268. 3I + 2N + F + T + E
3 same + 1 diff ---> 1 x ${}^4C_1$
2 same + 2 same ---> 1 x 1
2 same + 2 diff ---> 1 x ${}^4C_2$ + 1 x ${}^4C_2$
all diff ---> ${}^5C_4$
Total ${}^4C_1 + 1 + {}^4C_2 + {}^4C_2 + {}^5C_4 = 22$

269. ${}^4C_2 \cdot 2!$ ${}^6C_3 \cdot 3!$

270. ${}^4C_1 \cdot \frac{5!}{2!}$

(Select one subject, repeat it two times in 5 periods)

271. ${}^9C_7$

273. ${}^5C_2 \cdot {}^4C_2 \cdot {}^3C_2 \cdot 6!$

274. Without the 3 - specified numbers for the non-stroke side = ${}^9C_4 \cdot 4!$
From remaining 8 members for stroke side
$= {}^8C_4 \cdot 4!$
Total $= {}^9C_4 \cdot 4! - {}^8C_4 \cdot 4!$

275. Selection of (r-3) things from (n-3) and arrange r things

276. W + R + B + G = 10 => x + y + z + w = 10

277. a x^2 + bx + c

a	b	c
1	0	0
2	1	1
3	2	2
	3	3

3 x 4 x 4 = 48

278. x + y + z + w = 3
No. of non-negative integral solutions
$${}^{3+4-1}C_{4-1} = 20$$

279. Give 2 marks to each question
$Q_1+Q_2+Q_3+Q_4+Q_5+Q_6+Q_7+Q_8 = 30-16 = 14$
$\therefore$ No. of non-negative integral solutions
$${}^{14+8-1}C_{8-1} = {}^{21}C_7$$

280. $x_1+x_2+x_3+x_4 = 15-8 = 7$
$\therefore$ No. of non-negative integral solutions
$${}^{7+4-1}C_{4-1} = 120$$

LEVEL-II

PERMUTATIONS

1. The number of ways in which a TRUE or FALSE examination of n statements can be answered on the asumption that no two consecutive questions are answered the same way is
1) 2^{n-1} 2) 2^n 3) 1 4) 2

2. There are 5 multiple choice questions in test. If the first three questions have 4 choices each and the next two have 5 choices each, the number of answers possible is
1) 1500 2) 1600 3) 1700 4) 1800

3. The prismatic colours are arranged in a row. The number of arrangements in which Red and Blue come together is
1) 720 2) 360 3) 2880 4) 1440

4. On a new year's day every member a family sends a card to every other member and the postman delivers 156 cards, the number of members of the family is
1) 12 2) 11 3) 14 4) 13

5. Six examination papers are to be set in a certain order not to be disclosed. It is discovered that one order has been leaked out. The number of ways that their order can be changed is
1) ${}^6P_1$ 2) ${}^6C_1$ 3) 216 4) 719

6. A family of 4 brothers and 3 sisters is to be arrnaged in a row for a photograph. The number of ways in which they can be seated if all the sisters are to sit together is
1) 120 2) 240 3) 360 4) 720

7. 9 articles are to be placed in 9 boxes one in each box 5 of them are too big for three of the boxes. The number of possible arrangements is
1) 9! 2) 5! 4! 3) 6! 4! 4) 5! 6!

8. If ${}^nP_{100} = {}^nP_{99}$ then n =
1) 100 2) 101 3) 99 4) 86

9. The number of other ways that the letters of SIMPLETON be arranged is
1) 9! - 1 2) 9! 3) 8! 2! 4) 9! - 8!

10. Assertion (A) : The number of ways of arranging 6boys and 5 girls alternately at circular table is 0
Reason (R) : To arrange boys and girls alternately at a circular table, they should be equal in number.
1) A is true, R is true and R is the correct explanation for A
2) A is true, R is false and R is the not the correct explanation for A
3) A is true, R is false
4) A is false, R is true.

11. If words are formed by taking only 4 at a time out of the letters of the word PHYSICS, in how many of them will the letter Y occur?
1) 360 2) 288 3) 480 4) 180

12. The number of different numbers of six digits without repetition of digits can be formed form 4,

5, 6, 7, 8, 9 such that not divisible by '5' is
1) 120 2) 720 3) 600 4) 100

13. The sum of all the numbers that can be formed by taking all the digits from 2, 3, 4, 5 is
1) 93,324 2) 79,992
3) 66,66,600 4) 78,456

14. The sum of all the numbers that can be formed by taking all the digits from 1, 0, 2, 3, is
1) 38,646 2) 38,466 3) 38664 4) 38,446

15. The sum of all 3 digited numbers that can be formed from the digits 1 to 9 and when the middle digit is a perfect square is (repetitions are allowed)
1) 1,34,055 2) 2,70,540
3) 1,70,055 4) 2,34,520

16. The sum of all 4 digited even numbers that can be formed from the digits 1, 2, 3, 4, 5 is
1) 1,58,994 2) 1,59,984
3) 1,59,894 4) 1,59,884

17. The sum of all 4 digited numbers that can be formed by taking the digits from 0, 1, 3, 5, 7, 9 is
1) 16,23,300 2) 16,32,300
3) 16,32,030 4) 16,33,200

18. The total number of seven-digit numbers such that the sum of whose digits is even is
1) 9×10^6 2) 45×10^5
3) 81×10^5 4) 9×10^5

19. If the letters of the word "MIRROR" are arranged as in a dictionary then the Rank of the given word is
1) 23 2) 84 3) 49 4) 48

20. The letters of the word CRICKET are permuted in all possible ways and the words thus formed are rearranged as in a dictionary. The rank of the word CRICKET is
1) 243 2) 452 3) 531 4) 729

21. The letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged as in a dictionary. The rank of the word STREAM is
1) 597 2) 480 3) 612 4) 385

22. All the numbers that can be formed using the digits 1, 2, 3, 4, 5 are arranged in the decreasing order of magnitude. The rank of 34215 is
1) 58 2) 62 3) 96 4) 128

23. The four digited numbers that can be formed with the digits of {1, 2, 4, 6, 8} no digit occuring more than once in each number are written in the asscending order of magnitude and ranked. The rank of 4618 is
1) 60 2) 61 3) 62 4) 59

24. A guardian with 5 wards wishes everyone of them to study either graduation in Arts or Science or Engineering. The number of ways he can make up his mind with regard to the education of his wards if everyone of them is fit for any of those branches of study is ....
1) 5! 2) 243 3) 125 4) 81

25. Four dice are rolled. The number of possible outcomes in which atleast one die shows 2 is
1) 1296 2) 625 3) 615 4) 671

26. Two dice are thrown. The number of ways of getting doublets on them is
1) 36 2) 25 3) 6 4) 30

27. The number of times the digit '5' will be written while listing the integers from 1 to 1000 is
1) 271 2) 272 3) 300 4) 285

28. In the word 'ENGINEERING' if all 'E''s are not together and N's come together then number of permutations is
1) $\frac{9!}{2!\,2!} - \frac{7!}{2!\,2!}$ 2) $\frac{9!}{3!\,2!} - \frac{7!}{2!\,2!}$
3) $\frac{9!}{3!\,2!\,2!} - \frac{7!}{2!\,2!\,2!}$ 4) $\frac{9!}{3!\,2!\,2!} - \frac{7!}{2!\,2!}$

29. How may words can be formed using the letters A thrice, the letter B twice and the letter C once?
1) 60 2) 120 3) 90 4) 59

30. Out of seven letters, a few of them are similar and other are different if different words are formed taking all together are 210, then the number of similar letters is
1) 4 2) 5 3) 3 4) 6

31. The number of ways in which the letters of the word MULTIPLE be arranged without changing the order of the vowels is
1) 3360 2) 20160 3) 6720 4) 3359

32. The number of ways in which the letters of the word MULTIPLE be rearranged without changing the order of the vowels is
1) 3360 2) 20159
3) 20160 4) 3359

33. A library has 6 copies of one book 4 copies of each of two books, 6 copies of each of three books and single copies of 8 books. The number of arrangements of all the books is
1) $\frac{40!}{(2!)^4\,(3!)^6}$ 2) $\frac{40!}{6!\,.\,(4!)^2\,(6!)^3}$
3) $\frac{40!}{6!\,.\,4!\,.\,6!}$ 4) $\frac{40!}{4!\,.\,(4!)^3\,.\,6!}$

34. The number of different numbers each of six digits that can be formed by using the digits of the numbers 121022 is
1) 50 2) 100 3) 600 4) 120

35. 21 identical white balls and 19 identical black balls are arranged in a row so that no two balls of the black colour are together. The number of ways of doing it is
1) 1540 2) 9240
3) 21! x $^{22}C_{19}$ 4) 21! x 19!

36. In a set of n things 'r' things are similar and remaining are different. Then the number of circular arrangements of those n things is
1) (n-1)! r! 2) $\frac{(n-1)!}{r!}$
3) $\frac{(n-1)!}{r}$ 4) r(n-1)!

COMBINATIONS

37. If 10($^nC_2$) = 3($^{n+1}C_3$) then n =
1) 8 2) 9 3) 10 4) 11

38. $^nC_{r+1}$ + 2 ^nC_r + $^nC_{r-1}$ =
1) $^{n+1}C_r$ 2) $^{n+2}C_r$
3) $^{n+2}C_{r+1}$ 4) $^{n+2}C_{r+2}$

39. The least value of n so that $^nC_6 + {^nC_7} > {^{n+1}C_6}$ is
1) 13 2) 12 3) 11 4) 10

40. A father with 6 children takes 3 at a time to a park without taking the same children. How often father goes to the park?
1) 14 2) 16 3) 18 4) 20

41. A father with 6 children takes 3 at a time to a park without taking the same children. How often each child goes to the park?
1) 10 2) 12 3) 15 4) 20

42. A committee of 12 is to be formed from 9 women and 8 men. The number of ways this can be done if men are in majority is
1) 1024 2) 1134 3) 1230 4) 1314

43. The number of ways that a volley ball 6 can be selected out of 10 players so that 2 particular players are excluded is
1) 56 2) 55 3) 27 4) 28

44. A party of 9 persons are to travel in two vehicles, one of which will not hold more than 7 and the other not more than 4. The number of ways the party can travel is
1) 120 2) 220 3) 236 4) 246

45. ^nP_r and ^nC_r are equal when
1) n=r 2) n=r+1 3) r=1 4) n=r-1

46. A train going from Vijayawada to Hyderabad stops at nine intermediate stations. Six persons enter the train during the journey with six different tickets of the same class. The number of different tickets they may have will be
1) $^{11}C_6$ 2) $^{45}C_6$ 3) $^9C_6$ 4) $^{10}C_6$

47. The values of $^{(k-1)}C_{(k-1)} + {^kC_{(k-1)}} + {^{(k+1)}C_{k-1)}}$ + ... + $^{(n+k-2)}C_{(k-1)}$ is
1) $^{(n+k)}C_k$ 2) $^{(n+k+1)}C_k$ 3) $^{n+k}C_{(k-1)}$ 4) $^{n+k-l}C_k$

48. $^nC_0 + {^{n+1}C_1} + {^{n+2}C_2}$ + ... + $^{n+r}C_r$ =
1) $^{n+r+1}C_r$ 2) $^{n+r-1}C_r$ 3) n 4) $^{n+r+2}C_{r+1}$

49. A question paper consisting of 10 questions is divided into 3 parts with 5, 3, 2 questions. A candidate is to answer 6 questions without neglecting any part. The number of ways in which he can make up his choice is
1) 175 2) 200 3) 225 4) 150

50. A committee of 5 men and 3 women is to be formed out of 7 men and 6 women. If two particular women are not to be together in the committee, the number of committees formed is
1) 420 2) 5040 3) 336 4) 216

51. Six points are taken on a circle. The number of triangle formed inside the circle is
1) 20 2) 22 3) 25 4) 32

52. If r>1 then $\frac{^np_r}{^nC_r}$ is
1) is an integer 2) may be fraction
3) is an odd number 4) an even number

53. Out of 9 boys the number to be taken to form a group, so that the number of different groups may be greatest is
1) 4 2) 5 3) 4 or 5 4) 6

54. From a council of 7 Hindus, 5 Muslims and 4 Christians a committee of 5 is to be to be formed with 1 Christian and at least two Hindus. The number of ways of forming the committee is
1) 1220 2) 1240 3) 1680 4) 1280

55. A reserve of 12 railway station masters is to be divided into two groups of 6 each one for day duty and the other for night duty. The number of ways in which this can be done if two specified persons A, B should not be included in the same group is
1) 500 2) 504 3) 508 4) 512

56. The number of solutions of $^{61}C_{n+1} = {^{61}C_{2n-1}}$ is
1) 3 2) 1 3) 2 4) 4

57. A guard of 15 men is formed form a group of n soldiers. The number of times two particular soldiers will guards
1) $\frac{n!}{13!\,2!}$ 2) $\frac{(n-2)!}{13!}$
3) $\frac{(n-2)!}{13!\,(n-15)!}$ 4) $\frac{(n-2)!}{13!\,12!}$

58. A guard of 12 men is formed form n soldiers. If A and B are three times as often together on guard as C, D, E then =
1) 16 2) 32 3) 64 4) 8

59. If n and r are integers such that $1 \le r \le n$, then n.c(n-1.r-1) =
1) C(n,r) 2) n.c(n,r)
3) r.c.(n,r) 4)(n-1) c(n,r)

60. A person wishes to make up as many different parties of 10 as he can out of 20 friends, each party consisting of the same number. In how many of the parties the same man is found?
1) 380 2) 19 3) 90378 4) 92378

61. 5 balls of different colours are to be kept in 3 boxes of different sizes. Each box can hold all five balls. Number of ways in which the balls can be kept in the boxes so that no box remain empty is
1) 60 2) 90 3) 150 4) 200

62. If n is an integer between 0 and 21, then the minimum value of n! (21-n)! is
1) 9! 2! 2) 10! 11! 3) 20! 4) 21!

63. The maximum number of points of intersection of 8 straight lines, is
1) 8 2) 16 3) 28 4) 56

64. The number of non-congruent rectangles that can be found on a chess board is
1) 18 2) 36 3) 16 4) 64

64 a. Assetion (A): The no.of parallelograms in a chess board is 1296.
Reason(R): The no.of parallelogram when a set of 'm' parallel lines is intersected by another set of 'n' parallel lines is ${}^{m}C_2.{}^{n}C_2$
1. A is true and R is false
2. A is false and R is true
3. Both A and R are true and R is correct expalantion of A
4. Both A and R are true and R is not correct explanation of A.

65. If n straight lines terminate at a point and no two are in the same line, number of angles less than two right angles that are formed is
1) n-1 2) $\frac{1}{2}$ n(n+1)
3) $\frac{1}{2}$ n(n-1) 4) (n+1)

65 a. Arrange the following values in decending order.
a. The number of diagonals of a decagon
b. The number of positive integral factors of 2940
c. The number of circles that can be drawn out of 10 points of which 7 are collinear
d. The number of ten balls selecting from the unlimited of red, green, white and yellow balls, if atleast one ball of each colour must be included in the 10 balls selections.
1) c, d, a, b 2) c, a, d, b
3) c, d, b, a 4) a, d, b, c

66. A regular polygon has 23 vertices and consequently 23 sides. The number of additional lines to be drawn so that each pair of vertices will be connected, is
1) 230 2) ${}^{23}P_2$ 3) ${}^{23}C_2$ 4) 250

66 a. Assertion(A): If a polygon has 35 diagonals then the number of the sides of the polygon is 15.
Reason(R): The number of diagonals of polygon with 'n' sides is $\frac{n(n-3)}{2}$
1) Both A and R are true and r is the correct explanation of A
2) Both A and R are true and R is not correct explanation of R
3) A is true but R is false
4) A is false but R is true.

67. There are 10 points in a plane and A is one of them. If no three of the points are collinear then the number of triangles formed with A as vertex is
1) 45 2) 36 3) 84 4) 120

68. The number of ways of choosing 2 squares from a chess board so that they have exactly one common corner is
1) 98 2) 112 3) 36 4) 72

69. The number of ways in which we can put n distinct things in two identical boxes so that no box is empty, is
1) $2^n - 2$ 2) $2^n - 1$ 3) $2^{n-1} - 1$ 4) $2^{n-1} - 2$

70. If the (n+1) numbers a, b, c, d ..., be all different and each of them a prime number, then the number of different factors (other than 1) of a^m . b . c . d ...is
1) m - 2^n 2) (m+1) 2^n
3) (m+1) 2^n - 1 4) (m+1) 2^{n-1}

71. The number of ways of writing 98 as the product of two positive integers is
1) 1 2) 2 3) 3 4) 4

72. The number of ways in which 2160 can be written as product of two positive integers is
1) 40 2) 20 3) 80 4) 100

73. The number of permutations altogether of n things when r specified things are to be in an assigned order, though not necessarily consecutive is
1) $\frac{n!}{(n-r)!}$ 2) $\frac{n!}{(n-r)!\,r!}$
3) $\frac{n!}{r!}$ 4) (n-r)! . r!

74. ABCD is a convex quadrilateral, 3, 4, 5 and 6 points are marked on AB, BC, CD and DA respectively. The number of triangles that can be formed by joining these points with vertices on different sides is
1) 282 2) 270 3) 220 4) 342

75. There are 15 trees in a row. 4 trees are to be cut down. The number of ways that no two of the cut down trees are consecutive is
1) ${}^{11}C_4$ 2) ${}^{12}C_4$ 3) ${}^{15}C_4$ 4) ${}^{14}C_4$

76. Four newly married couples are dancing at a function. The selection of the partener is random. The number of ways that exactly one husband is not dancing with his own wife is

1) 0 2) $\underline{|4}$ 3) $\underline{|3}$ 4) 1

77. The number of 3×3 matrices that can be formed by using the elements 0,1,2,3 such that all the principal diagonal elemeents are different is

1) $4^6.6$ 2) $4^7.6$ 3) $3^7.6$ 4) 4^7

78. The number of 'n' digit number's such that no two consecutive digits are are same is

1) 9! 2) n^9 3) 9^n 4) 9n

79. The number of ways that all the letters of the word SWORD can be arranged such that no leeters is in its original position is

1) 32 2) 44 3) 20 4) 28

80. The number of different ways that three distinct rings can be worn to 4 fingers with atmost one ring in each of the fingers is

1) ${}^4P_3$ 2) ${}^5P_4$ 3) ${}^5P_3$ 4) ${}^4P_2$

KEY

1)4	2)2	3)4	4)4	5)4
6)4	7)3	8)1	9)1	10)1
11)2	12)3	13)1	14)3	15)1
16)2	17)4	18)2	19)1	20)3
21)1	22)1	23)3	24)2	25)4
26)3	27)3	28)4	29)1	30)1
31)1	32)4	33)2	34)1	35)1
36)2	37)2	38)3	39)1	40)4
41)1	42)2	43)4	44)4	45)3
46)2	47)4	48)1	49)1	50)3
51)1	52)4	53)3	54)3	55)2
56)2	57)3	58)2	59)3	60)4
61)3	62)2	63)3	64)2	64a)3
65)3	65a)3	66)1	66a)4	67)2
68)1	69)3	70)3	71)3	72)2
73)3	74)4	75)2	76)1	77) 2
78) 3	79) 2	80) 1		

HINTS

1. True, False - 1 Way
   False, True - 1 Way
   Number of ways = 2
2. First 3 Questions ---> 4.4.4
   Next 2 Questions ---> 5.5
   Total = $4^3 \cdot 5^2$
3. Number of Colours = 7
   Consider Red and Blue as one Unit.
   It is 2! ways with this and remaining are 6
   They are in 6! ways
   $\therefore$ 6! 2! = 1440
4. ${}^nP_2$ = 156 => n = 13
5. 6! - 1 = 719
6. 3! 5!
7. 5 big articles placed 6 big boxes in ${}^6P_5$ remain 4 place in 4 boxes in 4!
   Ans : ${}^6P_5$. 4!
8. $\dfrac{n!}{(n-100)!} = \dfrac{n!}{(n-99)!}$ => n = 100
9. Total arrangements - 1
   9! - 1
11. $4! + 4! + \dfrac{4!}{2!}$ =60
12. $4\ .\ {}^5P_3$
13. Not divisible = Total - divisible
   = 6! - 5!

For the problems from 14 to 23 use Synopsis 30 to 33.

18. Suppose $a_1\ a_2\ a_3\ a_4\ a_5\ a_6\ a_7$ represents a seven digit number. Then a_1 taken the value 1, 2, ... 9 and a_2, a_3 ... a_7 all take values 0, 1, 2, ... 9. If we keep a_1, a_2, ... a_6 fixed then the sum ..... $a_1 + a_2$ + ... + a_6 is either even or odd. Since a_7 taken 10 values 0, 1, 2 ... 9. Five of the numbers so formed will be even and 5 odd.
   $\therefore$ Required numbers = 9.10.10.10.10.10.5=45x10^5.
19. M I R R O R
   I M O R R R
   $1.\dfrac{5!}{3!} + 0.4! + 1.\dfrac{3!}{3!} + 1.\dfrac{2!}{2!} + 0.1! + 1 = 23$
20. C C E I K R T
   CRICKET
   4(5!) + 2(4!) + 2! + 1 = 531
22. 1 2 3 4 5
   34215
   2(24) + 6 + 2 + 1 + 1 = 58
24. 1 word can be put in 3 ways
   2 words can be put in 3 ways
   ⋮ ⋮
   5 words can be put in 3 ways
   Total no. of ways = 3x3x3x3x3 = 243
25. Total number of ways not showing 2
   $6^4 - 5^4 = 671$
27. _ _ 5 = 10^2
   _ 5 _ = 10^2 300
   5 _ _ = 10^2
28. NNN = One unit
   Remaining = 8 units. Total 9 units
   $\therefore$ Total permutations - E's come together.
29. $\dfrac{(3+2+1)!}{3!\ 2!\ 1!}$

30. $\frac{7!}{n!} = 210 \Rightarrow n = 10$

31. $\frac{{}^8P_5}{2!} \times 1$

32. $\frac{{}^8P_5}{2!} \times 1 - 1$

33.

1	2	3	4	5
6	7	8	9	10
11	12	13	1	4
6	4	4	6	6
6	1	1	1	1
1	1	1	1	

34. $\frac{6!}{3!\,2!} - \frac{5!}{3!\,2!}$

35. $\frac{21!}{21!}\ \frac{{}^{22}P_{19}}{19!} = 1540$

36. $\frac{(n-1)!}{r!}$

37. $10\ \frac{n!}{2!(n-2)!} = 3\ \frac{(n-1)!}{3!(n-2)!}$

$10 = (n+1) \Rightarrow n = 9$

38. ${}^nC_{r+1} + {}^nC_r + {}^nC_r + {}^nC_{r-1}$

${}^{n+1}C_{r+1} + {}^{n+1}C_r = {}^{n+2}C_{r+1}$

39. ${}^{n+1}C_7 > {}^{n+1}C_6 \Rightarrow n+1 > 7+6$

$\Rightarrow n > 12$

$\Rightarrow n = 13, 14, ...$

$\therefore n = 13$

40. No. of times he will go to garden

= No. ways of selecting 3 children from 6

$= {}^6C_3$

$= \frac{6x5x4}{1x2x3} = 20$

41. ${}^{n-s}C_{c-s} = {}^{6-1}C_{3-1} = {}^5C_2 = \frac{5x4}{1x2} = 10$

42.

w	m	
9	8	
5	7	---> ${}^9C_5 \cdot {}^8C_7$
4	8	---> ${}^9C_4 \cdot {}^8C_8$

$\therefore$ Total No. of ways $= {}^9C_5 \cdot {}^8C_7 + {}^9C_4 \cdot {}^8C_8$

43. ${}^{10-2}C_6 = {}^8C_6 = {}^8C_2 = \frac{8x7}{1x2} = 28$

44.

A	B			
(7)	(4)			
7	2	${}^9C_7$ +	${}^9C_6$ +	${}^9C_5$
6	3	${}^9C_2$ +	${}^9C_3$ +	${}^9C_4$
5	4			

45. ${}^nP_1 = \frac{n!}{(n-1)!} = {}^nC_1$

46. ${}^{(9+8+7+....1)}C_6$

47. ${}^kC_k + {}^kC_{k-1} + ... + {}^{(n+k-2)}C_{k-1} = {}^{n+k-1}C_k$

48. Put r = 1 then LHS is

${}^nC_0 + {}^{n+1}C_1 = n+2$ (1) option is satisfied

49. ${}^5C_1 \cdot {}^3C_3 \cdot {}^2C_2 + {}^5C_3 \cdot {}^3C_1 \cdot {}^2C_2 + {}^5C_3 \cdot {}^3C_2 \cdot {}^2C_1$ +

${}^5C_2 \cdot {}^3C_3 \cdot {}^2C_1 + {}^5C_2 \cdot {}^3C_2 \cdot {}^2C_2 + {}^5C_4 \cdot {}^3C_1 \cdot {}^2C_1$ = 175

50. ${}^7C_5 \cdot {}^6C_3 - {}^7C_5 \cdot {}^4C_1 = 336$

51. ${}^6C_3$

52. $\frac{{}^np_2}{{}^2C_r} = r! =$ even

53. ${}^9C_r$ is greatest if r = 4 or 5

54. ${}^4C_1 \cdot {}^7C_2 \cdot {}^5C_2 + {}^4C_1 \cdot {}^7C_3 \cdot {}^5C_1 + {}^4C_1 \cdot {}^7C_4 \cdot {}^5C_0$

55. $2 \times {}^{12-2}C_{6-1}$

56. $n+1 = 2n-1 \Rightarrow n = 2$

57. ${}^{n-2}C_{15-2}$

58. Include A, B in 12 = 3 (include C, D, E)

${}^{n-2}C_{10} = 3\ {}^{n-3}C_9$

59. $n\ {}^{n-1}C_{r-1} = {}^nC_r \cdot r$

60. ${}^{20-1}C_{10-1}$

62. $n!\,(21-n)! = 21!\ \frac{n!\ (21-n)!}{21!} = \frac{(21)!}{{}^{21}C_n}$

For minimum value of, $\frac{(21)!}{{}^{21}C_n}$ n should be 10

$\therefore \frac{(21)!}{{}^{21}C_{10}} = \frac{21!}{21!} \times 10! \times 11! = 10!\ 11!$

63. ${}^8C_2 = 28$

64. Non-congruent = different dimension = $\sum 8 =$ 36

65. ${}^nC_2 = \frac{n(n-1)}{2}$

66. ${}^{23}C_2 - 23$

67. ${}^{10-1}C_{3-1} = 36$

68. 4 (1+2+3+4+5) + 2x7

69. Put n=3; ${}^3C_1 \cdot {}^3C_2 = 3$

(3) option verified

70. (n+1) {(1+1) (1+1) .... n factors} - 1

$(m+1)\ 2^n - 1$

71. $98 = 2^1\ 7^2 \Rightarrow \frac{(1+1)(2+1)}{2} = 3$

72. $2160 = 2^4 \cdot 3^3 \cdot 5^1$

$$\frac{(4+1)(3+1)(1+1)}{2} = 28$$

73. ${}^nC_r \cdot (n-r)!$

74. ${}^{18}C_3 - ({}^3C_3 + {}^4C_3 + {}^5C_3 + {}^6C_3)$

LEVEL-III

1. In a library, there are m books of mathematics and n books of natural science. They can be placed on a shelf in 1209600 ways so that the books of the same subject are not separated. If $m \geq n$. then m =
   1) 6 2) 7 3) 8 4) 9

2. If ${}^{2n}P_3 = k.\ {}^nP_2$. then
   1) k is not a multiple of 4
   2) k is an even multiple of 4
   3) k is an odd multiple of 4
   4) k is an multiple of 4

3. If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30800 : 1$, then r =
   1) 40 2) 41 3) 42 4) 39

4. A code word consists of three letters of the English alphabet followed by two digits of the decimal system. If neither letter nor digit is repeated in any code word, then the total number of code words is
   1) 1404000 2) 16848000
   3) 2808000 4) 157010

5. Six identical coins are arranged in a row. The total number of ways in which the number of heads is equal to the number of tails, is
   1) 9 2) 20 3) 40 4) 120

6. A car will hold 2 persons in the front seat and 1 in the rear seat. If among 6 persons only 2 can drive, the number of ways, in which the car can be filled, is
   1) 10 2) 18 3) 20 4) 40

7. If a denotes the number of permutations of (x+2) things taken all at a time, b the number of permutations of x things taken 11 at a time and c the number of permutations of (x - 11) things taken all at a time such that a = 182 bc, then the value of x is
   1) 15 2) 12 3) 10 4) 18

8. The number of words which can be formed out of letters a, b, c, d, e, f taken 3 together, each containing one vowel atleast is
   1) ${}^2P_1 \cdot {}^4P_2$ 2) 96 3) ${}^6P_3$ 4) 120

9. The number of ways of permuting the letters of the word DEVIL so that neither D is the first letter nor L is the last letter is
   1) 36 2) 114 3) 42 4) 78

10. The number of products that can be formed with 10 prime numbers taking two or more at a time is
   1) 1003 2) 1008 3) 1009 4) 1013

11. A five-digit number divisible by 6 is to be formed by using 0, 1, 2, 3, 4, 5 without repetition. The number of ways in which this can be done is
   1) 60 2) 48 3) 108 4) 216

12. The letters of the word SURITI are written in all possible orders and these words are written out as in a dictionary. Then the rank of the word SURITI is
   1) 236 2) 245 3) 307 4) 315

13. If the permutations of a, b, c, d, e taken all together be written down in alphabetical order as in dictionary and numbered, then the rank of the permutation *debac* is
   1) 90 2) 91 3) 92 4) 93

14. We are required to form different words with the help of the letters of the word INTEGER. Let m_1 be the number of words in which I and N are never together and m_2 be the number of words which begin with I and end with R, then m_1/m_2 is given by
   1) 42 2) 30 3) 6 4) 1/30

15. Statement 1: ${}^nC_r$ means selection of 'r' objects from n distinct objects successively.
   Statement 2: ${}^nC_r$ means selection of 'r' objects from n distinct objects simultaneously. Which of the above is the true.
   1) only 1 2) only 2
   3) both 1 & 2 4) neither 1 or 2

16. If ${}^nC_{r-1} = 10$, ${}^nC_r = 45$ and ${}^nC_{r+1} = 120$ then r equals
   1) 1 2) 2 3) 3 4) 4

17. The least positive integral value of x which satisfies the inequality ${}^{10}C_{x-1} > 2 \cdot {}^{10}C_x$ is
   1) 7 2) 8 3) 9 4) 10

18. The number of ways that the letters of the word "PERSON" can be placed in the squares of the adjoining figure so that no row remains empty
   1) 20x6! 2) 26x6! 3) 20x5! 4) 26x5!

19. Six X's have to placed in the squares of the adjoining figure such that each row contains atleast one X. The number of different ways this can be done, is
   1) 26 2) 13 3) 15 4) 26 x 6!

20. A man starts moving from the point (3, 5) and moves to the right or vertically upwards only covering unit distance in each step. The number of ways he could reach the point (7, 11) is
1) C(16,6) 2) C(10,6)
3) C(6,4) 4) C(16,10)

21. A Tennis Tournament is to be played by 10 pairs of students each pair is to play with every other pair one set. If four sets are played each day. The days should be allowed for the match is
1) 12 2) 16 3) 80 4) 90

22. The ratio of $^{24}C_r$ to $^{25}C_r$ when each of them has the greatest value possible is
1) 12 : 25 2) 13 : 25 3) 13 : 24 4) 1 : 2

23. The difference between the greatest values of $^{15}C_r$ and $^{12}C_r$ is
1) 5500 2) 5502 3) 5508 4) 5511

24. A committee of 6 is chosen from 10 men and 7 women so as to contain atleast 3 men and 2 women. If 2 particular women refuse to serve on the same committee, the number of ways of forming the committee is
1) 7800 2) 8610 3) 810 4) 8000

25. The number of ways in which we can select 4 numbers from 1 to 30 so as to exclude every selection of four consecutive numbers is
1) 27378 2) 27405 3) 27504 4) 27387

26. A man has 7 relatives, 4 women and 3 men. His wife also has 7 relatives, 3 women and 4 men. The number of ways in which they can invite 3 men and 3 women so that they both invite three each is
1) 485 2) 584 3) 720 4) 1024

27. An examination paper, which is divided into two groups consisting of 3 and 4 questions respectively carries the note : It is not necessary to answer all the questions. One question atleast should be answered form each group. The number of ways can an examinee select the questions is
1) 22 2) 105
3) $^3P_3 \times {}^4P_4$ 4) $^3C_3 \times {}^4C_4$

28. The results of 21 football matches (win, lose, draw) are to be predicted. The no. of different forecasts that can contain 19 wins is
1) 210 2) 640 3) 840 4) 1260

29. There are two baskets containing x balls in each one. A person has to select equal number of balls form both the baskets. The number of ways in which this can be done so that atleast one ball must be drawn form each bag is equal to
1) $\left({}^{2x}C_x\right)^2$ 2) $\left({}^{2x}C_x\right)-1$
3) $\left({}^{2x}C_{x-1}\right)$ 4) $\left({}^{2x}C_{x-1}\right)^2$

30. All possible two factors products are formed from the numbers 1, 2, 3, 4, ... 200. The number of factors out of the total obtained which are multiples of 5 is
1) 5040 2) 7180 3) 8150 4) 2720

31. Given that n is odd, the number of ways in which three numbers in AP can be selected from 1, 2, 3, ... n is
1) $(n - 1)^2 / 2$ 2) $(n + 1)^2 / 4$
3) $(n + 1)^2 / 2$ 4) $(n - 1)^2 / 4$

32. There are 12 intermediate stations on a railway line between 2 stations. The numbers of ways that a train can be made to stop at 4 of these intermediate stations no two of these halting stations being consecutive is
1) 125 2) 126 3) 127 4) 130

33. The number of ways of distiributing 8 identical balls in three distrint boxes so that none of the boxes is empty
1) 5 2) $^8C_3$ 3) 3^8 4) 21

34. n bit strings are made by filling the digits 0 or 1. The number of strings in which there are exactly k zeros with no two 0's consecutive is
1) $^{(n-k)}C_k$ 2) $^{(n-k+1)}C_k$ 3) $^{(n-k-1)}C_k$ 4) $^{(n-k)}C_{(k-1)}$

35. In how many ways can a group of 5 letters be formed out of 5a, 's, 5b 's, 5c 's and 5d 's ?
1) $^5C_4 \times 5$ 2) $^5C_4 \times 5$ 3) $^9C_5$ 4) $^8C_5$

36. The number of all three element subsets of the set $\{a_1, a_2, a_3 .....a_n\}$ which contain a_3 is
1) $^nC_3$ 2) $^{n-1}C_3$ 3) $^{n-1}C_2$ 4) $^nC_2$

37. If one quarter of all three element subsets of the set $A = \{a_1, a_2, a_3 ..., a_n\}$ contains the element a_3 then n =
1) 10 2) 12 3) 14 4) 16

38. A is a set containing n elements. A subset P of A is chosen.The set A is reconstructed by replacing the elements of P,A subset Q of A is again chosen. The number of ways of choosing P and Q so that $P \cap Q$ contains exactly two elements is
1) $9 . {}^nC_2$ 2) $3^n - {}^nC_2$ 3) $2 . {}^nC_n$ 4) $^nC_2\, 3^{n-2}$

39. The number of positive integers satisfying the inequlity $^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \leq 100$ is
1) Nine 2) Eight 3) Five 4) Six

40. A person writes letters to six friends and addresses corresponding envelopes let x be the number of ways so that atleast two of the letters are in wrong envelopes and y be the number of ways so that all the letters are in wrong envelopes then $x - y =$
1) 716 2) 454 3) 265 4) 0

41. The no.of 5digit numbers that can be made using the digits 1 and 2 and in which atleast one digit is different is
1) 31 2) 32 3) 30 4) 29

42. The number of triangles whose vertices are at the vertices of an octagon, but none of whose sides happen to come from the sides of the octagon is
1) 24 2) 44 3) 48 4) 16

43. The maximum number of points into which 4 circles and 4 straight lines intersect, is
1) 26 2) 50 3) 56 4) 72

44. Given that n is odd. The number of ways in which 3 numbers in A.P. can be selected from 1,2, 3....n is
1) $\frac{(n-1)^2}{2}$ 2) $\frac{(n+1)^2}{4}$
3) $\frac{(n-1)^2}{4}$ 4) $\frac{(n+1)^2}{2}$

45. The number of factors (excluding 1 & the expression itself) of the product of $a^7b^4c^3$ def where a, b, c, d, e, f are all prime numbers is
1) 634 2) 1872 3) 1278 4) 2078

46. If n = ${}^{m}C_2$, the value of ${}^{n}C_2$ is given by
1) ${}^{m+1}C_4$ 2) ${}^{m-1}C_4$
3) ${}^{m+2}C_4$ 4) $3({}^{m+3}C_4)$

47. The position vector of P, $\overline{OP}$ = xi + yj + zk where x,y,z $\in$ N and $\boldsymbol{a}$ = i + j + k. If $\overline{OP}.\boldsymbol{a}$ = 18 then the number of possible positions of P is
1) 272 2) 306 3) 153 4) 136

48. If $\alpha = {}^{m}C_2$ then ${}^{\alpha}C_2$ =
1) ${}^{(m+1)}C_4$ 2) $3.{}^{(m+1)}C_4$
3) $2.{}^{(m+1)}C_4$ 4) ${}^{m}C_4$

49. The sum of all the numbers that can be formed by taking all digits 2, 3, 4, 4, 5 only is
1) 2399976 2) 2339976
3) 2333976 4) 2399376

50. $\frac{{}^{4n}C_{2n}}{{}^{2n}C_n}$ =
1) $\frac{1.3.5...(4n-1)}{1.3.5...(2n-1)}$ 2) $\left[\frac{1.3.5...(4n-1)}{1.3.5...(2n-1)}\right]^2$
3) $\frac{[1.3.5...(4n-1)]^2}{1.3.5...(2n-1)}$ 4) $\frac{1.3.5...(4n-1)}{[1.3.5...(2n-1)]^2}$

51. The number of permutations of the letters of the word 'INDEPENDENT' taken 5 at a time
1) 3302 2) 3320 3) 3230 4) 3203

52. How many different words can be formed out of the letters of the word "MORADABAD" taken 4 at a time
1) 620 2) 622 3) 626 4) 624

53. The number of divisors of the form $4n+2$ of the integer 240 is
1) 4 2) 8 3) 10 4) 20

54. The number of ways in which four letters can be selected from the letters of the word "MATHEMATICS" is
1) 133 2) 146 3) 136 4) 73

55. The tens' digit of $\lfloor 1 + \lfloor 2 + \lfloor 3 + ... + \lfloor 29$ is
1) 1 2) 2 3) 3 4) 4

56. I : 'n' letters are kept in 'n' addressed envelopes at random. The number of ways that all the letters will go wrong is 1.
II :'n' letters are kept in 'n' addressed envelopes at random. The number of ways that all the letters will go wrong is n.
Which of the above is true ?
1) only I 2) only II
3) Neither I nor II 4) Both I and II

57. A person goes in for an examination in which there are four papers with a maximum of m marks from each paper. The number of ways in which one can get 2 m marks is
1) ${}^{2m+3}C_3$
2) $\frac{1}{3}$(m+1) (2m^2 + 4m + 1)
3) $\frac{1}{3}$(m+1)(2m^2+4m+3) 4) ${}^{2m-3}C_3$

58. The number of ways in which n distinct objects can be put into two different boxes is
1) n^2 2) 2^n 3) 2n 4) $2n^2$

59. The numberof ways in which n distinct objects can be put into two different boxes so that no box remains empty, is
1) 2^n - 1 2) n^2 - 1 3) 2^n - 2 4) n^2 - 2

60. The number of ways in which n distinct objects can be put into two identical boxes so that no box remains empty, is
1) 2^n - 2 2) 2^n - 1 3) 2^{n-1} - 1 4) n^2 - 2

61. The total number of natural numbers of six digits that can be made with digits, 1, 2, 3, 4, if all digits are to appear in the same number atleast once, is
1) 1560 2) 840 3) 1080 4) 480

62. The number of 4 letter words that can be formed from the letters of the word COMBINATION is
1) 2436 2) 2454 3) 1698 4) 774

KEY

1)2	2)3	3)2	4)1	5)2
6)4	7)2	8)2	9)4	10)4
11)3	12)1	13)4	14)2	15)2
16)2	17)2	18)2	19)1	20)2
21)1	22)2	23)4	24)1	25)1

26)1	27)2	28)3	29)2	30)2
31)4	32)3	33)4	34)2	35)4
36)3	37)2	38)4	39)2	40)2
41)3	42)4	43)2	44)3	45)3
46)4	47)4	48)2	49)1	50)4
51)2	52)3	53)1	54)3	55)1
56)3	57)3	58)2	59)3	60)3
61)1	62)2			

HINTS

1. m! n! 2! = 1209600
m! n! = 7! 5!

2. ${}^{2n}P_3 = K\ {}^{n}P_3 \Rightarrow K = 4\ (2n-1)$

3. $\frac{56!}{(50-r)!} = 30800 \times \frac{54!}{(51-r)!} \Rightarrow$

$51 - r = \frac{30800}{56x55} \Rightarrow r = 41$

4. Three English alphabets can be arranged in ${}^{26}P_3$ ways and two digits in ${}^{10}P_2$ ways
Total number of ways = $({}^{26}P_3)\ ({}^{10}P_2)$

5. $\frac{6!}{3!\,3!} = 20$

6. No. Drivers = 2
The drivers seat can be filled in ${}^{2}C_1$ ways.i.e., 2 ways out of the remaining persons = 4+1=5.
5 persons arrange in vacant seats in ${}^{5}P_2$ ways.
$\therefore$ Total number of ways = 2 x ${}^{5}P_2$ = 40

7. ${}^{x+2}P_{x+2} = a \Rightarrow a = (x+2)!$

${}^{x}P_{11} = b \Rightarrow 6 = \frac{x!}{(x-11)!}$

${}^{x-11}P_{x-11} = C \Rightarrow C = (x-11)!$
but a = 182 . bc

$(x+2)! = 182 . \frac{x!}{(x-11)!} . (x-11)!$

x+1 = 13
x = 12

8. At least one vowel = total - no vowel vowels
$= {}^{6}P_3 - {}^{4}P_3 = 96$

9. Total arrangement with the letters of the word DEVIL = 5! = 120
No. of arrangement starting with D = 24 = 4!
No. of arrangement ending with L = 24 = 4!
No. of arrangement that begin with D and end with L is = 6
No. of arrangements required = 120-(24+24-6) = 78

10. ${}^{10}C_2 + {}^{10}C_3 + {}^{10}C_4 ..... + {}^{10}C_{10}$

11. Number divisible by 2 and 3 is divisible by 6
<u>Case (i) detete 0</u>
i) fix 2 in units place ---> 4!
ii) fix 4 in units place ---> 4!
<u>Case (ii) detete 3</u>
i) fix 0 in units place ---> 4!
ii) fix 2 in units place ---> 4! - 3!
iii) fix 4 in units place ---> 4! - 3!

12. I I R S T U
SURITI

$\frac{6!}{2!} + \frac{5!}{2!} + 4! + \frac{4!}{2!} + \frac{4!}{2!} + 3! + 2 = 236$

13. 3.4! + 3.3! + 1.2! + 0.1! + 1= 93

14. **IN**TEGER

No. of ways = $\frac{6!}{2!} \times 2! = 6! = 720$

$m_1 = \frac{7!}{2!} - 720 = 1800$

$m_2 = \frac{5!}{2!} = 60$

$\frac{m_1}{m_2} = 30$

16. Use $\frac{{}^{n}C_r}{{}^{n}C_{r-1}} = \frac{n-r+1}{r}$

17. $10 \geq x - 1 \Rightarrow x \leq 11$
$10 \geq x$
$\therefore x \leq 10$
$\therefore$ Given inequation is
${}^{10}C_{x-1} > 2 . {}^{10}C_x$
$1 > 2 . \frac{10-x+1}{x}$
x > 7 1/3
$\therefore$ x = 8

18. There are 6 different letters. We have to select 6 squares, taking atleast one from each row and then arrange in each selection.

R_1 (2)	R_2 (2)	R_3 (4)	
1	1	4 ---> ${}^{2}C_1 . {}^{2}C_1 . {}^{4}C_4$ =	8
1	2	3 ---> ${}^{2}C_1 . {}^{2}C_2 . {}^{4}C_3$ =	8
2	1	3 ---> ${}^{2}C_2 . {}^{2}C_1 . {}^{4}C_3$ =	8
2	2	2 ---> ${}^{2}C_2 . {}^{2}C_2 . {}^{4}C_2$ =	6

Total number of selections of 6 squares = 4+8+8+6 =26. For each selection of 6 squares the number of arrangements of 6 letters = 6!
Total no. of ways = 26 x 6! = 18720

19. As all the X's are identical the question is of selection of 6 squares from 8 squares so that no. of row remains empty. The scheme is as follows

R_1	R_2	R_3
1	4	1 ---> ${}^2C_1 . {}^4C_4 . {}^2C_1$ = 4
1	3	2 ---> ${}^2C_1 . {}^4C_3 . {}^2C_2$ = 8
2	3	1 ---> ${}^2C_2 . {}^4C_3 . {}^2C_1$ = 8
2	2	2 ---> ${}^2C_2 . {}^4C_2 . {}^2C_2$ = 6

$\therefore$ Total number of ways = 26

20. $x_2 - x_1 = 7-3 = 4$
$y_2 - y_1 = 11-5 = 6$
From (6+4) select 6 or 4 in ${}^{10}C_6$ (or) ${}^{10}C_4$

21. $\dfrac{Number\ of\ games}{4\ sets} = \dfrac{{}^{10}C_2}{4} = 12$

22. ${}^{24}C_{12} : {}^{25}C_{12}$

23. ${}^{15}C_8 - {}^{12}C_6$

24. $\left({}^{10}C_3.{}^7C_3 + {}^{10}C_4..{}^7C_2\right) - \left({}^{10}C_4.{}^5C_0 + {}^{10}C_3.{}^5C_1\right)$

25. ${}^{30}C_4 - 27 = 27378$

26. ${}^4C_3 . {}^4C_3 + {}^3C_1 . {}^4C_2 . {}^4C_2 . {}^3C_1 + {}^3C_2 . {}^4C_1 . {}^4C_1 . {}^3C_2 + {}^3C_3 . {}^3C_3 = 485$

27. $(2^3 - 1)(2^4 - 1)$

28. ${}^{21}C_{19} \times 2 \times 2 = 840$

29. $C_1 . C_1 \times C_2 . C_2 + ... + C_x . C_x = {}^{2x}C_x - C_0^2$

30. ${}^{200}C_2 - {}^{160}C_2 = 7180$

32. By Synopsis - 89
${}^{n-3}C_4 = {}^{12-3}C_4$

33. Put n = 3, r = 3 verify

34. Take n = 4 k = 3

35. By Synopsis 63 note = ${}^{4+5-1}C_5$

36. Since each set must contain a_3, other two elements taken from remaining (n-1) can be selected in ${}^{n-1}C_2$ ways

37. $\dfrac{1}{4} . {}^nC_3 = {}^{n-1}C_2 \Rightarrow n = 12$

38. (1) $ai \in P$ & $ai \in Q$ (2) $ai \in P$ & $ai \notin Q$
(3) $ai \notin P$ & $ai \in Q$ (4) $ai \notin P$ & $ai \notin Q$
$A = \{a_1, a_2 .... \}$
If $a_1, a_2 \in p \cap Q$
Remaining (n-2) elements satisfy
(2) (3) (4) in 3^{n-2} way
$\therefore$ Ans ${}^nC_2 . 3^{n-2}$

39. Given = ${}^{n+1}C_3 - {}^{n+1}C_2 \leq 100$
$n(n+1)(n-4) \leq 100$
n = 2, 3, 4, 5, 6, 7, 8, 9

42. $\dfrac{n(n-4)(n-5)}{6}$ (If n = 8)

43. 4 lines intersect each other in ${}^4C_2 = 6$ points
4 circles intersect each other in ${}^4P_2 = 12$ points
Every line cuts 4 circles into 8 points
$\therefore$ 4 lines cut four circles into 32 points
$\therefore$ Maximum number of points = 6+12+32 = 50

45. (7+1)(4+1) (3+1) (1+1) (1+1) (1+1)-2 = 1278

46. $n = {}^mC_2 = \dfrac{m(m-1)}{2}$

$${}^nC_2 = \frac{n(n-1)}{2} = \frac{m(m-1)}{4}\left\{\frac{m(m-1)}{2} - 1\right\}$$

$= 3 . {}^{m+3}C_4$

47. x+y+z = 18
No. positive integral solutions = ${}^{18-1}C_{3-1} = 136$

49. 12 (2+3+5+8) (1 1 1 1 1) = 2599976

50. $\dfrac{(4n)!}{(2n!)^2} x \dfrac{(n!)^2}{(2n)!}$ expand or verify with n = 3

51. All different = ${}^6C_5 . 5!$

2 similar + 3 diff. = ${}^3C_1 . {}^5C_3 . \dfrac{5!}{2!}$

3 same + 2 diff. = ${}^2C_1 . {}^5C_2 . \dfrac{5!}{3!}$

2 same + 2 same + 1 diff. = ${}^3C_2 . {}^4C_1 . \dfrac{5!}{2!\,2!}$

3 same + 2 same = ${}^2C_1 . {}^2C_1 . \dfrac{5!}{3!\,2!}$

$\therefore$ Total selections = 72
Total arrangements = 3320

52. MORADABAD

4 diff	2 diff + 2 same	2 diff + 2 same
${}^6C_4$	${}^5C_2 . {}^1C_1$	${}^1C_1 . {}^5C_2$
${}^6C_4 . 4!$	${}^5C_2 . \dfrac{4!}{2!}$	${}^5C_2 . \dfrac{4!}{2!}$

3 diff + 1 diff   3 same + 1 diff   2 same+2 same

$^1C_1 \cdot {^5C_1}$ $^1C_1 \cdot {^1C_1}$ $^1C_1 \cdot {^1C_1}$

$^5C_1 \cdot \frac{4!}{3!}$ $\frac{4!}{3!}$ $\frac{4!}{2!\,2!}$

$\therefore$ 360 + 120 + 120 + 20 + 6 = 626

54. MATHEMATICS

There are 2M's; 2A's 2T's and H, E, I, C, S

We can select 5 letters from following cases

(i) All different (ii) 2 similar; 2 similar

(iii) 2 similar; 2 different

$^8C_4 + {^3C_2} + {^3C_1} \cdot {^7C_2} = 136$

57. The required number

= Coeff of x^{2n} in $(x^0+x^1+ .... + x^m)^4$

= Coeff of x^{2n} in $(1-x^{m+1})^4 (1-x)^{-4}$

$$= \frac{(2m+1)(2m+2)(2m+3)}{6} - 4m \frac{(m+1)(m+2)}{6}$$

$$= \frac{(m+1)(2m^2+4m+3)}{3}$$

58. 2x2x .... x 2 = 2^n

59. n objects can be put in two paxes in 2^n ways of these ways, the first or second box being empty

$\therefore$ No. ways 2^n-2

60. From above problem, no objects can be put in two boxes if no box is empty in 2^n-2 ways but two boxes are identical so required ways are $\frac{1}{2}$ (2^n - 2)

61. $^4C_1 \cdot \frac{6!}{3!} + {^4C_2} \cdot \frac{6!}{2!\,2!} = 1560$

PREVIOUS ENTRANCE QUESTIONS

1. 20 persons are invited for a party. The different number of ways in which they can be seated on a circular table with two particular persons seated on either side of th host is [EAM-85]

1) 20!   2) 2! 19!   3) 2! 18!   4) 18!

2. The number of ways in which a man can invite one or more of his 8 friends to dinner is [E-85]

1) 28   2) 128   3) 240   4) 255

3. If $^nC_r + {^nC_{r+1}} = {^{(n+1)}C_x}$ then x = [EAM-86]

1) r   2) r - 1   3) n   4) r + 1

4. If $^nP_r = 840$, $^nC_r = 35$ then n = [EAM-86]

1) 6   2) 7   3) 8   4) 9

5. If n and r are positive integers such that r < n then $^nC_r + {^nC_{r-1}}$ = [EAM-87]

1) $^{2n}C_{2r-1}$ 2) $^{(n+1)}C_r$ 3) $^nC_{r+1}$ 4) $^{(n+1)}C_{r+1}$

6. The number of positive divisors of $2^5\, 3^6\, 7^3$ is [EAM-87]

1) 14   2) 167   3) 168   4) 210

7. All the letters of the word EAMCET are arranged in all possible ways. The number of such arrangements in which no two vowels are adjacent to each order is [EAM-87]

1) 36   2) 54   3) 72   4) 144

8. A committee of 5 is to be formed from 6 boys and 5 girls. The number of ways that the committee can be formed so that the committee contains at least one boy and one girl is [E-88]

1) 248   2) 455   3) 720   4) 1025

9. Six teachers and six students have to sit round a circular table such that there is a teacher between any two students. The number of ways in which they can sit is [EAM-89]

1) 6! 6!   2) 5! 6!   3) 5! 5!   4) 6 x 5

10. 7 women and 7 men are to sit round a circular table such that there is a man on either side of every women. The number of seating arrangements is [EAM-90]

1) $(7!)^2$ 2) $(6!)^2$ 3) 6! 7!   4) 7!

11. In how many ways can 5 red and 4 white balls be draw from a bag containing 10 red and 8 white balls? [EAM-91]

1) $^8C_5 \times {^{10}C_4}$ 2) $^{10}C_5 \times {^8C_4}$

3) $^{18}C_9$ 4) $^{18}C_5 \times {^{18}C_4}$

12. $^{14}C_4 + \sum_{j=1}^{4} {^{(18-j)}C_3}$ = [EAM-91]

1) $^{14}C_5$ 2) $^{18}C_5$ 3) $^{18}C_4$ 4) $^{19}C_4$

13. 12 persons are to be arranged at a round table. If two particular persons among them are not to be side by side then the total number of arrangements is [EAM-94]

1) 9 x 10!   2) 2 x 10!   3) 45 x 8!   4) 10!

14. How many different committees of 5 can be formed from 6 men and 4 women on which exactly 3 men and 2 women serve? [EAM-95]

1) 6   2) 20   3) 60   4) 120

15. The number of ways to rearrange the letters of the word CHEESE is [EAM-95]
1) 119 2) 240 3) 720 4) 6

16. The number of ways of selections one or more out of 7 given things is [EAM - 96C]
1) 64 2) 63 3) 128 4) 127

17. The number of diagonals for an n sided polygon is [EAM-96]
1) $\frac{n(n-1)}{2}$ 2) $\frac{n(n-1)(n-2)}{6}$
3) n (n - 1) 4) $\frac{n(n-3)}{2}$

18. The number of lines that can be formed from 12 points in a plane of which no three of them are collinear except 6 points lie on a line is [EAM-97]
1) 45 2) 52 3) 50 4) 46

19. If a polygon has 35 diagonals, then the number of sides of the polyon is [EAM-97]
1) 25 2) 20 3) 15 4) 10

20. If ${}^{(2n+1)}P_{n-1} : {}^{(2n-1)}P_n = 3 : 5$ then n = [EAM-98]
1) 4 2) 5 3) 6 4) 3

21. A group contains 6 men and 3 women. A committee is to be formed with 5 people containing 3 men and 2 women. The number of different committees that can be formed is [E-98]
1) ${}^9C_5$ 2) ${}^6C_3 \times {}^3C_2$
3) ${}^6C_3$ 4) ${}^3C_2$

22. The least value of n so that ${}^{n-1}C_3 + {}^{(n-1)}C_4 > {}^nC_3$ is [EAM-99]
1) 7 2) 8 3) 9 4) 10

23. If ${}^nP_7 = 42\ {}^nP_5$ then n = [EAM-99]
1) 5 2) -1 3) 7 4) 12

24. The number of ways in which 13 gold coins can be distributed among three persons such that each one gets at least two gold coins is [E-2000]
1) 36 2) 24 3) 12 4) 6

25. If C (2n, 3) : C (n, 2) = 12 : 1, then n = [E-2000]
1) 4 2) 5 3) 6 4) 8

26. The number of quadratic expressions with the coefficients drawn from the set{0, 1, 2, 3} is [EAM-2000]
1) 27 2) 36 3) 48 4) 64

27. The number of ways in which 5 boys are 4 girls sit around a circular table so that no two girls sit together is [EAM-2001]
1) 5! 4! 2) 5! 3! 3) 5! 4) 4!

28. Using the digits 0, 2, 4, 6, 8 not more than once in any number, the number of 5 digited numbers that can be formed is [EAM-2001]
1) 16 2) 24 3) 120 4) 96

29. If n and r are integers such that $1 \le r \le n$ then n . C (n-1, r-1) = [EAM-2001]
1) C (n, r) 2) n . C (n, r)
3) r C (n, r) 4) (n - 1) . C (n, r)

EAMCET - 2002

30. The least value of the natural number 'n' satisfying c(n,5) + c(n,6) > c(n+1,5)
1) 10 2) 12 3) 13 4) 11

31. The no. of ways such that 8 beads of different colour be strung in a neckles is...
1) 2520 2) 2880 3) 4320 4) 5040

32. The number of 5 digited numbers which are not divisible by 5 and which contains of 5 odd digits is
1)96 2) 120 3) 24 4) 32

EAMCET-2004

33. The number of positive divisors of 216 is
1) 4 2)6 3)8 4)12

EAMCET-2005

34. A three digit number n is such that the last two digits of it are equal and different from the first. The number of such n's is
1) 64 2) 72 3)81 4)900

35. If N denotes Set of all positive integers and if and if $f : N \to N$ is defined by $f(n)$ = the sum of positive divisors of n. then $f(2^k.3)$ where 'k' is a positive integer is
1) $2^{k+1}-1$ 2) $2(2^{k+1}-1)$
3) $3(2^{k+1}-1)$ 4) $4(2^{k+1}-1)$

Eamcet-2007

36. The number of ways of arrranging 8 men and 4 women around a circular table such that no two women can sit together, is **(E-2007)**
1) 8! 2) 4! 3) 8! 4! 4) 7! $8P_4$

37. If a polygon of n sides has 275 diagonals, then n = **(E-2007)**
1) 25 2) 35 3) 20 4) 15

KEY

1.3	2.4	3.4	4. 2	5.2
6.2	7.3	8.2	9. 2	10.3
11.2	12.3	13.1	14.4	15.1
16.4	17.4	18.2	19.4	20.1
21.2	22.2	23.4	24.1	25.2
26.3	27.1	28.4	29.3	30.4
31.1	32.1	33.1	34.3	35.4
36.4	37.1			