**11. PERMUTATION & COMBINATION**

**Solution Exercise – Easy**

1. (b) : In all, there are 5 people and we wish to arrange all 5. Hence, the total number of ways to do this is:

5*P*5 or 5! = 120 ways

2. (c) : Here we know that the order is important.

∴ Total number of ways is 7*P*7 = 7 × 6 × 5 × 4 × 3 × 2 ×1 = 5040 ways

3. (b) : A decagon has 10 sides, hence number of diagonals

=  = 35

4. (a) : Required number of permutations =  × (7 − 1)! = 360

(Since there is no difference in clockwise and anticlockwise arrangements)

5. (b) : The number of circular arrangements for 6 stones would be (6 – 1)! = 5!

But in a ring clockwise and anticlockwise arrangements are same. Hence, actual number of permutations =  = 60 ways.

6. (b) : 6 people can be seated around a circular table in (6– 1)! = 5! = 120 ways.

7. (c) : There are only 21 consonants in English alphabets. So, there are 21 ways of filling up the first place. Now, there are only 20 ways of filling up the second place and the third place can be filled up in 19 ways & so on.

Hence, the required number of words

= 21 × 20 × 19 × 18 = 143640

8. (b) : Fixing *n* at first place, we can arrange remaining 5 letters in 5! ways.

∴ Number of words = 120.

9. (a) : Number of letters in the word BRIGHT = 6

∴ Number of ways in which letters of the word BRIGHT can be arranged = 6!

10. (b) : Since the word ‘triangle’ consists of 8 different letters, the number of permutations of choosing 3 letters out of eight

= 8*P*3 = 8 × 7 × 6 = 336 or, we can say 1st place can be filled in 8 ways, 2nd in 7 and so on.

11. (b) : Total number of letters in the word MODERN = 6.

Number of ways in which they can be arranged amongst themselves is 6*P*6 or 6! = 720 ways.

12. (a) : REJUVENATE

There are total 10 letters, but since 3 *E*’s are together, we have 8. Therefore number of words when 3 *E*’s are together = 8! = 40320

13. (a) : Number of five letter words that can be formed = 8 × 7 × 6 × 5 × 4 = 8*P*5

14. (c) : Number of letters in the word SPEED = 5

Number of time *E* is repeated = 2

∴ Total number of possible words =  = 60

15. (d) : Fixing *d* at first place & *a* at last place, remaining letters can be arranged in 5!

∴ 120 words can be formed.

16. (a) : There are 8 letters in the word DISTANCE and each letter is used only once. So, all the 8 letters can be arranged in 8! ways.

8 = 8 × 7 × 6 × 5 × 4 × 3 × 2 × 1 = 40320

17. (c) : There are 11 letter & *T* is appearing twice, hence number of arrangements = 

18. (b) : As we can use a digit more than once, for each place we can choose any of the 4 digits.

Thus, 4 × 4 × 4 × 4 = 256 such numbers can be formed.

19. (c) : Repetition is allowed and there are 7 digits in all.

∴ The number of four- digit numbers that can be formed would be given by 7 × 7 × 7 × 7 = 2401.

20. (a) :

|  |  |  |
| --- | --- | --- |
| 6 | 5 | 4 |

⇒ 6 ×5 × 4 = 120

We have 6 digits to fill up hundreds place and only 5 digits for tens place and only 4 digits for unit place since repetition is not allowed.

21. (d) : There are 15 books out of which 3 are of one kind and 5 are of another kind.

∴ The number of arrangements = 

22. (a) : Here we have to make selections and find the number of combinations of 12 things taken 5 at a time, which is 12*C*5

=  =  = 792

23. (d) : He has to select 5 shirts from 10 shirts. This can be done in 10*C*5 ways. The trousers can be selected in 12*C*6 ways.

The number of ways in which he can pack his shirts and trousers = 10*C*5 × 12*C*6

24. (c) : As per the given condition from 30 we have to select 8 and that can be done in 30*C*8 ways.

25. (d) : We can go from *A* to *B* in 8 ways

We can return also in 8 ways number of ways = 8 × 8 = 64 ways

26. (b) : A man can go from Delhi to Amritsar in 7 ways by any one of the 7 trains available. Then he can return from Amritsar to Delhi in 6 ways by the remaining 6 trains, since he cannot return by the same train by which he goes to Amritsar from Delhi. Thus the required number of ways = 7 × 6 = 42

27. (b) : He can arrange his schedule in 10*P*5 = 10 × 9 × 8 × 7 × 6 = 30240 ways

28. (b) : Each letter can be posted in the 7 letter boxes in 7 ways. Hence, 4 letters can be posted 7 letter boxes in 7 × 7 × 7 × 7 ways, *i.e*. 74 ways.

29. (a) : The problem is of selection. Hence, the promotions can be done in 5*C*3 = 5 × 2 = 10 ways

30. (d) : Number of ways that we can deal with red balls is (6 + 1) = 7

Number of ways that we can deal with blue balls is (5 + 1) = 6

Number of ways that we can deal with green balls is (4 +1) = 5

So, number of ways of selecting balls is 7 × 6 × 5 = 210. Out of these there is one way when we have not selected blue balls, green balls and red balls hence total number of ways of selecting one or more balls is 210 – 1 = 219

31. (c) : Mudit has to select one or more of his 6 friends, he can do so in 26 – 1

64 – 1 = 63 ways

**Alternate Method:**

He can invite his friends one by one, in two’s, in threes, etc. and hence the number of ways.

= 6*C*1 + 6*C*2 + 6*C*3 + 6*C*4 + 6*C*5 + 6*C*6

= 6 + 15 + 20 + 15 + 6 + 1

= 63 ways

32. (b) : A question can be answered in two ways *i.e*. either true or false. Hence all the 5 questions can be answered in 2 × 2 × 2 × 2 × 2 = 25 = 32 ways.

33. (c) : Number of ways that we can deal with red balls is (8 + 1) = 9

Number of ways that we can deal with blue balls is (9 + 1) = 10

Number of ways that we can deal with green balls is (9 + 1) = 10

So, number of ways of selecting balls is 9 × 9 × 10 = 810.

34. (d) : Hence, here atleast one of each type is to be selected.

Number of ways that we can deal with red balls 3.

Number of ways that we can deal with blue balls 6.

Number of ways that we can deal with green balls 9.

So, number of ways of selecting balls is 3 × 6 × 9 = 162.

35. (b) : As *nCr* = *nCn – r*’ we have 16*Cr* = 16*C*16 – *r*

But it is given, 16*Cr* = 16*Cr* + 2

∴ 16*C*16 – r = 16*Cr* + 2

or, 16 – *r* = *r* + 2

14 = 2*r*

*r* = 7

36. (a) : As we know

*nCr* × *r*! = *nPr*

60 × *r*! = 302400

*r*! = 5040

37. (d) : There is alternative question for each ; so if a particular question is to be done, it can be selected in 2 ways, but it can be rejected too ; so number of ways of dealing one question is 3. Thus, questions can be dealt in 38 ways ; but this includes the case when all questions have been rejected ; hence, leaving that case the required number = 38 − 1.

38. (c) : Required number of newspapers = 

39. (b) : Since, *A* × *B* will have 2 × 4 = 8 elements so required answer is 28 − 8*C*0 − 8*C*1 − 8*C*2 = 256 − 1 − 8 − 28 = 219

**Solution Exercise – Medium**

1. (b) : The committee may contain 2, 3, or 4 Managers.

Hence, the required number of ways = 4*C*2 × 7*C*4 + 4*C*3 × 7*C*3 + 4*C*4 × 7*C*2

= 210 + 140 + 21 = 371.

In this we have only to make use of the suitable formula for combinations, for we are not concerned with the possible arrangements of the members of the committee among themselves.

2. (a) : 3 experts including atleast a technicians and a manager can be selected by taking.

I. 2 managers out of 3 and 1 technician out of 3.

II. 1 manager out of 3 and 2 technician out of 3.

III. 2 persons out of 6 (3 managers and 3 technicians) and 1 person out of one who is both technician and manager.

In case I, the number of ways = 3*C*2 × 3*C*1 = 9

In case II, the number of ways = 3*C*1 × 3*C*2 = 9

In case III, the number of ways = 6*C*2 × 1*C*1 = 15

Hence, the required number of ways = 9 + 9 + 15 = 33.

3. (b) : Total number of ways

= 4*C*1 × 6*C*3 + 4*C* × 6*C*2 + 4*C*3 × 6*C*1 + 4C4 × 6*C*0 .

= 4 × 20 + 6 × 15 + 4 × 6 + 1

= 80 + 90 + 24 + 1

=195

4. (a) : A committee of 4 persons, consisting of at most two ladies, can be formed in the following ways.

I. Selecting 4 gents out of 6.

II. Selecting 3 gents only out of 6 and 1 lady out of 4.

III. Selecting 2 gents only out of 6 and two ladies out of 4.

In case I, the number of ways =6*C*4 = 15

In case II, the number of ways = 6*C*3 × 4*C*1 = 80

In case III, the number of ways = 6*C*2 × 4*C*2 = 90

∴ Required number of ways = 15 + 80 + 90 = 185

5. (b) : ATTITUDE has 8 letters, of which 3 are *T*’s, the other 5 letters can be arranged in 5! ways.

Now, we can place the 3 *T*’s in the 6 spaces between the letters \_\_ *A \_\_ I \_\_ U \_\_ D \_\_ E* \_\_ , which can be done in 6*C*3 ways.

∴ Total number of ways = 5! × 6C3 = 2400.

6. (b) : Number of vowels in the word ‘EQUATION’ = 5[*A, E, I, O, U*]

Total number of letters in the word ‘ EQUATION’ = 8.

The first place (as required) can be filled in five ways by any of the five vowels.

The remaining seven places can be filled by the remaining seven letters in 7*P*7 ways, *i.e*., 5040 ways.

Therefore, the required number of words = 5 × 5040 = 25200.

7. (d) : These are 9 letters in all which have 3 vowels (*I, E, E*).

Now, we have 6 consonants which include 2 *F*’s and 3 vowels which include 2 *E*’s together, *i.e*. 7 letters to be arranged.

∴ Required number of permutations = 

= 120960

8. (d) : MACHINE

Consonants : *MCHN*

Vowel : *AIE*



“*A*” vowel can take 4 place

“*I”* vowel can take 3 place

“*E”* vowel can take 2 place

So, vowels can be filled in 4 ´ 3 ´ 2 = 24 or 4*P*3 = 24

Similarly, remaining words can be filled in = 4 ´ 3 ´ 2 = 24

Total ways = 24 ´ 24 = 576

9. (b) : The word ‘PATLIPUTRA’ has ten letters, in which 2P’s, 2A’s, 2T’s, 1L, 1U, 1R, 1I. Vowels are AIUA.

These vowels can be arranged themselves in  = 12 ways.

The consonants are a PTLPTR these consonants can be arranged amongst themselves in  = 180 ways

∴ Required number of words = 12 × 180 = 2160 ways.

***Solutions questions 10 and 11:***

The word contains 12 letters of which there are 2 *A*’s, 2*C*’s, 3*O*’s and rest all are different.

The letters can be arranged in 

10. (b) : Since all *O*’s are together, treat them as one letter.

∴ Number of ways are = 

11. (b) : Since all *A*’s and *O*’s are together, treat *A*’s as 1 letter & *O*’s as 1 letter.

∴ Number of arrangements = 

12. (b) : The word ‘PENCIL’ has six letters. As *N* needs to be next to *E*, treat these two letters as one unit. The remaining four letters and one unit of ‘*EN*’ can be arranged in 5! ways.

Now, *N* and *E* can be arranged between themselve in two ways: *NE* and *EN*. Hence, the required number of arrangements is 120 ´ 2 = 240.

13. (d) : There are 4 vowels *O, I, E, E* in the given word. If the four vowels always come together, taking them as one letter we have to arrange 5 + 1 = 6 letters which include 2 *M*’s and 2 *T*’s and this be done in  = 180 ways.

In which of 180 ways, the 4 vowels *O, I, E, E* remaining together can be arranged in  = 12 ways.

∴ Total number of ways = 180 × 12 = 2160.

14. (a) : There are five letters in the word MANGO.

When *O* and *A* occuping end places *M, N, G*, (*AO*).

First three letters can be arranged in 3! = 6 ways and last two letters can be arranged in 2 ways.

Total number of such words = 6 × 2 = 12 ways.

15. (b) : When *G* is fixed in the middle, there are four place left to be filled by remaining four letters. This can be done in 4! ways.

Total number of such words = 4! = 24 ways.

16. (c) : Two vowels (*A, O*) can be arranged in even places in 2! ways (2nd & 4th) & three consonants (*M, N, G*) can be arranged in odd places in 3! ways.

Total number of such words = 3! × 2! = 12 ways.

17. (c) : Total number of words = 5! = 120.

Number of words when vowels are together = 4! ´ 2! = 48

Hence, number of words, when vowels are never together = 120 – 48 = 72 ways.

18. (d) : There are 13 people to be seated in a circle. As two girls want to sit next to each other, we consider them to be one entity.

Then we have 12 people to be arranged in a circle. This can be done in 11! ways. The two girls can be arranged in 2! ways.

∴ The total number of ways in which eight boys and five girls can be arranged = 11! × 2!

19. (b) : 7 boys can be placed in a circular table in (7 – 1)! − 6! ways.

Now there are 7 places in between & 6 girls can sit in 7*P*6 ways.

∴ Total number of ways = 6! × 7*P*6

20. (a) : 6 girls can be arranged in 5! ways then 6 boys can be arranged in 6 places in 6 ways.

Hence, the required number of ways = 5! × 6!

= 120 × 720 = 86400

21. (b) : **Case 1.** When a boys comes at first place number of ways are 5!

Number of arrangements of 5 girls is 5*P*5 = 5!

Number of arrangements in this case = 5! × 5!

**Case 2.** When a girl comes at 1st place.

Number of arrangements = 5! 5!

Total number of arrangements are = 2 × 4! × 4! = 1152

22. (b) : The first building can be painted using any one of the four colours in 4 ways. The second building can be painted using any of the remaining three colours in 3 ways. The third building can have any colour except the one with which the second building is painted. Thus it can be painted in 3 ways. Similarly, the fourth, fifth, sixth and seventh buildings can be painted using 3 colours each.

Thus, the total number of ways in which the buildings can be painted = 4 × 36

23. (c) : Let the four bands be called *ABCD*.

*A* can be selected in 3 ways. It could be red, blue or green.

*B* can be any of the three colours except *A*. So, there are 2 possible options for *B*.

*C* can be any of the three colours except *B*. So, there are 2 possible options for *C*.

*D* can be any of the three colours except *C*. So, there are 2 possible options for *D*.

Total number of options = 3 × 2 × 2 × 2 = 24 ways

24. (a) : A ticket will be between two stations so 2 stations from *x* stations can be selected in *xC*2 ways *i.e*.  which is given to us equal to 210.

So, *x*(*x* – 1) = 210 × 2 = 420 or *x* = 20.

25. (d) : Since the three people *E, F, G* must sit on the side facing the window (4 seats). We have to select 1 for the side facing the window from of 7 – 3 = 4 in 4*C*1 ways.

Now, 3 people remain and we have to select all of then *i.e*. 1 way.

Now, we have 4 persons (including *E*, *F*, *G*) on the side facing the window.

Number of arrangements of 4 people = 4!. Number of arrangements of 3 people the other side = 3!

Number of ways in which 7 people can be seated is 4*C*1 4!3! = 576

26. (c) : 1 to 4 are arranged in = 4! = 24 ways

If 1 & 4 are arranged together then no of ways = 3! × 2 = 12 ways.

∴ Total number of ways = 24 – 12 = 12 ways

27. (c) : The required number of words = 7*C*3 × 4*C*2 × 5!

=  = 25200.

28. (b) : Required number of ways = (6*C*4 × 6*C*2) + (6*C*3 × 6*C*3) + (6*C*2 × 6*C*4)

= (15 × 15) + (20 × 20) + (15 × 15)

= 225 + 400 + 225 = 850

29. (b) : After *H*1 entered the field, there are six portions left for *H*2, as no two can enter into the same portion of the field, After first two entered the field, *H*3 can enter the field in five ways.

Therefore, the three horses can graze the grass of the field in 7 × 6 × 5 = 210 ways.

30. (b) : There is no restriction on red, green, violet and yellow balls.

Hence, these four balls can be arranged in 4! ways.

Now, for black and white balls, there are five (5) place and hence two balls (black and white) can be arranged in 5P2 = 20.

Required number of arrangements = 4! × 20 = 480.

31. (c) : Required number of ways = 7*C*3 × 5*C*5 + 7*C*4 × 5*C*4 + 7*C*5 × 5*C*3

= 35 × 1 + 35 × 5 + 21 × 10

= 35 + 175 + 210 = 420

32. (c) : Here we have two sections *A* and *B*, the section A has 4 questions and section *B* has 6 questions and one question from each section is compulsory according to the given direction.

∴ Number of ways of selecting one or more than one question from section *A* is 24 – 1

16 – 1 = 15 and number of ways of selecting one or more than one question from section *B* is 26 – 1 = 63

Hence, the required number of ways in which a candidate can select the questions = 15 × 63 = 945

33. (c) : Number of 4 digit numbers in which repetition is allowed = 9 × 10 × 10 × 10 = 9000

Number of in which repetitions is not allowed = 9 × 9 × 8 × 7 = 4536

Hence the required number of numbers of 4 digit = 9000 – 4536 = 4464

34. (b) : Total number of numbers of 6 digits formed with the digits 4, 5, 6, 7, 8, 9 is:

6! = 720

Number which end with 5 must be divisible by 5.

Hence, are number of digits divisible by 5 and formed with the digits 4, 5, 6, 7, 8, 9 is:

5! = 120

Now numbers not divisible by 5 = total numbers – numbers divisible by 5.

720 – 120 = 600

35. (c) : Since 0, 1, 2, 3, 4 and 5 are not to be used, therefore, you are left with the digits 6, 7, 8 and 9.

Unit’s place can be filled up by 6, 7, 8 or 9, *i.e*., in four ways, 10’s place can be filled up by 6, 7, 8 or 9, *i.e*., in four ways and the 100’s place can be filled up by 6, 7, 8 or 9, *i.e*., in four ways.

Therefore, number of three digits numbers which can be formed without using the digits 0, 1, 2, 3, 4 and 5 = 4 × 4 × 4 = 64.

36. (c) : 

I place can be filled in 5 ways

II & III place can be filled in 10 ways

IV place can be filled in 9 ways

Number of ways = 5 × 10 × 10 × 9 = 4500.

37. (a) : 3, 4, 5 & 7

= 

Fixing 7 at first place, remaining places can be filled in 3 × 2 = 6 ways. Also, 7 will come at (10, 100’s) place 6 times.

Similarly for 3, 4 & 5 this can be done.

Hence, sum of the numbers (3 + 4 + 5 + 7) × 6 × (1 + 10 + 100)

= 114 × (111)

= 12654

38. (c) : There is only one digit *i.e*. 6 among the given that can form even numbers.

∴ We place 6 at the units place.



The rest 4 places can be filled in 4 × 3 × 2 × 1 ways

∴ Total number of numbers possible are 24.

[**Note:** In each case 8 is fixed at unit place. Since if the unit digit is an even digit then the whole number is an even number.]

39. (a) : For a number to be odd, the unit’s digit must be odd. Here, the unit’s place can be 1, 3, or 5, *i.e*., there are three ways of filling up the unit’s place.

a) Since repetition of digits is not allowed, the 10’s place can be filled in five ways.

The 100’s place therefore, can be filled up in four ways.

Therefore, the required number of three - digit odd numbers is 3 × 5 × 4 = 60.

b) Since the repetition of digits is allowed, the 10’s & the 100’s place can be filled up by any one of the given six digits in six ways.

Therefore, the required number of three-digit odd numbers is 3 × 6 × 6 = 108.

40. (b) : III II I

III place can be filled in 5 ways. (using 1, 2, 3, 4, 5)

II place can be filled in 4 ways.

I place can be filled in 5 ways.

Total numbers = 5 × 5 × 4 = 100

41. (b) : A number is divisible by 4 if last two digits are divisible by 4.

∴ If a digit has 12, 24, 32, 44 ( as repetition is allowed) & 52 as last digits, then the no is divisible by 4.

Hence, fixing 12 at last two places, remaining place can be filled in 25 ways.

We will do the same for all other numbers - 24, 32, 44 & 52.

∴ Possible numbers are = 25 + 25 + 25 + 25 + 25 = 125

42. (b) : 

I place can be filled in 5 ways. (1, 3, 5, 7, 9)

IV place can be filled in 8 ways.(0 can’t be taken)

III place can be filled in 8 ways.

As repetition is not allowed.

II place can be filled in 7 ways

So, number of digits are = 8 × 8 × 7 × 5 = 2240

43. (a) : Let *n* be number of contestant.

Number of games = *nC*2

According to question *nC*2 = 45

 = 45 or *n*2 – *n* –90 = 0

or *n* = – 9, 10

⇒ = 10

44. (b) : Since total number of students is 20. Number of pairs will be 20*C*2 , and

With each pair we have two gifts, so total number of gifts 2 . 20C2 .

45. (c) : Required number of permutations = 12*P*4 = 11880

**Alternative Method:**

First prize can be given to any one of the 12 students and second prize can be given to any one of the remaining 11 students and the third prize can be given to any one of the remaining 10 students & so on. Therefore it can be done in 12 × 11 × 10 × 9 = 11880

46. (c) : First position may be won by = 14 teams

Second position may be won by = 13 teams

Third position may be won by = 12 teams

Total number of ways = 14 × 13 × 12 = 2184

47. (a) : After fixing the places of three persons (1 host + 2 persons).

Treating (1 host + 2 persons) = 1 unit, we have now (remaining 23 persons + 1 unit) = 24 persons. The number of arrangement will be (24 – 1)! = 23! Also these two particular persons can be seated on either side of the host in 2! ways.

Hence, the number of ways are = 23! × 2!

48. (d) : There are 4 queens in a pack of 52 cards.

∴ There are 52 – 4 = 48 non- queen cards.

∴ 48*C*5 selections have no queen in them.

∴ 52*C*5 – 48*C*5 selections have at least one queen in them.

49. (c) : Since two particular cars are always selected, it means that 6 – 2 = 4 cars are selected out of the remaining 11 – 2 = 9 cars.

∴ Required number of ways = 9*C*4 = 

= 126.

50. (b) : Since two particular cars are never selected. It means that 6 cars are selected out of the remaining 11 – 2 = 9 cars.

∴ Required number of ways = 9*C*6

=  = 84.

51. (b) : A line requires 2 end points.

Hence, required number of lines

= 6*C*2 = 15

***Solution for questions 52 to 55:***

52. (d) : Number of ways of selection from 10 distinctly different pens of 1 set = 210

Since there are 2 sets, total selections are 210 × 210 = 220

Since atleast 1 has to be selected, total ways = 220 – 1.

53. (b) : If all pens are identical, then number of ways is 11.

Since there are 2 sets, there are 11 × 11 = 121 ways

Since atleast 1 has to selected, number of ways = 121 – 1 = 120 ways.

54. (b) : If we have to pick atleast 1 pen from each set, then –

From I set ⇒ 210 – 1

From II set ⇒ 210 – 1

∴ Total number of ways = (210 – 1)2

55. (b) : If atleast one has to selected from either of the sets, total ways are 10 × 10 = 100

The case of ‘0’ selection from each of the sets is not taken.

56. (b) : First letter can be posted in 4 ways.

Similarly, he can post 2nd, 3rd, 4th and 5th letter in any of the boxes *i.e*., in 4 ways.

So, total number of ways = 45

57. (d) : Total number of red balls = 6

Total number of green balls = 6

**Possible combinations are:**

|  |  |
| --- | --- |
| **Red** | **Green** |
| 2 | 3 |
| 3 | 2 |

∴ Required number of selections = 6*C*3 × 6*C*2 + 6*C*2 × 6*C*3

= 20 × 15 + 15 × 20 = 600

58. (a) : Form 2 wicket keepers only 1 is selected and this can be done in 2*C*1 ways and remaining 10 can be selected from remaining 14 players and that can be done in 14*C*10 so total number of ways is 2*C*1 × 14*C*10.

59. (c) :

I. ORDINATE contains 8 letters : 1, 2, 3, 4, 5, 6, 7, 8. 4 odd places, 4 vowels.

⇒ Number of arrangements of the vowels 4!. Also number of arranging consonants is 4!.

⇒ Number of words = 4! × 4! = (4 × 3 × 2 × 1)2 = 576.

II. When *O* is fixed we have only seven letters at our disposal ⇒ Number of words = 7! = 5040.

III. When we have only six letters at our disposal, leaving ‘*O*’ and ‘*E*’ which are fixed,

Number of permutations = 6! = 720.

60. (c) : There are 8 letters, 3 consonants and 5 vowels. So arrangement of 1st and last places can be made in 3*P*2 ways. Also the remaining 6 letters can be arranged in 6! ways.

⇒ The required number of words = 3*P*2 × 6! = 3 × 2 × 6! = 4320.

61. (a) : Number of ways of selecting men

= 6*C*3 = 

Number of ways of selecting women

= 5*C*2 = 

Number of ways = 20 × 10 = 200

62. (b) : The diagonal is obtained by joining two angular points which are 8 in number.

⇒ Number of line joining the two points = 8*C*2

= . But it includes 8 sides also as they too are obtained by joining two points.

⇒ Number of diagonals = 28 − 8 = 20

63. (d) : 3 points in a straight line form a triangle ⇒ Number of triangles = 6*C*3 = 

64. (c) : Sum = Number of numbers × Average of numbers

= 

= 

65. (b) : With 0, 1, 2, 3 we can form 4! = 24 numbers. But it includes the numbers in which 0 occurs in thousand’s place and they will be only of 3 digits. Such numbers will be 3! = 6.

⇒ (24 − 6) = 18 numbers can be formed which will be of four digits.

66. (a) : Every number between 3000 and 4000, which is divisible by five and which can be formed by the given digits, must contains 5 in unit’s place and 3 in thousand’s place. Thus, we are left with four digits out of which we are to place two between 3 and 5, which can be done in 4*P*2 = 12 ways. Hence, 12 numbers can be formed.

67. (a) : We have following cases:

|  |  |  |  |
| --- | --- | --- | --- |
| **Cases** | **Men** | **Women** | **No. of ways** |
| I | 8 | 4 | (8*C*8) (9*C*4) = 1 × 126 = 12 |
| II | 7 | 5 | (8*C*7) (9*C*5) = 8 × 126 = 1008 |
| III | 6 | 6 | (8*C*6) (9*C*6) = 28 × 84 = 2352 |
| IV | 5 | 7 | (8*C*5) (9*C*7) = 56 × 36 = 2016 |
| V | 4 | 8 | (8*C*4) (9*C*8) = 70 × 9 = 630 |
| VI | 3 | 9 | (8*C*3) (9*C*9) = 56 × 1 = 56 |

So,

I. At least five women number of ways = 1008 + 2352 + 2016 + 630 + 56 = 6062

II. When women are in majority = 2016 + 630 + 56 = 2702

III. When men are in majority = 126 + 1008 = 1134.

68. (a) : In this question we have 3 cases:

**Case I:** One black and two other then number of ways is (3*C*1)(6*C*2) = 45

**Case II:** Two black and one other then number of ways is

(3*C*2)(6*C*1) = 18

**Case III:** All the three are blacks, then number of ways is (3*C*3) = 1

Sum = 45 + 18 + 1 = 64

69. (a) : As per the given condition

*n* + 1*C*3 − *nC*3 = 10 or *nC*2 = 10 or *n* = 5

70. (b) : We have following cases in this question:

**Case I:** If one point is selected from each side then number of triangles is 3 × 4 × 5 = 60

**Case II:** If one point is selected from one side then number of ways is 3*C*2 (4 + 5) + 4*C*2 (3 + 5) + 5*C*2 (3 + 4)

= 27 + 48 + 70 = 145

So, total number of triangles is 60 + 145 = 205

71. (c) : Total number of characters are 6 + 4 = 10

6 signs of ‘+’ can be arranged in 1 way (They are identical) then they will create 7 gaps and we have to select 4 gaps out of these 7 gaps that can be done in 7*C*4 ways = 35 ways.

72. (c) : Since number of girls is 3 and that of boys is 7.

As per the given condition no two girls are together so 7 boys can be arranged in (7!) ways now this will create 8 separated places where girls can be arranged, and the number of ways for this 8*P*3 or 8 × 7 × 6 ways.

So, total number of ways is (6 × 7 × 8)(7!) = 42(8!)

73. (b) : If we tie two delegates together then this can be done in (2!) ways, now we have 19 distinct identities and that can be arranged around a circle in (18!) ways.

So, total number of ways is 2(18!).

74. (b) : Number of ‘*n*’ digit numbers formed by digits 2, 5, and 7 is 3*n* as per the given condition 3*n* > 900 so least value of *n* is 7.

75. (c) : The given word is COCHIN, if we arrange them in alphabetical order then C, C, H, I, N, O

Number of words starts with CC is 4! = 24

Number of words starts with CH is 4! = 24

Number of words starts with CI is 4! = 24

Number of words starts with CN is 4! = 24

Next word is the given word COCHIN.

So, required number is 24 × 4 = 96

76. (a) : Here we have two cases:

**Case I:** If digits are 1, 2, 3, 4 and 5 so number of 5 digit numbers formed is 5! = 120

**Case II:** If digits are 0, 1, 2, 4 and 5 so number of 5 digit numbers formed is 4(4!) = 96

So, total number of numbers is 120 + 96 = 216

77. (b) : Total number of ways is given by

35 − 3*C*1 × (3 − 1)5 + 3*C*2 (3 − 2)5

= 243 − 3 × 32 + 3 = 150

**Alternate Method:**

**Case I:** If distribution is done such that 5 = (1, 2, 2) then number of ways is



**Case II:** If distribution is done such that 5 = (1, 1, 3) then number of ways is



So, total number of ways is 90 + 60 = 150

78. (c) : Clearly, 30 candies can be distributed among 4 kids such that each kid can receive any number of candies.

Hence, total number of ways

= 30 + 4 − 1*C*4 − 1

= 33*C*3

= 

79. (d) : **Case I:** When no couple is chosen

We can choose 2 men in 4*C*2 = 6 ways and hence two teams can be formed in 2 × 6 = 12 ways.

**Case II:** When only one couple is chosen

A couple can be chosen 4*C*1 = 4 ways and the other team can be chosen in 3*C*1 × 2*C*1 = 6 ways. Hence, two teams can be formed in 4 × 6 = 24 ways.

**Case III:** When two couples are chosen

Then team can be chosen in 4*C*2 = 6 ways.

Hence, total ways = 12 + 24 + 6 = 42.

80. (a)

81. (b) :

I. 4*C*1 × 8*C*5 = 224

II. 12*C*6 − 8*C*6 = 896

***Solutions for questions 82 to 86:***

There will be as many ways of choosing 4 cards from 52 cards as there are combinations of 52 different things, taken 4 at a time. Therefore, the required number of ways

= 

82. (d) : There are four suits − diamond, club, spade, heart − each containing 13 cards. Therefore, there are 13*C*4 ways of choosing 4 diamonds. Similarly, there are 13*C*4 ways of choosing 4 clubs, 13*C*4 ways of choosing 4 spades and 13*C*4 ways of choosing 4 hearts.

Therefore, the required number of ways

= 

83. (a) : There are 13 cards in each suit. Therefore, there are 13*C*1 ways of choosing 1 card from 13 cards of diamond. 13*C*1 ways of choosing 1 card from 13 cards of heart, 13*C*1 ways of choosing 1 card from 13 cards of club, 13*C*1 ways of choosing 1 card from 13 cards of spade. Hence, by multiplication principle, the required number of ways

= 13*C*1 × 13*C*1 × 13*C*1 × 13*C*1 = 134

84. (b) : There are 12 face cards and 4 are to be selected out of these 12 cards. This can be done in 12*C*4 ways. Therefore, the required number of ways

= 

85. (a) : There are 26 red cards and 26 black cards. Therefore, the required number of ways

= 26*C*2 × 26*C*2 = 

= 

86. (d) : 4 red cards can be selected out of 26 red cards in 26*C*4 ways. 4 black cards can be selected out of 26 black cards in 26*C*4 ways. Therefore, the required number of ways  
= 26*C*4 + 26*C*4 = 

= 

87. (c) : when 18 identical red balls are put in straight line, there will be 19 spaces created. Thus, 16 blue balls will have 19 places to fill in. Therefore, the required number of ways

= 

= 19 × 3 × 17 = 969

(Since, the balls are identical, the arrangement is not important.)

88. (d) : Total possible numbers with the given digits

= 5 × 5 × 5 × (5 − 1) = 500

The number of natural number greater than 4300 which can be formed from the given digits

= 1 × 2 × 5 × 5 = 50

Hence, the required number of numbers = 500 − 50 = 450.

89. (a) : Number of ways of selecting any from one set of 5 different objects = 52.

Since, at least one has to be selected, so we, deduct one case where none of the objects from either set is selected,

Required number of ways = 210 − 1 = 1023.

90. (c) : Since the objects are identical, number of selection from one set = (5 + 1).

There are two sets, so the total number of selections = 6 × 6 = 36, one of these selections involves 0 selection from either of the sets, so, to find the at least one we deduct is as

The required number of ways = 36 − 1 = 35.

91. (d) : Here, we have to select at least one from each set of 5 different objects. Number of ways to select at least one from set 1 = 25 − 1 = 31.

Since, there are two sets, required number of ways = 31 × 31 = 961

92. (a) : Selecting at least one from each of the sets can be done as the required number of ways = 5 × 5 = 25.

93. (d) : The data is insufficient because we do not know if any of the 6 points between the lines are collinear with the points on the two lines, *i.e*. a point not on any of the two lines may be collinear with a point each on the other two lines.

94. (c) : Number of lines that can be formed = 20*C*2

Number of lines lost due to points being collinear = 10*C*2

Required number of lines = 20*C*2 − 10*C*2 + 1 = 146.

95. (d) : Number of triangles that can be formed = 20*C*3 − 10*C*3 = 1020.

96. (b)

97. (d) : (10*C*6 × 6*C*4 × 2*C*1) + (10*C*5 × 6*C*5 × 2*C*1) + (10*C*4 × 6*C*6 × 2*C*1) + (10*C*5 × 6*C*4 × 2*C*2) + (10*C*4 × 6*C*5 × 2*C*2) + (10*C*3 × 6*C*6 × 2*C*2) = 14904

98. (c) : Aryabhatt is selected, then Ramanujan cannot. Hence, there are 8*C*4 ways of selecting the team, *i.e*. 70 ways.

Similarly, if Ramanujan is selected, there are 70 ways. And if both are not selected, there are 8*C*5 = 56 ways.

Hence, total number of ways = 70 + 70 + 56 = 196

99. (b) : 42 people are expected to come to the big party.

Each table has 6 chairs, so there are a total of (6 + 1) × 4 = 28 legs at each table.

196 legs ÷ 28 legs at each table = 7 tables

Therefore, 7 × 6 = 42 guests are expected to come to the party.

100. (d) : Three cases: 1*W* + 6*M* , 2*W* + 5*M*, 3*W* + 4*M*,

*i.e*. 9*C*6 × 6*C*1 + 9*C*5 × 6*C*2 + 9*C*4 × 6*C*3 = 4914

101. (b) : Out of 5 girls, 3 girls can be invited in 5*C*3 ways. Nothing is mentioned about the number of boys that he has to invite. He can invite 1, 2, 3, 4, or even no boys. Out of 4 boys, he can invite them in the said manner in (2)4 ways. Thus, the total number of ways is:

5*C*3 × (2)4 = 10 × 16 = 160

102. (d) : To construct 2 roads, three towns can be selected out of 4 in 4 × 3 × 2 = 24 ways. Now, if the third road goes from the third town to the first town, a triangle is formed and if it goes to the fourth town, a triangle is not formed. So, there are 24 ways to form a triangle and 24 ways of avoiding a triangle.

**Solution Exercise – Difficult**

1. (a) : Assuming Adani, Tatas and Bildas as a single personality, then there are total (10 – 3) + 1 = 8 person, which can be arranged in 7! ways.

Also Adani and Bildas can be multually permuted in 2 ways.

Therefore required number of arrangements = 2 × 7! = 10080

2. (a) : Akshay can have only male dancer as his neighbours which can be mutually arranged in 2! ways.

Similarly Mansi can have only female dancer as her neighbours which can be arranged in 2! ways.

Hence, the required number of arrangements = 2! × 2! = 4

3. (d) : If *n* is even, *nCr* is maximum when r = 

Number of invites in a party == 4

⇒ Maximum possible number of parties = 8*C*4 = 70

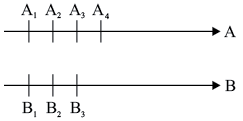
4. (b) : If *n* is odd, *nCr* is maximum when *r* = 

or r = 

⇒ *r* =  = 5 or *r* == 6

⇒ 11*C*5 = 11*C*6 = 462

5. (b) : Since 4 friends desire to sit on one side and the other 3 friends desire to sit on the other side.



Hence, we are left with 11 friends only out of which we choose 5 friends for the side *A* in 11*C*5 ways and remaining 6 friends can be selected for the side *B* in 6*C*6 ways.

Further in each side 9 friends can be arranged in 9! ways.

Hence, the required number of arrangements = 11*C*5 × 6*C*6 × 9! × 9! = 462 × (9!)2

6. (b) :



For *H*1, 9 different tickets available, one for each of the remaining 9 stations; similarly at *H*2, 8 different tickets are available; and so on.

⇒ Hence it is clear, that total number of different tickets = 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 45.

Hence, the six different tickets must be any six of these 45; and there are evidently as many different sets of 6 tickets as there are combinations of 45 things taken 6 at a time.

Hence, the required number = 45*C*6 = 8145060.

7. (b) : Considering *CC* as single object, *U*, *CC*, *E* can be arranged in 3! ways

\_ *U* \_ *CC* \_ *E* \_

Now the three S are to be placed in the four available places.

Hence, required no. of ways = 3! × 4*C*3 = 24.

8. (b) : Let us first find the words in which no two *S* are together.

Arrange the remaining letters =  = 12 ways

\_ *U \_ C \_ C \_ E* \_

Now there are five available places for three *SSS*.

Hence, total number of ways no two *S* together = 12 × 5*C*3 = 120

Hence, number of words having *CC* separated and *SSS* separated = 120 – 24 = 96.

9. (c) :

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 1 | 1 | 3 |

Total ways = 5*C*1 × 5*C* × 5*C* = 250 ways.

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 1 | 2 | 2 |

Total ways = 5*C*1 × 5*C*2 × 5*C* = 500 ways

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 1 | 3 | 1 |

Total ways = 5*C*1 × 5*C*3 × 5*C* = 250 ways

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 2 | 2 | 1 |

Total ways = 5*C*2 × 5*C* × 5*C* = 500 ways

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 3 | 1 | 1 |

Total ways = 5*C*3 × 5*C*1 × 5*C*1 = 250 ways

Total ways = 250 + 500 + 250 + 500 + 500 + 250 = 2250

10. (c) : Here, places for *A*, *B* and *C* can be chosen in 15*C*3 ways. Now, 12 persons remain to speak and these 12 persons can speak in 12! ways. Hence, number of way in which they can speack is 15*C*3 × 12!.

11. (b) : If we distribute 12 different pens equally among 4 persons then each person will get 3 pens. Hence, required number of distribution is =.

12. (c) : If we divide 12 different sweets equally among 4 groups then each groups contains 3 sweets. Hence, required number of ways is given by =.

13. (b) : 

As I & III digit are equal, place can be filled in 9 ways IInd place can be filled in 10 ways.

Number of words = 9 × 10 = 90

14. (d) : Total numbers (using digits 0 to 9) = 900 1000 1000 = 9 × 10 × 10 = 900

Words with none of their digit as 8 8 9 9 = 8 × 9 × 9 = 648

Numbers with atleast one digit as 8 = 900 – 648 = 252

15. (b) :



If letter 2 is in correct-envelope then for letter 1 to be wrong, there are 3 choices. Similarly for letters 3, there are 34.

So, total ways are = 3 × 3 × 3 × 3 = 81

16. (a) : 9 letters: 1 ‘*M*’: 1 ‘*O*’ ; 1 ‘*R*’ ; 3 ‘*A*’ ; 1 ‘*B*’ ; 2 ‘*D*’, *i.e*. 6 different letters.

|  |  |  |
| --- | --- | --- |
| **Group can be formed as** | **No. of Groups** | **No. of words** |
| All the 4 different | 6C4 = 15 | 15 × 4! = 24 × 15 = 360 |
| 2 alike and 2 different | 2*C*1 × 5*C*2 = 20 | 20 × 4!/2! = 240 |
| 3 alike and 1 different | 1 × 5*C*1 = 5 | 5 × 4!/3! = 20 |
| 2 alike of one kind and two alike of other | 2*C*2 = 1 |  |
| **Total** | **= 41** | **= 626** |

17. (c) : The three clues can have 3 alternatives each ; so each of them can be filled in three different ways and when associated together, the three can be filled in 33 = 27 ways ; similarly others which have 2 alternatives each can be filled in 24 = 16 ways. thus, when associated together the seven clues can be filled in 16 × 27 = 432 ways which include the correct answer. So, he should send 432 solutions.

18. (c) : Required number of rectangle is

(*mC*1) (*mC*1) (*nC*1) (*mC*1) = *m*2 *n*2

19. (a) : This is question of De-arrangement so required number of ways is



20. (d) : Since, *a + b + c + d* = 29 ..... (1)

and *a, b, c* and *d* are integers

∴ *a* ≥ 1, *b* ≥ 2, *c* ≥ 3, *d* ≥ 0

⇒ *a* − 1 ≥ 0, *b* − 2 ≥ 0, *c* − 3 ≥ 0, *d* ≥ 0

let *a*1 = *a* − 1, *a*2 = *b* − 2, *a*3 = *c* − 3

or *a* = *a*1 + 1, *b* = *a*2 + 2, *c* = *a*3 + 3 and then *a*1 ≥ 0, *a*2 ≥ 0, *a*3 ≥ 0, *d* ≥ 0

From (1),

*a*1 + 1 + *a*2 + 2 + *a*3 + 3 + *d* = 29

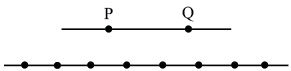
⇒ *a*1 + *a*2 + *a*3 + *d* = 23

Hence, total number of solutions = 23 + 4 − 1*C*4 − 1

= 26*C*3 = 

***Solutions for questions 21 and 22:***

Let *L*1 and *L*2 has two points *P* and *Q*, ∆ *L*2 has 8 points.



21. (c) : Now for a triangle, we can choose 1 point from *L*1 and 2 points from *L*2 or 2 points from *L*1 and 1 point from *L*1 in

2*C*1 × 8*C*2 + 2*C*2 × 8*C*1 = 

= 2 × 28 + 8

= 64

22. (c) : If the triangle include the point *P* and exclude the point *Q* then 2 other points are to be taken from the 8 points on *L*2 in

1*C*1 × 8*C*2 = 28 ways

Hence, in this cases required number of triangles formed = 28.

23. (d) : Any single male will have 13 + 7 = 20 options.

∴ Total number of handshakes by single males

= 5 × 20 = 100

Any married man will have 12 + 7 = 19 options.

∴ Total number of handshakes by married men

= 19 × 13 = 247

∴ Total number of handshakes = 247 + 100 = 347

**Alternate Method:**

Number of males = 13 + 5 = 18

Number of females = 13 + 7 = 20

⇒ Number of handshakes = 18 × 20 − 13 = 347

Because 13 couples do not shake hands mutually.

24. (b)

25. (b) : There are 33 stations where the train has to stop.

∴ Remaining stations, *i.e*. (719 − 33) = 686 would be the routes arranged in 686*C*33 ways.

But the train from where it starts or any station from where it starts would be counted as station on the third stoppage, leaving the second stoppages not to be counted.

∴ Number of ways = 685*C*33

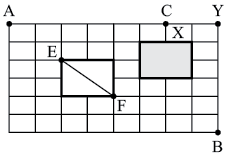
26. (a) : For a train with *m* stations and *n* stops, the train cannot stop the two consecutive stations, the number of ways of choosing the stoppages is *m − n* + 1*Cn*. Hence, 667*C*32.

27. (b) : The answer should be 6*C*3 × 4*C*2 × 5! × 5!

28. (b) : The answer would be

b. 6*C*3 × 4*C*2 × (3!)2 (2!)2

29. (d) :



To follow the shortest route, Neelam will follow the following path

*A → E → F → B*

Number of ways to reach from *A* to *E*

= 

Number of ways to reach from *E* to *F* = 1

Number of ways to reach from *F* to *B*

= 

∴ Total number of possible shortest paths

= 6 × 1 × 15 = 90

30. (a) : Neelam has to reach *C* via *B*.

From *A* to *B*, the number of paths are 90.

From *B* to *C*, Neelam can take following routes.

I. *B → X → C* or

II. *B → Y → C*

Number of ways of reach from *B* to *X*.

Number of ways to reach from *X* to *C* is 2.

II. *B → Y → C*

From *B* to *Y* there is only one way.

From *B* to *C* number of ways = 6 × 2 + 1 = 13 ways

⇒ Total number of ways of reaching from *A* to *C* via *B*

= 90 × 13 = 1170

31. (a) : Keeping one digit in fixed position, other four can be arranged in 4! ways = 24 ways. Thus, each of the 5 digits will occur in each of five places 4! times. Hence, the sum of digits in each position is 24 (1 + 3 + 5 + 7 + 9) = 600. So, the sum of all numbers

= 600 (1 + 10 + 100 + 1000 + 10000) = 6666600.