Chapter 4

Permutation, Combination & Probability

1. A student has 60% chance of passing in English and 54% chance of passing in both English and Mathematics. What is the percentage probability that he will fail in Mathematics? *[1995]*

(a) 12 (b) 36
(c) 4 (d) 10

2. A table has three drawers. It is known that one of the drawers contains two silver coins, another contains two gold coins and the third one contains a silver coin and gold coin. One of the drawers is opened at random and a coin is drawn. It is found to be a silver coin. What is the probability that the other coin in the drawer is a gold coin? *[1995]*

(a) 0.25 (b) 1.00
(c) 0.50 (d) 0.60

3. X and Y are two variables whose values at Y time are related to each other as shown in Fig. (i). X is known to vary periodically with reference to time as shown in Fig. (ii)

Figure (i)

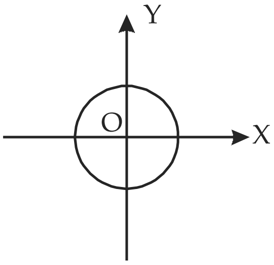
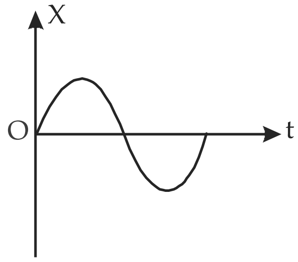
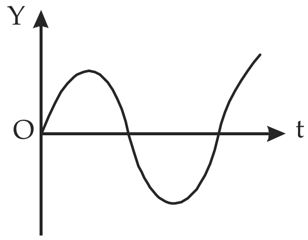


Figure (ii)

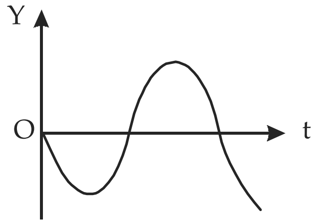


Which of the following curves depicts correctly the dependence of Y on time? *[1995]*

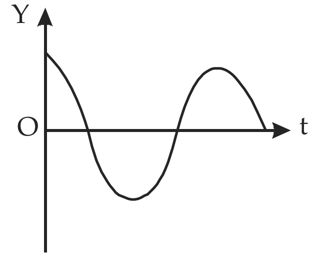
(a)



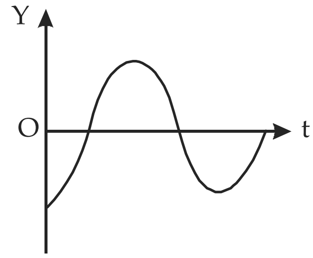
(b)



(c)



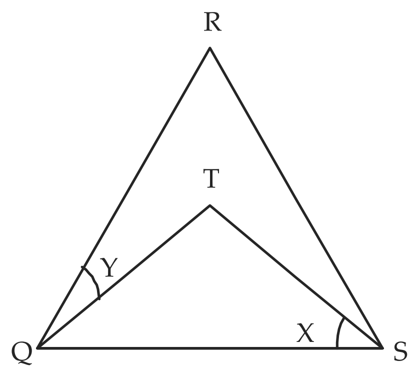
(d)



4. Two packs of cards are thoroughly mixed and shuffled and two cards are drawn at random, one after the other. What is the probability that both of them are jacks? *[1996]*

(a) 1/13 (b) 2/13
(c) 7/1339 (d) 1/169

5. In the given figure, if QRS is an equilateral triangle and TQS is an isosceles triangle and $x = 47°$, then the value of y (in degrees) will be *[1997]*



(a) 13° (b) 23°
(c) 33° (d) 33°

6. When three coins are tossed together, the probability that all coins have the same face up, is [1997]
(a) $\frac{1}{3}$ (b) $\frac{1}{6}$
(c) $\frac{1}{8}$ (d) $\frac{1}{12}$

7. In a factory quality assurance test is conducted on various samples for a specific characteristic value of the product. The values and the number of samples are as given in the following table: [1999]

Characteristic value, *X*	No. of Samples
10	3
11	7
12	10
13	15
14	28
15	33
16	24
17	11
18	10
19	6
20	3

Consider the following statements based on the table:
1. The probability that $X \le 15$ is 0.64
2. The probability that $13 < X \le 17$ is greater than 0.64
3. The probability that X = 15 is less than 0.22

Which of the above statements is/are not true?
(a) 1 alone (b) 1 and 2
(c) 2 and 3 (d) 1, 2 and 3

8. A bag contains 20 balls, 8 balls are green, 7 are white and 5 are red. What is minimum number of balls that must be picked up from the bag blind-folded (without replacing any of it) to be assured of picking atleast one ball of each colour? [2000]
(a) 4 (b) 7
(c) 11 (d) 16

9. A complete cycle of a traffic light takes 60 seconds. During each cycle the light is green for 25 seconds, yellow for 5 seconds and red for 30 seconds. At a randomly chosen time, the probability that the light will not be green, is [2002]
(a) 1/3 (b) 1/4
(c) 5/12 (d) 7/12

10. Three flags, each of different colour, are available for a military exercise. Using these flags, different codes can be generated by waving [2003]
(i) single flag of different colours or
(ii) any two flags in a different sequence of colour

Or

(iii) three flags in a different sequence of colours. The maximum number of codes that can be generated, is
(a) 6 (b) 9
(c) 15 (d) 18

11. A two member committee comprising of one male and one female member is to be constituted out of five males and three females. Amongst the females, Mrs. *A* refused to be a member of the committee in which Mr. *B* is taken as the member. In how many different ways can the committee be constituted? [2003]
(a) 11 (b) 12
(c) 13 (d) 14

12. In a question of a test paper, there are five items each under List-A and List-B. The examinees are required to match each item under List-A with its corresponding correct item under List-B. Further, it is given that
(i) no examinee has given the correct answer.
(ii) answers of no two examinees are identical

Which is the maximum number of examinees who took this test? [2004]
(a) 24 (b) 26
(c) 119 (d) 129

13. Nine different letters are to be dropped in three different letter boxes. In how many different ways can this be done? [2004]
(a) 27 (b) 3^9
(c) 9^2 (d) $3^9 - 3$

14. In how many different ways can six players be arranged in a line such that two of them, Ajit and Mukherjee, are never together? [2004]
(a) 120 (b) 240
(c) 360 (d) 480

15. Three students are picked at random from a school having a total of 1000 students. The probability that these three students will have identical date and month of their birth, is [2004]
(a) $\frac{3}{1000}$ (b) $\frac{3}{365}$
(c) $\frac{1}{(365)^2}$ (d) None of these

16. On a railway route between two places A and B, there are 20 stations on the way. If 4 new stations are to be added, how many types of new tickets will be required if each ticket is issued for a one way journey? [2005]
(a) 14 (b) 48
(c) 96 (d) 108

17. 2 men and 1 women board a bus in which 5 seats are vacant. One of these five seats is reserved for ladies. A women may or may not sit on the seat reserved for ladies but a man can not sit on the seat reserved for ladies. In how many different ways can the five seats occupied by these passengers? [2005]
(a) 15 (b) 36
(c) 48 (d) 60

18. A square is divided into 9 identical smaller squares. Six identical balls are to be placed in these smaller square such that each of the three rows gets at least one ball (one ball in one square only). In how many different ways can this be done? *[2005]*

(a) 27 (b) 36
(c) 54 (d) 81

19. There are 10 identical coins and each one of them has '*H*' engraved on its one face and '*T*' engraved on its other face. These 10 coins are lying on a table and each one of them has '*H*' face as the upper face.

In one attempt, exactly four (neither more nor less) coins can be turned upside down. What is the minimum total number of attempts in which the '*T*' faces of all the 10 coins can be brought to be the upper faces? *[2005]*

(a) 4 (b) 7
(c) 8 (d) Not possible

20. Ten identical particles are moving randomly inside a closed box. What is the probability that at any given point of time all the ten particles will be lying in the same half of the box? *[2005]*

(a) $\frac{1}{2}$ (b) $\frac{1}{5}$
(c) $\frac{1}{2^9}$ (d) $\frac{2}{11}$

21. Each of two women and three men is to occupy one chair out of eight chairs, each of which numbered from 1 to 8. First, women are to occupy any two chairs from those numbered 1 to 4; and then the three men would occupy any, three chairs out of the remaining six chairs. What is the maximum number of different ways in which this can be done? *[2006]*

(a) 40 (b) 132
(c) 1440 (d) 3660

22. In a tournament, each of the participants was to play one match against each of the other participants. Three players fell ill after each of them had played three matches and had to leave the tournament. What was the total number of participants at the beginning, if the total number of matches played was 75? *[2006]*

(a) 08 (b) 10
(c) 12 (d) 15

23. There are three parallel straight lines. Two points, 'A' and 'B', are marked on the first line, points, 'C' and 'D' are marked on the second line; and points, 'E' and 'F', are marked on the third line. Each of these 6 points can move to any position on its respective straight line. *[2006]*

Consider the following statements:

1. The maximum number of triangles that can be drawn by joining these points is 18.
2. The minimum number of triangles that can be drawn by joining these points is zero.

Which of the statement(s) given above is/are correct?

(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

24. A mixed doubles tennis game is to be played between two teams (each team consists of one male and one female.) There are four married couples. No team is to consist of a husband and his wife. What is the maximum number of games that can be played? *[2006]*

(a) 12 (b) 21
(c) 36 (d) 42

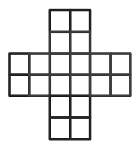
25. 3 digits are chosen at random from 1,2,3,4,5,6,7,8 and 9 without repeating any digit. What is the probability that their product is odd? *[2006]*

(a) 2/3 (b) 5/108
(c) 5/42 (d) 8/42

26. In a question paper, there are four multiple choice type questions. Each question has five choices with only one choice for its correct answer. What is the total number of ways in which a candidate will not get all the four answers correct? *[2006]*

(a) 19 (b) 120
(c) 624 (d) 1024

27. Each of eight identical balls is to be placed in the squares shown in the figures given below in a horizontal direction such that one horizontal row contains six balls and the other horizontal row contains two balls. In how many maximum different ways can this be done? *[2006]*

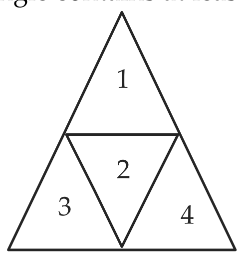


(a) 38 (b) 28
(c) 16 (d) 14

28. Each of the 3 persons is to be given some identical items such that product of the numbers of items received by each of the three persons is equal to 30. In how many maximum different ways can this distribution be done? *[2007]*

(a) 21 (b) 24
(c) 27 (d) 33

29. In the figure shown below, what is the maximum number of different ways in which 8 identical balls can be placed in the small triangles 1, 2, 3 and 4 such that each triangle contains at least one ball? *[2007]*



(a) 32 (b) 35
(c) 44 (d) 56

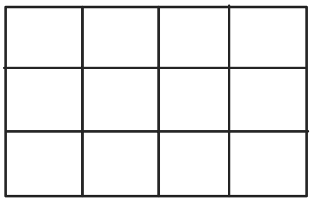
30. Amit has five friends: 3 girls and 2 boys. Amit's wife also has 5 friends: 3 boys and 2 girls. In how many maximum number of different ways can they invite 2 boys and 2 girls such that two of them are Amit's friends and two are his wife's? *[2007]*
(a) 24 (b) 38
(c) 46 (d) 58

31. Five balls of different colours are to be placed in three different boxes such that any box contains at least one ball. What is the maximum number of different ways in which this can be done? *[2007]*
(a) 90 (b) 120
(c) 150 (d) 180

32. All the six letters of the name SACHIN are arranged to form different words without repeating any letter in any one word. The words so formed are then arranged as in a dictionary. What will be the position of the word SACHIN in that sequence? *[2007]*
(a) 436 (b) 590
(c) 601 (d) 751

33. Three dice (each having six faces with each face having one number from 1 to 6) are rolled. What is the number of possible outcomes such that at least one dice shows the number 2? *[2007]*
(a) 36 (b) 81
(c) 91 (d) 116

34. In how many maximum different ways can 3 identical balls be placed in the 12 squares (each ball to be placed in the exact centre of the squares and only one ball is to be placed in one square) shown in the figure given below such that they do not lie along the same straight line? *[2007]*



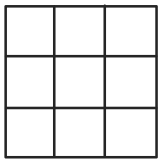
(a) 144 (b) 200
(c) 204 (d) 216

35. Groups each containing 3 boys are to be formed out of 5 boys - A, B,C, D and E such that no one group contains both C and D together. What is the maximum number of such different groups? *[2007]*
(a) 5 (b) 6
(c) 7 (d) 8

36. In how many different ways can four books A, B, C and D be arranged one above another in a vertical order such that the books A and B are never in continuous position? *[2008]*
(a) 9 (b) 12
(c) 14 (d) 18

37. A schoolteacher has to select the maximum possible number of different groups of 3 students out of a total of 6 students. In how many groups any particular student will be included? *[2008]*
(a) 6 (b) 8
(c) 10 (d) 12

38. In how many different ways can all of 5 identical balls be placed in the cells shown below such that each row contains at least 1 ball? *[2008]*



(a) 64 (b) 81
(c) 84 (d) 108

39. There are 6 different letters and 6 correspondingly addressed envelopes. If the letters are randomly put in the envelopes, what is the probability that exactly 5 letters go into the correctly addressed envelopes? *[2008]*
(a) Zero (b) 1/6
(c) $\frac{1}{2}$ (d) 5/6

40. There are two identical red, two identical black and two identical white balls. In how many different ways can the balls be placed in the cells (each cell to contain one ball) shown below such that balls of the same colour do not occupy any two consecutive cells? *[2008]*

(a) 15 (b) 18
(c) 24 (d) 30

41. A person has 4 coins each of different denomination. What is the number of different sums of money the person can form (using one or more coins at a time)? *[2009]*
(a) 16 (b) 15
(c) 12 (d) 11

42. How many numbers lie between 300 and 500 in which 4 comes only one time? *[2009]*
(a) 99 (b) 100
(c) 110 (d) 120

43. How many three-digit numbers can be generated from 1, 2, 3, 4, 5, 6, 7, 8, 9 such that the digits are in ascending order? *[2009]*
(a) 80 (b) 81
(c) 83 (d) 84

44. In a carrom board game competition, m boys and n girls ($m > n > 1$) of a school participate in which every student has to play exactly one game with every other student. Out of the total games played, it was found that in 221 games one player was a boy and the other player was a girl. *[2009]*
Consider the following statements:
1. The total number of students that participated in the competition is 30.
2. The number of games in which both players were girls is 78.

Which of the statements given above is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

45. A question paper had ten questions. Each question could only be answered as True (T) or False (F). Each candidate answered all the questions. Yet, no two candidates wrote the answers in an identical sequence. How many different sequences of answers are possible? *[2010]*
(a) 20 (b) 40
(c) 512 (d) 1024

46. When ten persons shake hands with one another, in how many ways is it possible? *[2010]*
(a) 20 (b) 25
(c) 40 (d) 45

47. In how many ways can four children be made to stand in a line such that two of them, A and B are always together? *[2010]*
(a) 6 (b) 12
(c) 18 (d) 24

48. A group of 630 children is seated in rows for a group photo session. Each row contains three less children than the row in front of it.Which one of the following number of rows is ***not*** possible ? *[2014 - II]*
(a) 3 (b) 4
(c) 5 (d) 6

49. Twelve people form a club. By picking lots, one of them will host a dinner for all once in a month. The number of dinners a particular member has to host in one year is *[2015-II]*
(a) One (b) Zero
(c) Three (d) Cannot be predicted

50. There are 5 tasks and 5 persons. Task-l cannot be assigned to either person-l or person-2. Task-2 must be assigned to either person-3 or person-4. Every person is to be assigned one task. In how many ways can the assignment be done? *[2015-II]*
(a) 6 (b) 12
(c) 24 (d) 144

51. In a society it is customary for friends of the same sex to hug and for friends of opposite sex to shake hands when they meet. A group of friends met in a party and there were 24 handshakes.
Which one among the following numbers indicates the possible number of hugs? *[2015-II]*
(a) 39 (b) 30
(c) 21 (d) 20

52. In a box of marbles, there are three less white marbles than the red ones and five more white marbles than the green ones. If there are a total of 10 white marbles, how many marbles are there in the box? *[2015-II]*
(a) 26 (b) 28
(c) 32 (d) 36

53. A selection is to be made for one post of Principal and two posts of Vice-Principal. Amongst the six candidates called for the interview, only two are eligible for the post of Principal while they all are eligible for the post of Vice-Principal. The number of possible combinations of selectees is *[2015-II]*
(a) 4 (b) 12
(c) 18 (d) None of the above

54. A student has to opt for 2 subjects out of 5 subjects for a course, namely, Commerce, Economics, Statistics, Mathematics I and Mathematics II. Mathematics II can be offered only if Mathematics I is also opted. The number of different combinations of two subjects which can be opted is *[2015-II]*
(a) 5 (b) 6
(c) 7 (d) 8

55. A person ordered 5 pairs of black socks and some pairs of brown socks. The price of a black pair was thrice that of a brown pair. While preparing the bill, the bill clerk interchanged the number of black and brown pairs by mistake which increased the bill by 100%. What was the number of pairs of brown socks in the original order? *[2015-II]*
(a) 10 (b) 15
(c) 20 (d) 25

56. The number of persons who read magazine X only is thrice the number of persons who read magazine Y. The number of persons who read magazine Y only is thrice the number of persons who read magazine X. Then, which of the following conclusions can be drawn? *[2015-II]*
1. The number of persons who read both the magazines is twice the number of persons who read only magazine X.
2. The total number of persons who read either one magazine or both the magazines is twice the number of persons who read both the magazines.

Select the correct answer using the code given below:
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

HINTS & SOLUTIONS

1. **(d)** $P(E)$ = Probability of passing in English = 0.6

$P(E \cap M)$ = Probability of passing in Maths and English = 0.54

$P(M)$ = Probability of passing in Maths

Since, $P(M)$ and $P(E)$, both are independent events.

So, $P(E \cap M) = P(E) \times P(M)$

$$P(M) = P(E \cap M)/P(E) = \frac{0.54}{0.6} = 0.9$$

$\therefore$ Probability of failing in Maths = 1 – 0.9 = 0.1 = 10%

2. **(c)** For finding the silver coin, only drawer 1 and 3 remains in consideration, because the open drawer in any case cannot be the drawer that have only gold coins. Now the probability of next coin being a gold coin = 1/2.

3. **(c)** Let the radius of the circle be unity

Equation of the circle, $x^2 + y^2 = 1$

$$y = \sqrt{1-x^2} \quad .....(i)$$

and, $$x = \sin t \quad .... (ii)$$

From (i) and (ii), $$y = \sqrt{1-\sin^2 t} = \cos t$$

Now, option (c) is the graph of $y = \cos t$.

4. **(c)** Total number of cards = 104 = 2 × 52

and total number of jacks = 8 = 2 × 4

$\therefore$ Probability for the jack in first draw = $\frac{8}{104}$

and probability for the jack in second draw = $\frac{7}{103}$

Since both the events are independent events.

Hence the probability that both of them are jacks.

$$= \frac{8}{104} \times \frac{7}{103} = \frac{7}{1339}$$

5. **(a)** As ΔTQS is an isosceles triangle.

$\therefore \angle TSQ = \angle TQS = 47°$

Now, in equilateral triangle ΔQRS,

$\angle RQS = \angle RSQ = \angle QRS = 60°$

Now, $\angle RQS = \angle RQT + \angle TQS = 60°$

$\angle RQT = Y = 60° - 47° = 13°$

6. **(c)** Probability of Head or Tail on the upper side for a coin

$= \frac{1}{2}$

$\therefore$ Probability of same side on the upper side for the three coins $= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$

7. **(c)** Number of samples = 150

So probability $(P) = \frac{\text{Number of samples for } (X)}{\text{Total number of samples (150)}}$

When we consider the given statements

(1) $P(X \le 15) = \frac{3+7+10+15+28+33}{150} = \frac{96}{150} = 0.64$

(2) $P(13 < X \le 17) = \frac{28+33+24+11}{150} = \frac{96}{150} = 0.64$

(3) $P(X = 15) = \frac{33}{150} = 0.22$

8. **(d)** Since, 8 Green balls + 7 White balls = 15 balls

7 White balls + 5 Red balls = 12 balls

and 8 Green balls + 5 Red balls = 13 balls

Now, if we pick 15 balls, they may be white, green or red but if we pick 16 balls, then its certain that there will be atleast one ball of each colour.

9. **(d)** Probability that the light is not green

$= \frac{\text{time for which light is not green}}{\text{time taken for the entire cycle}}$

$= \frac{(5+30)}{60} = \frac{35}{60} = \frac{7}{12}$

10. **(c)**

(i) Number of ways of arranging three colours taken 1 at a time = ${}^3P_1 = \frac{3 \times 2!}{2!} = 3$

(ii) Number of ways of arranging three colours taken 2 at a time = ${}^3P_2 = \frac{3!}{1!} = 6$

(iii) Number of ways of arranging three colours taken 3 at a time = ${}^3P_3 = 6$

Hence, Maximum no. of codes = No. of ways of arranging these flags = 3 + 6 + 6 = 15

11. **(d)** For each combination, let us name the females and males

Female (3)	***Male (5)***
A	B
C	D
E	F
	G
	H

Since *A* can't go with *B*, it will make team with four males in four ways *AD*, *AF*, *AG*, *AH*. Since there is no restriction with female *C* and *E*, they may combine with 5 males in 5 different ways each.

Total number of ways = 4 + 5 + 5 = 14

12. **(c)** Since, answers of no. two examinees are identical, so first item in List-A can be matched with any of the 5 items in List-B. It can be done in 5 ways. Similarly, 2nd item in List-A can be matched with any of the remaining 4 items in List-B. It can be done in 4 ways. Continuing in the same way,

No of ways of arranging the items = 5 × 4 × 3 × 2 × 1=120

Now, in this arrangement there is one such arrangement, which is the correct answer.

$\therefore$ Maximum number of examinees = no. of ways of arrangement of items = 120 – 1 = 119

13. **(b)** First letter can be dropped into any of the 3 boxes. It can be done in 3 ways. Similarly second letter can also be dropped into any of the 3 boxes in 3 ways and so on. Hence, total no of ways = 3×3×3×.........upto 9 times = 3^9

14. **(d)** Total no of ways of arrangement for six players = 6!
Let us take Ajit and Mukerjee as one entity.
So now there are (6 – 2 + 1) = 5 players
These 5 players can be arranged in 5! ways and Ajit and Mukerjee can be arranged among themselves in 2! ways.
Thus, no of ways, when Ajit and Mukerjee are always together = 5 ! × 2!
Hence, no of ways when they are never together = Total no of ways – no of ways when they are always together

$= 6! - (5! \times 2!) = 6 \times 5! - (5! \times 2!) = 5!(6-2) = 480$

15. **(c)** For 1st student, Probability of selecting any one day as his birthday $= \frac{365}{365} = 1$
Now, the remaining two students to be selected must have same day as their birthday as for the 1st student.
Probability of rest two students, having the same birthday as that of the 1st student $= \frac{1}{365} \times \frac{1}{365}$

Hence, required probability $= 1 \times \frac{1}{(365)^2} = \frac{1}{(365)^2}$

16. **(d)** For $(10 + A + B) = 12$ stations, no of tickets required, when 4 new stations are added for one way journey = 12 × 4 = 48
Also, each 4 new stations require (16 – 1) = 15 new tickets for one way journey.
∴ No. of tickets for 4 new stations = 15 × 4 = 60
Hence, total new tickets = 60 + 48 = 108

17. **(b)** There can be two cases :
(i) Lady occupies the reserved seat
(ii) Lady does not occupy the reserved seat.
(i) □□□□□→ Lady
Fixing one seat for the lady, 1st man can occupy any of the remaining 4 seats in four ways and the 2nd man occupy any of the remaining 3 seats in three ways.
Hence, no of ways = 1 × 4 × 3 = 12
(ii) □□□□□
Leaving the reserved seat, 1st man can occupy any of the 4 seats in four ways. 2nd man can occupy any of the remaining 3 seats in three ways. Lady can occupy any of the remaining 2 seats in two ways.
Hence, no of ways = 4 × 3 × 2 = 24
Thus, Total no of ways = 12 + 24 = 36

18. **(d)** Total number of ways in which 9 balls occupy any of the 6 squares $= {}^9C_6 = 84$
Number of ways in which one row is not filled = 3
∴ Number of ways in which at least one ball occupies each row = 84 – 3 = 81

19. **(a)** On the first attempt four coins are overturned. Now, six coins are left.
In the next turn, four more are overturned. Now only two would be left. We take one more from the left over two coins and any three from the previously turned ones. Finally, the leftover coin and the three coins from the presiding step which have already been turned twice can be overturned. Thus, in four attempts, one can complete the process.

20. **(c)** Probability of a particle lying in any particular half $= \frac{1}{2}$
∴ Probability of all 10 particles lying in either 1st half or 2nd half $= \left(\frac{1}{2}\right)^{10} + \left(\frac{1}{2}\right)^{10} = 2\left(\frac{1}{2}\right)^{10} = \frac{1}{2^9}$

21. **(c)** 2 Women can occupy 2 chairs out of the first four chairs in ${}^4P_2$ ways. 3 men can be arranged in the remaining 6 chairs in ${}^6P_3$ ways.
Hence, total no. of ways $= {}^4P_2 \times {}^6P_3 = 1440$

22. **(d)** Let the total no. of participants be 'n' at the beginning.
Players remaining after sometime = $n - 3$
Now, ${}^{n-3}C_2 + (3 \times 3) = 75$

$\frac{(n-3)!}{2!(n-5)!} + 9 = 75$

$n^2 - 7n - 120 = 0$
$(n + 8)(n - 15) = 0$
neglecting $n = -8$, $n = 15$

23. **(b)** Maximum number of triangles can be formed by selecting 3, 4 or 5 points out of 6 at a time.
So, maximum no. of triangles $= {}^6C_3 + {}^6C_4 + {}^6C_5$ which is clearly more than 18. Now, triangles formed will be minimum i.e., zero, when the points will overlap on the same line and all the points are along the same vertical line.

24. **(d)** Married couples: MF MF MF MF
a<u>b</u>, c<u>d</u>, e<u>f</u>, g<u>h</u>

Possible teams: ad cb eb gb
af cf ed gd
ah ch eh gf

Now, team ad can play only with: cb, cg, ch, eb, eh, gb, gf, i.e. 7
The same will apply with all teams.
So no. of total match = 12 × 7 = 84
Since every match includes 2 teams, so the No. of matches = 84/2 = 42

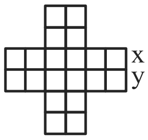
25. **(c)** Let E be the event of selecting the three numbers such that their product is odd and S be the sample space.
For the product to be odd, 3 numbers choosen must be odd.

∴ $n(E) = {}^5C_3$
$n(S) = {}^9C_3$

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{{}^5C_3}{{}^9C_3} = \frac{5}{42}$

26. **(c)** Since, every question has five options, so no. of choices for each question = 5
$\therefore$ total no. of choices = 5 × 5 × 5 × 5 = 625
Now, no. of choices of all correct answer = 1
Hence, no of choices for all the four answers not correct = total no. of choices – no. of choices of all correct answer = 625 – 1 = 624

27. **(a)**



There can be two cases:
Case (I) : When x row contains 6 balls:
Then the 2 balls can be arranged in y row in $^6P_2$ ways = 15 or the 2 balls can be arranged in any of the 4 two box row in 4 ways.
So, no of ways, when x contains 6 balls = 15 + 4 = 19.
Case (II) : Similarly, no. of ways, when y row contains 6 balls = 19
As, either of case (I) or case (II) is possible,
Hence, total no. of ways = 19 + 19 = 38

28. **(c)** Suppose three people have been given a, b and c number of items.
Then, a × b × c = 30
Now, There can be 5 cases :
Case I : When one of them is given 30 items and rest two 1 item each.
So, number of ways for (30 × 1 × 1) = $\frac{3!}{2!} = 3$
(As two of them have same number of items)
Case II : Similarly, number of ways for (10 × 3 × 1) = 3! = 6
Case III : Number of ways for (15 × 2 × 1) = 3! = 6
Case IV : Number of ways for (6 × 5 × 1) = 3! = 6
Case V : Number of ways for (5 × 3 × 2) = 3! = 6
Here, either of these 5 cases are possible.
Hence, total number of ways = 3 + 6 + 6 + 6 + 6 = 27

29. **(b)** There can be five cases :
Case I : First triangle can have 5 balls and rest three 1 each.
So, number of ways for (5, 1, 1, 1) = $\frac{4!}{3!} = 4$
($\because$ Three triangles are having same number of balls)
Case II : Number of ways for (4, 2, 1, 1) = $\frac{4!}{2!} = 12$
($\because$ Two triangles are having same number of balls)
Case III : Similarly, number of ways for (2, 2, 2, 2) = $\frac{4!}{4!} = 1$
Case IV : Number of ways for (3, 3, 1, 1) = $\frac{4!}{2! \times 2!} = 6$
Case V : Number of ways for (3, 2, 2, 1) = $\frac{4!}{2!} = 12$
As, either of these five cases are possible,
Hence total number of ways = 4 + 12 + 1 + 6 + 12 = 35

30. **(c)** There can be three cases :

	Amit	**Wife**
(I)	1 Boy and 1 Girl	1 Boy and 1 Girl
(II)	2 Girls	2 Boys
(III)	2 Boys	2 Girls

Case I : number of ways = $^2C_1 \times {}^3C_1 \times {}^3C_1 \times {}^2C_1 = 36$
Case II : number of ways = $^3C_2 \times {}^3C_2 = 9$
Case III : number of ways = $^2C_2 \times {}^2C_2 = 1$
Hence, total number of ways = 36 + 9 + 1 = 46

31. **(c)** These can be two cases :
Case I - One box contain 3 balls and rest two Contains 1 ball each.
Case II - One box contain 1 ball and rest two Contains 2 balls each.
Case 1 : Number of ways = $^5C_3 \times {}^2C_1 \times {}^1C_1 = 20$
Now, these 3 boxes can be arranged in $\frac{3!}{2!}$ among themselves, as two of them contains similar number of balls.
So, number of ways = $20 \times \frac{3!}{2!} = 60$
Case II : Number of ways = $^5C_1 \times {}^4C_2 \times {}^2C_2 = 30$
Also, these 3 boxes can be arranged among themselves in $\frac{3!}{2!}$, as two of them contains similar number of balls.
Thus, number of ways = $30 \times \frac{3!}{2!} = 90$
Now, either of case (I) or case (II) is possible,
Hence, total number of ways = 60 + 90 = 150

32. **(c)** Out of the given letters in the word SACHIN, S is the last letter in the alphabetical order to start a word. If the word starts with A, then A can be kept fixed and the remaining letters can be arranged in 5! ways.
Similarly, number of words starting with C = 5!
Number of words starting with H = 5!
Number of words starting with I = 5!
Number of words starting with N = 5!
Now, when the word starts with S, then SACHIN is the first word in the alphabetical order to follow up.
So, Position of the word SACHIN = 5 (5!) + 1 = 601

33. **(c)** There can be 3 cases :
I. When one dice shows 2.
II. When two dice shows 2.
III. When three dices shows 2.
Case I : The dice which shows 2 can be selected out of the 3 dices in $^3C_1$ ways.
Remaining 2 dices can have any 5 numbers except 2. So number of ways for them = $^5C_1$ each, so no of ways when one dice shows 2 = $^3C_1 \times {}^5C_1 \times {}^5C_1$.
Case II : Two dices, showing 2 can be selected out of the 3 dices in $^3C_2$ ways and the rest one can have any 5 numbers except 2, so number of ways for the remaining 1 dice = 5.
So, number of ways, when two dices show 2
= $^3C_2 \times 5$
Case III : When three dices show 2 then these can be selected in $^3C_3$ ways.

So, number of ways, when three dices show 2 = $^3C_3 = 1$
As, either of these three cases are possible.
Hence, total number of ways
$= (3 \times 5 \times 5) + (3 \times 5) + 1 = 91$

34. (b) 3 balls can be placed be in any of the 12 squares in $^{12}C_3$ ways.
Total number of arrangements = $^{12}C_3 = 220$
Now, assume that balls lie along the some line.
There can be 3 cases :
Case I: When balls lie along the straight horizontal line.
3 balls can be put in any of the 4 boxes along the horizontal row in $^4C_3$ ways.
Now, since there are 3 rows, so number of ways for case I = $^4C_3 \times 3 = 12$
Case II : When balls lie along the vertical straight line
3 balls can be put in any of the 3 boxes along the vertical row in $^3C_3$ ways.
Now, as there are 4 vertical rows, so number of ways for
Case II = $^3C_3 \times 4 = 4$
Case III : Balls lie along the 2 diagonal lines towards the left and 2 diagonal lines towards the right.
Number of ways = 2 + 2 = 4
Number of ways, when balls lie along the line = 12 + 4 + 4
= 20
Number of ways when balls don't lie along the line = Total number of ways – number of ways when balls lie along the line.
= 220 – 20 = 200.

35. (c) Total number of arrangements, when any 3 boys are selected out of 5 = $^5C_3$. Now, when groups contains both C and D, then their selection is fixed and the remaining 1 boy can be selected out of the remaining 3 boys. It can be done in $^3C_1$ ways.
So, number of groups, when none contains both C and D = total number of arrangements-number of arrangements when group contains both C and D
$= {^5C_3} - {^3C_1}$
$= 10 - 3 = 7$

36. (b) Let us take books A and B as one i.e., they are always continuous.
Now, number of books = 4 – 2 + 1 = 3
These three books can be arranged in 3! ways and also A and B can be arranged in 2 ways among themselves.
So, number of ways when books A and B are always continuous = 2 × 3!
Total number of ways of arrangement of A, B, C and D = 4!
Hence, number of ways when A and B are never continuous = Total number of ways – number of ways when A and B always continuous
$= 4! - 2 \times 3! = 12$

37. (c) Suppose any particular student is always selected.
Now, remaining 2 students are to be selected out of the remaining 5 students.
It can be done in $^5C_2$ ways.
$$= \frac{5!}{2! \times 3!} = 10$$

38. (d) There can be two cases :
Case I : When 1 row contains 3 balls and rest two contains 1 ball each.
Now, the row which contains 3 balls can be selected out of the 3 rows in $^3C_1$ ways and in this row number of ways of arrangement = $^3C_3$. In other two rows, number of ways of arrangement in each = $^3C_1$.
Thus, number of ways for case I = $^3C_1 \times {^3C_3} \times {^3C_1} \times {^3C_1}$
$= 3 \times 1 \times 3 \times 3 = 27$
Case II : When 1 row contains 1 ball and rest two rows contain 2 balls each.
This row, containing 1 ball can be selected in $^3C_1$ ways and number of ways of arrangement in this row = $^3C_1$. In other two rows, containing 2 balls each, number of ways of arrangement in each = $^3C_2$.
Thus, number of ways for case II = $^3C_1 \times {^3C_1} \times {^3C_2} \times {^3C_2} = 3 \times 3 \times 3 \times 3 = 81$
As, either of these two cases are possible, hence total number of ways = case I or case II = 27 + 81 = 108.

39. (a) As there are 6 letters and envelopes, so if exactly 5 are into correctly addressed envelopes, then the remaining 1 will automatically be placed in the correctly addressed envelope. Thus, the probability that exactly 5 go into the correctly addressed envelope is zero.

40. (c) Let us start with Red colour
Where, R = Red, B = Black, W = White

R	B	R	W
R	W	R	B
R	B	R	B
R	W	R	W
R	B	W	R
R	W	B	R
R	B	B	R
R	W	W	R

There are eight such arrangements, if we start with Red ball. Similarly, there are 8 arrangements, if we start with black or white ball.
Hence, No. of arrangements = 8 + 8 + 8 = 24

41. (b) No. of different sums of money = any 1 coin at a time + any 2 coins + any 3 coins it all 4 coins
$= {^4C_1} + {^4C_2} + {^4C_3} + {^4C_4}$
$= 4 + 6 + 4 + 1 = 15$

42. (a) Case I : When 4 is at the hundredth place.
□□□ Remaining two places can be filled through any of the numbers 0 to 9 except 4 in 9 ways.
So, no of ways = 1 × 9 × 9 = 81
Case II : When 4 is at the units or tens place and 3 is at the hundredth place. Here, 4 is at the units place, then tens place can be filled through any of the numbers 0 to 9 except 4 in 9 ways or else if 4 is at the tens place, then units place can be filled in 9 ways.
So, no of ways = 1 × (9 + 9) = 1 × 18 = 18
Here, either case I or case II is possible. Hence, total no. of ways = 81 + 18 = 99

43. (d) Any 3 numbers out of 9 can be selected in $^9C_3$ ways.
Now, these three numbers can be arranged among themselves in ascending order in only 1 way.
Hence, total no. of ways = $^9C_3 \times 1 = 84$

44. **(c)** Since in 221 games each boy plays exactly one game with each girl,
So, $mn = 221$ (1)
as, $m > n > 1$, so only $m = 17$ and $n = 13$ satisfies (1)
$\therefore$ Total no of students $= m + n = 17 + 13 = 30$
Number of games in which both players are girls $= {}^{13}C_2 = 78$

45. **(d)** Each question can be answered in 2 ways.
Hence, total no. of sequences $= 2 \times 2 \times$ .... 10 times
$= 2^{10} = 1024$

46. **(d)** First person can shake hand with the other 9 i.e, in 9 ways. Second person can shake hand with the remaining 8 persons and so on.
$\therefore$ total no. of hands shaked $= 9 + 8 + \ldots\ldots. + 2 + 1$

$$= \frac{9(9+1)}{2} = 45$$

47. **(b)** Take, A and B to be always together as a single entity.
Now, total no. of children $= 4 - 2 + 1 = 3$
These can be arranged in 3! ways and A, B can be arranged among themselves in 2! ways.
Hence, no. of arrangements such that A and B are always together $= 3! \times 2! = 3 \times 2 \times 2 = 12$

48. **(d)** Let no. of column = x, no. of rows = y
$\therefore xy = 630 - [3 \times 1 + 3 \times 2 + \ldots\ldots\ldots + 3 \times (y - 1)]$
$= 630 - 3\,[1 + 2 + \ldots\ldots.. + (y - 1)]$

$$xy = 630 - \frac{3(y-1)y}{2}$$

(a) If y = 3, then $3x = 630 - 9 \Rightarrow x = \frac{621}{3} = 207$

(b) If y = 4, then $4x = 630 - 18 \Rightarrow x = \frac{612}{4} = 153$

(c) If y = 5, then $5x = 630 - 30 \Rightarrow x = \frac{600}{5} = 120$

49. **(d)** We cannot predict the number of dinners for a particular member from the given data. It may be possible that by choosing members from picking lots, one may have to host a dinner more than one times.

50. **(c)** Here are five persons, and 5 tasks
So, When T_2 task is fixed for person 3

Task

		T_2		
1	2	3	4	5

For Task 1 no. of ways = 2
Task 2 no. of ways = 1
Task 3 no. of ways = 3
Task 4 no. of ways = 3
Task 5 no. of ways = 3
Total no. of ways for condition $= 3 + 3 + 3 + 2 + 1$
$= 12$

Condition II
When task T_2 is given to be person 4

Task

			T_2	
1	2	3	4	5

No. of ways for Task $T_1 = 2$
No. of ways for Task $T_2 = 1$
No. of ways for Task $T_3 = 3$
No. of ways for Task $T_4 = 3$
No. of ways for Task $T_5 = 3$
Total number of ways for condition II
$= 3 + 3 + 3 + 2 + 1$
$= 12$
Total number of ways for condition I and II $= 12 + 12$
$= 24$

51. **(c)** Let x be the number of women.
Let y be the number of men.
Total number of hand shakes = xy = 24
Then, the possible factors of x and y are x = 6 or 4, y = 4 or 6
Number of hugs $= {}^xC_2 + {}^yC_2$
$= {}^6C_2 + {}^4C_2$
$= \frac{6 \times 5}{2 \times 1} + \frac{4 \times 3}{2}$
$= 15 + 6 = 21$

52. **(b)**

White Marbles	Red Marbles
10	13
White Marbles	Green Marbles
10 . 0	5

Now, total number of Marbles = 5 + 10 + 13 = 28

53. **(d)** Number of ways to select Principal $= {}^2C_1$
Number of ways to select Vice Principal $= {}^5C_2$
Total number of ways $= {}^2C_1 + {}^5C_2$
$= 2 + \frac{5 \times 4}{2 \times 1}$
$= 2 + 10 = 12$
Number of possible combinations of selectres
$= 2 \times 10 = 20$

54. **(c)** It mathematics I is not opted, then two subjects out of four subjects have to be opted for.
$\therefore$ Number of ways in which two subjects can be opted for $\frac{4 \times 3}{2} = 6$
If mathematics II is opted, then it can be offered only if mathematics I is also opted for Number of ways in which two subjects can be opted for $= 6 + 1 = 7$.

55. **(d)** Let number of a pairs of brown socks = y
Price of brown socks = x
Price of black socks = 3x
According to question
$\Rightarrow 5 \times 3x + yx = 100$ ... (i)
Now, clerk has interchanged socks pairs then price is increased by 100%

$$3xy + 5x = (15x + yx) + \frac{(15x + yx) \times 100}{100}$$

$\Rightarrow 3xy + 5x = 30x + 2xy$ ... (ii)
$\Rightarrow 30x + 2yx = 3xy + 5x$
$\Rightarrow 25x = xy$
$y = 25$
$\therefore$ So, number of brown socks = 25

56. (*) Data Inconsistent.