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Class: 11
Subject: Mathematics
Topic: Permutation And Combinations
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. Among 14 players, 5 are bowlers. In how many ways a team of 11 may be formed with at least 4 bowlers?
    a. 265
    b. 263
    c. 264
    d. 275

    Ans. C

    Solution. : $({}^{9}C_{7} \text{ x } {}^{5}C_{4}) + ({}^{9}C_{6} \text{ x } {}^{5}C_{5})$

2. In a certain test, there are n questions. In this test, 2K students gave wrong answers to at least (n - K) questions where K = 0, 1,2, ... n. If the total number of wrong answers is 4095, then the value of n is
    a. 11
    b. 12
    c. 13
    d. 15

    Ans. B

    Solution :

    No. of students answering at least ‘r’ questions incorrectly is 2^{n-r}
    No. of students answering exactly ‘r’ ($1 \le r \le n-1$) questions incorrectly is $2^{n-r} - 2^{n-(r+1)}$
    And , no. of students answering all questions wrong os $2^0 = 1$
    Therefore , no. of wrong answers :
    $= 1(2^{n-1}-2^{n-2})+\ldots+(n-1)(2^1-2^0)+n(2^0)$
    $= 2^{n-1} + 2^{n-2}+\ldots+2^0 = 2^n-1$
    Now , $2^n-1=4095$
    Or, $2^n = 4096$
    Or, $n = 12$

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3. Everybody in a room shakes hand with everybody else. The total number of handshakes is 66. The total number of persons in the room is
   a. 11
   b. 12
   c. 13
   d. 14

   Ans. B

   Solution:
   For 2 people there is 1 hand shake
   for 3 there is 3(1+2)
   for 4 there is 6(1+2+3)

   hence
   12 people, because sum of 1st 11 is 66

4. Sita has 5 coins each of the different denomination. The number of different sums of money she can form is
   a. 32
   b. 25
   c. 31
   d. None of these

   Ans. C

   Solution :

   As there are 5 coins, for every sum any particular coin may be selected or not.
   thus, for each sum, there are two possibilities of each coin.
   for example, let A,B,C,D AND E are coins, then sum can be get
   ABCDE
   1 1 1 1 1
   1 1 1 1 0
   :
   :
   :
   0 0 0 0 1
   Total no. of different sum = 2^5 -1 = 31

5. The number of words that can be formed out of the letters of the word “ARTICLE” so that the vowels occupy even places is
   a. 574
   b. 36
   c. 754
   d. 144

Ans. D

Solution :

The word 'ARTICLE' has Seven letters. So it contains seven places (3 even and 4 odd) to be filled with the lettersThe three vowels can be placed in 3 even places in 3! = 6 ways The four consonants can be placed in 4 odd places in 4! = 24 ways Seven letters can be placed in seven places in which vowels take only even positions = 6 × 24 = 144 ways

6. Ten different letters of an alphabet are given. Words with five letters are formed from these given letters. Then the number of words which have at least one letter repeated is
   a. 69760
   b. 30240
   c. 99784
   d. None of these

   Ans. B

   Solution :
   The number of 5-letter words where the letters are selected from a 10-letter alphabet (possibly with repetition) is 105.

   The number of 5-letter words with all letters distinct is 10*9*8*7*6= 30240

7. How many different arrangements can be made out of the letters in the expansion A^2 B^3 C^4, when written in full?
   a. $\frac{9!}{2!3!4!}$
   b. 2! + 3! + 4! (2! 3! 4!)
   c. 2! 3! – 4
   d. $\frac{9!}{2!+3!+4!}$

   Ans. A

   Solution :
   A^2 B^3 C^4 can written in full as AA BBB CCCC
   Thus , required no. of ways are = $\frac{9!}{2!3!4!}$

8. The number of ways of arranging p numbers out of 1, 2, 3, ..., q so that maximum is q-2 and minimum is 2 (repetition of number is allowed) such that maximum and minimum both occur exactly once (p > 5, q > 3) is
   a. $p^{-3}C_{q-2}$
   b. $pC_2(q-3)^{n-2}$
   c. $pC_2 x\, qC_3$

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d. $p(p-1)(q-5)^{p-2}$

Ans. D

Solution :
First we take one of the numbers as 2 and one another as *q-2*. We can arrange these two numbers in *p(p-1)* ways. We have to choose remaining *p-2* numbers from *3,4,5,…,q-4,q-3*. This can be done in $(q-5)^{p-2}$ ways.
Thus , the total number of ways of arranging the numbers in desired way is

$$p(p-1)(q-5)^{p-2}$$

9. The number of ways in which six '+' and four '-' signs can be arranged in a line such that no two ''signs occur together is
   a. C (10, 4)
   b. P (10, 4)
   c. C (7, 4)
   d. none of these

   Ans. C

   Solution :
   Think of it this way: + - + - + - + -
   We must pick 4 of the 7 boxes to put a single "-" in.
   The number of combinations of 7 things taken 4 at a time or 7C4 or C(7,4)

10. 66 games were played in a tournament where each player placed one against the rest. The number of players are
    a. 33
    b. 12
    c. 13
    d. 11

    Ans. B

11. The number of functions {f()} from the set A = {0, 1, 2} into the set
    B = {0, 1, 2, 3, 4, 5, 6, 7]- such that *f*(i) £ *f* (j) for i <j and i,jÎ A is
    a. $^{8}C_3$
    b. $^{8}C_3 + 2\,(^{8}C_2)$
    c. $^{10}C_3$
    d. none of these

    Ans. C
    Solution:

Sol. A function $f : A \to B$ such that
$f(0) \le f(1) \le f(2)$ falls in one of the following 4 cases:
1. $f(0) < f(1) < f(2)$.
There are ${}^8C_3$ functions in this case.
2. $f(0) = f(1) < f(2)$.
There are functions in this case.
3. $f(0) < f(1) = f(2)$.
There are again ${}^8C_2$ functions here.
4. $f(c) = f(1) = f(2)$.
There are ${}^8C_1$ functions in this case.
the required number of functions
$= {}^8C_3 + {}^8C_2 + {}^8C_2 + {}^8C_1$
$= {}^9C_3 + {}^9C_2 = {}^{10}C_3$

12. In an examination of 9 papers a candidate has to pass in more papers than the number of papers in which he fails in order to be successful. The number of ways in which he can be unsuccessful is
    a. 255
    b. 256
    c. 193
    d. 319

    Ans. B

    Solution :

    9C5 + 9C6 + 9C7 + 9C8 + 9C9 = 126 + 84 + 36 + 9 + 1 = 256

13. If ${}^nC_4$, ${}^nC_5$, ${}^nC_6$ are in A.P. then the value of n is
    a. 14 or 7
    b. 11
    c. 17
    d. 8

    Ans. A

    Solution :

    Coff. of T5 , T6 , T7 and in A.P for (1 + x)n
    ie., n C4 , n C5 & n C6 an in A.P
    So , 2 n C5 = n C4 + n C6 , Thus , n = 7 & 14

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14. Sum of all the three digit numbers (no digit being zero) having the property that all the digits are perfect squares, is
    a. 3108
    b. 6216
    c. 13986
    d. 31080

    Ans. C
    Solution:
    Sol. The non-zero perfect square digits are 1, 4, 9. 1 can occur at unit places in 3 x 3 = 9 ways sum due to 1 at unit place = 1 x 9
    Similar sum due to 1 at ten's place and sum due to 1 at hundreds place = 1 x 100 x 9
    Similarly we can deal with 4 and 9. the sum of the desired number = (1 + 4 + 9) (1 + 10 + 100)(9) = 13986

15. The least positive integral value of n which satisfies the inequality ${}^{10}C_{n-1} > 2.\ {}^{10}C_{n}$ is
    a. 7
    b. 8
    c. 4
    d. 10

    Ans. B

    Solution :
    Hint : Use the options to solve the problem. [Deductive analysis]

16. Six persons A, B, C, D, E and F are to be seated at a circular table. In how many ways can this be done if A must always have either B or C on his right and B must always has either C or D on his right?
    a. 12
    b. 120
    c. 18
    d. 38

    Ans. C

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If B is sitting on the immediate right of A, then C or D can sit on the immediate right of B and the rest 3 places can be filled in 3! ways. So, the total number of ways when B is sitting to the immediate right of A = 2 × 3! = 12.
Similarly, when C is sitting to the immediate right of A, then D has to sit on the immediate right of B, so B-D becomes a pair. Now for rest of 2 can be seated at three different positions in two ways each (This is dependent of the positions of B - C). Number of arrangements possible here = 6
So, total arrangements = 18

17. Note the arrangement (1, 1), (1, 2), (1, 3), (2, 3), (3, 3), (3, 4), (4, 4). Here we start from (1, 1), then increase one of the coordinates by 1 and repeat the same until we reach (4, 4). For example (1, 1), (2, 1), (2, 2), (2, 3), (3, 3), (3, 4), (4, 4) is another such arrangement. The number of such arrangements is
    a. ${}^6P_6$
    b. ${}^6C_6$
    c. $\frac{6!}{3!3!}$
    d. 6

    Ans. C
    Hint : We have 6 pairs , so 6! And on either ordinate and abscissa we make 3 changes so 3!*3!

18. A shopkeeper sells three varieties of the perfumes and he has a large number of bottles of the same size of each variety in his stock. There are 5 places in a row in his showcase. The number of different ways of displaying the three varieties of perfumes in the showcase is
    a. 6
    b. 50
    c. 150
    d. None of these

    Ans. C
    We have

Possibility	Selections	Arrangements
One triplet and 2 different	${}^3C_1 \times {}^2C_2$	${}^3C_1 \times {}^2C_2 \times \frac{5!}{3!} = 60$
Two pairs and one different	${}^3C_1 \times {}^1C_1$	${}^3C_2 \times {}^2C_1 \times \frac{5!}{2!2!} = 90$

Thus , 90+60 = 150

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19. If ${}^{K+5}P_{K+1} = \frac{11(K-1)}{2} \times {}^{K+3}P_K$, then K is

   a. 6
   b. 8
   c. 10
   d. 5

   Ans. A
   Solution:

   Sol. ${}^{K+5}P_{K+1} = \frac{11(K-1)}{2} \times {}^{K+3}P_K$

   $\Rightarrow \quad \frac{(K+5)!}{4!} = \frac{11(K-1)}{2} \frac{(K+3)!}{3!}$

   $\Rightarrow \frac{(K+5)(K+4)}{4} = \frac{11(K-1)}{2}$

   $\Rightarrow \quad K^2 + 9K + 20 = 22K - 22$

   $\Rightarrow \quad K^2 - 13K + 42 = 0$

   $\Rightarrow \quad (K-6)(K-7) = 0$

   $\Rightarrow \quad K = 6,7 \therefore (a)$ is the correct answer.

20. There are 4 letters and 4 direct envelopes. The number of ways in which every letter be put into a wrong envelope is

   a. 8
   b. 16
   c. 15
   d. 9

   Ans. D

   Solution: We can list the possible ways:

   2143
   2341
   2413
   3142
   3412
   3421
   4123
   4312
   4321

   or realize that the first mistake will start with 3 different envolops and the second one will be another 3 and finally another mistake on the 3rd envolope and the rest will be wrong anyways so

3+3+3 = 9