

**Question 1:** There are 3 sections in a question paper and each section contains 5 questions. A candidate has to answer a total of 5 questions, choosing at least one question from each section. Then the number of ways, in which the candidate can choose the questions, is:

- (a) 2250
- (b) 2255
- (c) 1500
- (d) 3000

**Solution:**

Total number of sections = 3

Number of questions in each section = 5

Number of ways, in which the candidate can choose the questions =  $3({}^5C_1 \times {}^5C_2 \times {}^5C_2) + 3({}^5C_1 \times {}^5C_1 \times {}^5C_3)$

$$= 3(5 \times 5 \times 2 \times 5 \times 2) + 3(5 \times 5 \times 10)$$

$$= 750 + 1500$$

$$= 2250$$

Hence option a is the answer.

**Question 2:** A test consists of 6 multiple choice questions, each having 4 alternative answers of which only one is correct. The number of ways, in which a candidate answers all six questions such that exactly four of the answers are correct, is

**Solution:**

Number of multiple choice questions = 6

Number of alternative answers = 4

The number of ways, in which a candidate answers all six questions such that exactly four of the answers are correct =  ${}^6C_4 \times 1 \times 3^2$

$$= 15 \times 9$$

$$= 135$$

**Question 3:** Total number of six-digit numbers in which only and all the five digits 1, 3, 5, 7, and 9 appear, is

- (a)  $5^6$

(b)  $(\frac{1}{2})(6!)$

(c)  $6!$

(d)  $(\frac{5}{2}) 6!$

**Solution:**

Selecting all 5 digits =  ${}^5C_5 = 1$  way

We need to select one more digit to make it a 6 digit number =  ${}^5C_1 = 5$  ways

Total number of permutations =  $6!/2!$

Total numbers =  ${}^5C_5 \times {}^5C_1 \times (6!/2!)$

=  $(\frac{5}{2}) 6!$

Hence option d is the answer.

**Question 4: The total number of ways in which 5 balls of different colours can be distributed among 3 persons so that each person gets at least one ball is**

(a) 75

(b) 150

(c) 210

(d) 243

**Solution:**

Given that 5 balls to be distributed among 3 persons.

Here  $n = 5$ ,  $r = 3$

Number of ways to divide  $n$  non identical object in  $r$  different group such that each group gets atleast one object (empty group not allowed)

$$= r^n - {}^rC_1(r-1)^n + {}^rC_2(r-2)^n - {}^rC_3(r-3)^n \dots (-1)^{r-1} {}^rC_{r-1}(1)^n$$

$$= 3^5 - {}^3C_1(3-1)^5 + {}^3C_2(3-2)^5 - {}^3C_3(3-3)^5$$

$$= 243 - 96 + 3$$

$$= 150$$

Hence option b is the answer.

**Question 5: Let  $S = \{1, 2, 3, 4\}$ . The total number of unordered pairs of disjoint subsets of  $S$  is equal to**

(a) 25

(b) 34

(c) 42

(d) 41

**Solution:**

$$S = \{1, 2, 3, 4\}$$

If sets A and B are disjoint sets, then  $A \cap B = \phi$ .

Every element of S can be an element of A or of B or of neither of the subsets.

There exist 3 possibilities for each element.

Since there are 4 elements, there are  $3^4$  possibilities present.

Total number of ordered pairs of subsets =  $3^4 + 1$

$$= 81 + 1$$

$$= 82$$

Total number of unordered pairs =  $82/2 = 41$

Hence option d is the answer.

**Question 6:** Six cards and six envelopes are numbered 1, 2, 3, 4, 5, 6, and cards are to be placed in envelopes so that each envelope contains exactly one card and no card is placed in the envelope bearing the same number and moreover the card numbered 1 is always placed in envelope numbered 2. Then the number of ways it can be done is

(a) 264

(b) 265

(c) 53

(d) 67

**Solution:**

If the card number '2' goes in the envelope '1' then it is derangement of 4 things which can be done in  $4!(1/2! - 1/3! + 1/4!) = 9$  ways.

If card number '2' doesn't go in the envelope '1', then it is derangement of 5 things which can be done in  $5!(1/2! - 1/3! - 1/4! + 1/5!) = 44$  ways.

Total number of ways =  $9+44$

= 53 ways

Hence option c is the answer.

**Question 7: A debate club consists of 6 girls and 4 boys. A team of 4 members is said to be selected from this club including the selection of a captain (from among these 4 members) for the team. If the team has to be included at most one boy, then the number of ways of selecting the team is**

(a) 380

(b) 320

(c) 260

(d) 95

**Solution:**

Given that there is at most one boy in the group of 4.

Therefore the selection of 4 members team has 2 possibilities.

a) all 4 members are girls

b) 3 girls and 1 boy

From the first possibility, we can select 4 members in  ${}^6C_4$  ways = 15 ways

From the second possibility, we can select 4 members in  ${}^6C_3 \cdot {}^4C_1 = 80$  ways

Total number of ways =  $15+80 = 95$

So we can select 4 members in 95 ways.

The captain can be selected from the group of 4 members in  ${}^4C_1 = 4$  ways

So the number of ways of selecting the team of 4 members including the selection of captain is

$95 \times 4 = 380$

Hence option a is the answer.

**Question 8: The number of 5 digit numbers which are divisible by 4, with the digits from the set {1, 2, 3, 4, 5} and the repetition of digit is allowed is**

**Solution:**

A number will be divisible by 4, if last two digits of the number is divisible by 4.

The 2 digits numbers which are divisible by 4 from the given set  $\{1,2,3,4,5\}$  are 12, 24, 32, 44 or 52. So, if a number ends with 12, 24, 32, 44 or 52, then it is divisible by 4.

First 3 digits can be arranged in  $5^3$  ways

The total number of 5 digit numbers which are divisible by 4 without repetition is  $5^3 \times 5 = 625$

**Question 9: A bag contains 2 apples, 3 oranges, and 4 bananas. The number of ways in which 3 fruits can be selected if atleast one banana is always in the combination (Assume fruits of same species to be alike) is**

- (a) 6
- (b) 10
- (c) 29
- (d) 7

**Solution:**

We have to select 3 fruits. It will contain 1 banana and 2 more fruits.

Case 1: 2 fruits are bananas.

Number of ways = 1

Case 2: both are not bananas

a) both are same fruits

Number of ways =  ${}^2C_1 = 2$

b) both are different fruits

Number of ways = 1

Case 3: 1 fruit is banana

Number of ways =  $1 \times {}^2C_1 = 2$

total number of ways =  $1 + 2 + 1 + 2$

= 6

Hence option a is the answer.

**Question 10: Team A consists of 7 boys and n girls and Team B has 4 boys and 6 girls. If a total of 52 single matches can be arranged between these two teams when a boy plays against a boy and a girl plays against a girl, then n is equal to**

- (a) 5

(b) 6

(c) 2

(d) 4

**Solution:**

Total matches between boys of both teams =  ${}^7C_1 \times {}^4C_1$

$$= 28$$

Total matches between girls of both team =  ${}^n C_1 \times {}^6 C_1$

$$= 6n$$

$$\text{Now, } 28 + 6n = 52$$

$$6n = 24$$

$$n = 4$$

Hence option d is the answer.

