**12. PROBABILITY**

**Solution Exercise – Easy**

1. (b) : When a fair coin is tossed the sample space is {H, T}. Number of elements in sample space is 2. Hence required probability is.

2. (d) : If a fair coin is tossed twice then sample space is {HH, HT, TH, TT}. Number of elements in sample space is 4 and favorable cases are {HT, TH} and number of elements in this is 2. Hence required probability is.

3. (d) : *S* = {*HHH*, *HHT*, *HTH*, *HTT*, *HHT*, *HTT*, *TTH*, *TTT*}

⇒ *n* (*S*) = 8

*E* = {*HTT*, *THT*, *TTH*} ⇒ *n* (*E*) = 3

∴ *P* (*E*) = 

4. (b) : *S* = {*HHH*, *HHT*, *HTH*, *THH*, *HTT*, *THT*, *TTH*, *TTT*}

⇒ *n* (*S*) = 8

*E* = {*TTT*}⇒ *n* (*E*)= 1

∴ *P* (*E*) = 

5. (b) : *S* = {*HHH*, *HHT*, *HTH*, *THH*, *HTT*, *THT*, *TTH*, *TTT*}

⇒ *n* (*S*) = 8

*E* = {*HHH*, *HHT*, *HTH*, *HTT*, *THH*, *THT*, *TTH*} ⇒ *n* (*E*) = 7

∴ *P* (*E*) = 

6. (b) : *S* = {*HHH*, *HHT*, *HTH*, *THH*, *HTT*, *THT*, *TTH*, *TTT*}

⇒ *n* (*S*) = 8

*E* = {*HHT*, *HTH*, *THH*} ⇒ *n* (*E*) = 3

∴ *P* (*E*) = 

7. (a) : *S* = {*HHH*, *HHT*, *HTH*, *THH*, *HTT*, *THT*, *TTH*, *TTT*}

⇒ *n* (*S*) = 8

*E* = {*HHH*, *HHT*, *HTH*, *THH*} ⇒ *n* (*E*) = 4

∴ *P* (*E*) = 

8. (a) : Since, all events are independent,

∴ Required probability = 

9. (c) : Required probability is 

10. (d) : From 1 to 6 composite numbers are 4 and 6 i.e. 2 numbers. Hence required probability is 

11. (b) : Favorable numbers in this case are 2, 3, 4, 5 and 6 so required probability is .

12. (a) : *S* = {1, 2, 3, 4, 5, 6}

⇒ *n* (*S*) = 6

*E* = {1, 2, 3, 4, 5, 6} ⇒ *n* (*E*) = 6

∴ *P* (*E*) =  = 1

13. (c) : *S* = {1, 2, 3, 4, 5, 6}

⇒ *n* (*S*) = 6

*E* = {2, 3, 5} ⇒ *n* (*E*) = 3

∴ *P* (*E*) = 

14. (b) : *S* = {1, 2, 3, 4, 5, 6}

⇒ *n* (*S*) = 6

*E* = {2, 4, 6} ⇒ *n* (*E*) = 3

∴ *P* (*E*) = 

15. (b) : *S* = {1, 2, 3, 4, 5, 6}

⇒ *n* (*S*) = 6

*E* {3, 6} ⇒ *n* (*E*) = 2

∴ *P* (*E*) = 

16. (b) : *S* = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), .... (6, 5) (6, 6)}

⇒ *n* (*S*) = 6 × 6 = 36

*E* = {(1, 1), (2, 2), (3 3), (4, 4), (5, 5), (6, 6)} ⇒ *n* (*E*) = 6

∴ *P* (*E*) = 

17. (b) : *S* = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), .... (6, 5) (6, 6)}

⇒ *n* (*S*) = 6 × 6 = 36

*E* = {(2, 2), (4, 4), (6, 6)} ⇒ *n* (*E*) = 3

∴ *P* (*E*) = 

18. (b) : *S* = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), .... (6, 5) (6, 6)}

⇒ *n* (*S*) = 6 × 6 = 36

*E* = {(2, 3), (2, 6), (4, 3), (4, 6), (6, 3), (6, 6), (3, 2), (6, 2), (3, 4), (6, 4), (3, 6), }

⇒ *n* (*E*) = 11

∴ *P* (*E*) = 

19. (a) : *S* = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), .... (6, 5) (6, 6)}

⇒ *n* (*S*) = 6 × 6 = 36

*E* = {(1, 2), (1, 5), (2, 1), (2, 4), (3, 3), (3, 6), (4, 2), (4, 5), (5, 1), (5, 4), (6, 3), (6, 6), (1, 3), (2, 2), (2, 6), (3, 1), (3, 5) (4, 4), (5, 3), (6, 2)}

⇒ *n* (*E*) = 20

∴ *P* (*E*) = 

20. (b) : Required probability = 

[Hint: Why  because there are 13 spades and why 

instead of  (there are four kings) because one king is already counted in spades.**]**

21. (c) : In this case sample space S = {(5, 1), (5, 2), (5, 3), (5, 4), (5, 5) and (5, 6)}.

Number of elements in the sample space is 6 and the favorable case is (5, 6) so required probability is.

22. (b) : There are 4 aces, 4 kings and 4 jacks and their selection can be made in following ways.

4*C*1 × 4*C*1 × 4*C*1

*n*(*E*) = 4 × 4 × 4 = 64

Total selection can be made = 52*C*3 = 

*P* (*E*) = 

23. (b) : *E* = {(1, 1, 1, 1), (2, 2, 2, 2), ..... (13, 13, 13, 13)}

∴ *n* (*E*) = 13

and *n* (*S*) = 52*C*4 = 270725

∴ *P* (*E*) = 

24. (c) : *n* (*E*) = 13*C*1 × 12*C*1 × 11*C*1 × 10*C*1 = 13 × 12 × 11 × 10

*n* (*S*) = 52*C*4 = 270725

∴ *P* (*E*) = 

25. (b) : *n* (*S*) = 12*C*4 = 495

*n* (*E*) = 8*C*4 = 70

∴ *P* (*E*) = 

26. (b) : *n* (*S*) = 12*C*4 = 495

*n* (*E*) = 4*C*4 = 1

∴ *P* (*E*) = 

27. (d) : Total number of hats = 6 + 4 + 2 + 3 = 15

Ways of selection of two blue hats = *n* (*E*) = 6*C*2

Ways of selection of two hats = *n* (*S*) = 15*C*2

So, required probability = 

28. (b) : Ways of selection of two blue hats = 4*C*2

Ways of selection of one yellow hats = 3*C*1

Ways of selection of three hats = 15*C*3

So, required probability = = 

29. (b) : Probability that none is yellow from four hats

= 

So, probability that at least one is yellow from four hats

= 

30. (a) : Ways of selection of two green hats = 2*C*2 = 1

Ways of selection of two yellow hats = 3*C*2 = 3

So, probability (both are green) =  ..... (1)

Probability (both are yellow) =  ... (ii)

Then, required probability = 

31. (a) : Probability to be green = 

Probability to be a red = 

∴ Required probability = 

32. (c) : Total number of ways = *n* (*S*) = 6*C*2 = 15

Favourable number of ways = *n* (*E*) = 3*C*1 × 3*C*1 = 9

∴ Required probability = 

33. (c) : A red ball can be drawn in 6*C*1 ways in the first draw. Since this ball is replaced, a red ball in the second draw can also be drawn in 6*C*1 ways.

Hence, the probability that both are red = 

34. (a) : Since the ball drawn is replaced, we can get black balls in both draws in 8*C*1 ways.

Hence the probability that both are black is 

35. (d) : A red ball in the first and a black ball in the second draw with replacement can be done in 6*C*1 and 8*C*1 ways.

∴ Required probability = 

36. (a) : If 1st ball is blue then remaining balls in bag are 8 red and 5 blue balls, then probability of 2nd ball being red is 

37. (c) : There are in all 7 + 5 + 4 = 16 balls

Total number of ways of drawing 3 balls out of 16 = 16*C*3

∴ *n* (*S*) = 16*C*3

Ways of drawing 3 blue balls out of 7 blue ones = 7*C*3

∴ *n* (*E*) = 7*C*3

Hence, the probability of drawing 3 blue balls

=

38. (b) : There are in all 7 + 5 + 4 = 16 balls

Total number of ways of drawing 3 balls out of 16 = 16*C*3

∴ *n* (*S*) = 16*C*3

Ways of drawing one green ball and 2 red balls

= 5*C*1 × 4*C*2 = 30

Hence the chance of drawing one green and 2 red balls

=

39. (d) : Since in a week we have 7 days hence number of elements in the sample space is 7 and favorable case id only one. Hence required probability is.

40. (b) : Both the balls are white.

Or

Both the balls are black.

Hence, required probability = 

= 

41. (a) : Since in a week we have 7 days. Hence number of elements in the sample is 7 and favorable cases are two. Hence required probability is.

42. (b) : A leap year has 52 full weeks and 2 more days. These 2 days can be:

a. Sunday and Monday

b. Monday and Tuesday

c. Tuesday and Wednesday

d. Wednesday and Thursday

e. Thursday and Friday

f. Friday and Saturday

g. Saturday and Sunday

Clearly, there are atleast 52 Sundays.

Now, for having 53 Sundays in the year, one of the above 2 consecutive, days must be Sunday.

Thus, out of the above 7 possibilities, 2 possibilities are in favour [(a) and (g)] of the event that one of the two days is a Sunday *i.e*. Probability = 

43. (a) : Total number of outcomes = 2 + 9 = 11

Favourable number of cases = 2

∴ *P* (*E*) = 

44. (a) : Total number of outcomes = 5 + 7 = 12

Number of cases against the occurrence of event = 5

∴ Number of cases in favour of event = 12 − 5 = 7

∴ *P* (*E*) = 

45. (b) : Total number of letters = *n* (*S*) = 11

whereas number of vowels = *n* (*E*) = 6 (*E, A, I, A, I, O*)

∴ Required probability = 

46. (d) : Required probability = 

47. (c) : Let *A* = the event that horse *A* wins the race

and *B* = the event that horse *B* wins the race.

Since both the horses *A* and *B* take part in the same race, both of them cannot win at a time. Hence *A* and *B* are mutually exclusive events.

*P* (*A**B*) = *P* (*A*) + *P* (*B*) = 

48. (b) : Let *A* = the event that horse *A* wins the race

and *B* = the event that horse *B* wins the race.

Since both the horses *A* and *B* take part in the same race, both of them cannot win at a time. Hence, *A* and *B* are mutually exclusive events.

*P*  = 1 − *P* (*A**B*) = 

49. (d) : Given, P (A) = 0.25, P (B) = 0.50,

*P* (*A**B*) = 0.12

∴ *P* (*A**B*) = *P* (*A*) + *P* (*B*) − *P* (*A**B*)

= 0.25 + 0.50 − 0.12

= 0.63

∴ *P* = 1 − *P* (*A**B*)

= 1 − 0.63 = 0.37

50. (d) : Required probability = 

51. (d) : Required probability = 

52. (d) : Here, good bulbs are 6 and defective bulbs are 4.

∴ Required probability

= 

53. (a) : Let *E* = Event of getting a prime number = {2, 3, 5, 7}

∴ Required probability = 

54. (a) : Here, good bulbs are = 500 − 40 = 460

∴ Required probability = 

55. (c) : Let *P* (*A*) = *x*

Given, *P* (*A**B*) = 0.8

⇒ *P* (*A*) + *P* (*B*) − *P* (*A**B*) = 0.8

⇒ *P* (*A*) + *P* (*B*) − *P* (*A*) *P* (*B*) = 0.8

(*A* and *B* are independent.)

⇒ *x* + 0.3 − 0.3*x* = 0.8

⇒ 0.7*x* = 0.5

⇒ *x* = 

56. (b) : We know that *P* 

= 

57. (d) : Since A and B are two mutually exclusive events, so

*P* (*A**B*) = 0,

∴  = 0.

58. (b) : Since *P* (*A**B*) = *P* (*A*) + *P* (*B*) − *P* (*A**B*)

so *P* (*A**B*) = 

Then 

59. (c) : Since, there are only two types of socks in the bag. So, if Arvind picks up 3 socks, then certainly two of them are of same type. Thus, this is a certain event.

Hence, required probability = 1.

60. (b) : *P*(word start with *P*) = 

61. (c) : *P*(word start with *P* ends with *Y*) = 

62. (a) : All vowels together = 

63. (b) : The probability of selecting the first bag  and then drawing a coin from it  is .

The probability of selecting the second bag  and then drawing a coin from it  is.

Hence, the required probability is  (since they are mutually exclusive).

64. (d) : Total number of caps = 2 + 4 + 5 + 1 = 12

Total number of outcomes = *n*(*S*) = 12*C*2 = 66

∴ Favourable number of outcomes = *n*(*E*) = 2*C*2 = 1

∴ Required probability = 

65. (a) : Total number of caps = 12

Total number of results = *n*(*S*) = 12*C*4 = 495

Out of 5 caps, number of ways to not pick a green cap = *n*(*E*1) = 5C0 = 1 and out of 7 caps, number of ways to pick 4 caps = *n*(*E*2) = 7*C*4 = 35

∴ Required probability = 

66. (d) : Total number of caps = 12

∴ *n*(*S*) = 12*C*3 = 220

*n*(*E*1) = out of 4 red caps, number of ways to pick 2 caps = 4*C*2 = 6

*n*(*E*2) = out of 5 green caps, number of ways to pick one cap = 5*C*1 = 5

*P*(*E*) = 

= 

67. (b) : Total number of caps = 12

*n*(*S*) = 12*C*1 = 12

Out of (2 blue + 1 yellow) caps, number of ways to pick one cap *n*(*E*) = 3*C*1 = 3

Required probability

*P*(*E*) = 

68. (c) : Required probability = 

= 

69. (c) : First, we find the probability of not solving the problem.



=

= 

∴ Required probability = 

70. (d) : Total members = 8 + 5 = 13

We have to select 7 members out of 13.

∴ Number of ways to choose 7 members out of 13 = 13*C*7 and we have 5 ladies out of which 2 ladies have to be selected.

∴ Required probability = 



71. (d) : Given probabilities of encounter error are 0.2, 0.3 and 0.1.

∴ Probabilities of not encountering error are 1 − 0.2 = 0.8, 1 − 0.3 = 0.7 and 1 − 0.1 = 0.9

Hence, *P*(at least one error) = 1 − *P*(none)

= 1 − [0.8 × 0.7 × 0.9]

( all the probabilities are independent)

= 1 − 0.504 = 0.496

72. (a) : Let *E*1 be the event that exactly two players scored more than 50 runs then

*P*(*E*1) = 

=



Let *E*2 be the event the *A* and *B* scored more than 50 runs, then *P*(*E*1*E*2) = 

∴ Desired probability = 

73. (a) : The probability of selecting a same number

= 

∴ Required probability = 

74. (b) : If 2 is the unit’s digit, then ten’s place may be a number from 0 to 9 *i.e*., 10 ways. And if 2 is in ten’s place, then unit place may be a number from 0 to 9. But number 22 is common in both cases.

∴ Total cases = 20 − 1 = 19

∴ Required probability = 

75. (a) : Here, non - defective bulbs are 8.

∴ Required probability = 

**Solution Exercise – Medium**

1. (c) : Here, *p* = *q* = 

∴ Required probability

=

*=* 

2. (d) : When first dice shows 1, second may show 2, 3, 4, 5, 6 (i.e. 5 ways).

When first dice shows 2, second may show 3, 4, 5, 6 (i.e. 4 ways).

When first dice shows 3, ...... 4, 5, 6 (i.e. 3 ways).

................

When first dice shows 5 ........ 6 (*i.e*. 1 way).

∴ Total favourable cases = 1 + 2 + 3 + 4 + 5 = 15

∴ Required probability = 

3. (a) : As per the given condition outcome is (2,2), (2,3) (2,5) (3,2), (3,3), (3,5), (5,2), (5,3) and (5,5)

So, sample space is 3 × 3 = 9 and number of favorable case is (2,3) and (5,3)

So, required probability is.

4. (c) : For the sum of the numbers on the dice to be odd, the first number should be odd and the second number should be even or the first number should be even and the second should be odd. Therefore,

*P* (*A*) = 

5. (c) : Total number of ways = 65

Case I, When numbers are 3, 3, 2, 2, 2.

Number of ways =  = 10

Case II, When numbers are 3, 3, 3, 3,...

[Here ‘−’ denote for blank dice]

Number of ways = 5

∴ Required probability = 

6. (b) : Consider the following events.

*A*1 → *A* speaks truth, *A*2 → *B* speaks truth.

Then, *P* (*A*1) =, *P* (*A*2) = 

Thus, the required probability = 

= 

= 

7. (a) : Let *E*1 = Both speak truth

*E*2 = Both speak false

and *E* = *A* and *B* agree in a statement

Given, *P* (*A*) =, *P* (*B*) = 

∴ *P* (*E*1) = 

*P* (*E*2) = 

It is clearly, 

∴ 

= 

8. (a) : Given, *P* (*X*) = 0.7, *P* (*Y*) = 0.5

⇒ 

Also,  = 0.6d

⇒ 1 − *P* (X ∪ Y) = 0.6

⇒ *P* (*X* ∪ *Y*) = 0.4

∴ Required probability, *P* (*X* ∪ *Y*)

= *P* (*X*) + *P* (*Y*) − *P* (*X* ∪ *Y*)

= 0.7 + 0.5 − 0.4 = 0.8

9. (c) : Let *P*(*A*) = Probability that a randomly selected student likes chocolate = 0.3

Let *P*(*B*) = Probability that a randomly selected student likes cake = 0.2

Then *P* (*A* ∪ *B*) = 0.1

Now we have to find  = 

10. (b) : The different possibilities of forming a six - digit number with distinct digits with the help of digits 1, 2, 3, 4, 5 and 6;

*n* (*S*) = 6 × 5 × 4 × 3 × 2 × 1 = 720

Any number is divisible by 2, if the unit’s place is occupied by either 0 or even numbers.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 105 | 104 | 103 | 102 | 10 | 1 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 5 ways | 4 ways | 3 ways | 2 ways | 1 way | 3 ways  (*i.e*. 2 or  4 or 6) |

*n* (*E*) = 5 × 4 × 3 × 2 × 1 × 3 = 360

∴ Required probability = 

11. (c) : Here, the different possibilities of forming a six - digit number with distinct digits with the help of digits 1, 2, 3, 4, 5 and 6 is:

*n* (*S*) = 6 × 5 × 4 × 3 × 2 × 1 = 720

Any number is divisible by 3, if the sum of the digits is divisible by 3. As 1, 2, 3, 4, 5 or 6 are present in each of 720 six - digit numbers in different possible orders, the sum of digits of each of the 720 numbers is 1 + 2 + 3 + 4 + 5 + 6 = 21. Hence all 720 numbers are exactly divisible by 3.

∴ *n* (*E*) = 720

∴ Required probability = 

12. (b) : Here, the different possibilities of forming a six - digit number with distinct digits with the help of digits 1, 2, 3, 4, 5 and 6 is:

*n* (*S*) = 6 × 5 × 4 × 3 × 2 × 1 = 720

Any number is divisible by 4 if the digits at unit’s and ten’s places together, i.e. last two digits, are exactly divisible by 4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 105 | 104 | 103 | 102 | 10 | 1 |
| ↓ | ↓ | ↓ | ↓ | 1 | 2 |
| 4 ways | 3 ways | 2 ways | 1 way | 1 | 6 |
| (Since two digits are already used) | | | | 2 | 4 |
|  |  |  |  | 3 | 2 |
|  |  |  |  | 3 | 6 |
|  |  |  |  | 5 | 2 |
|  |  |  |  | 5 | 6 |
|  |  |  |  | 6 | 4 |
|  |  |  |  | ↓ | |
|  |  | 8 ways for last two places. | | | |

*n* (*E*) = 4 × 3 × 2 × 1 × 8 = 192.

∴ Required probability = 

13. (b) : Here, there are different possibilities of forming a six - digit number with distinct digits with the help of digits 1, 2, 3, 4, 5 and 6.

*n* (*S*) = 6 × 5 × 4 × 3 × 2 × 1 = 720

Any number is divisible by 5 if the unit’s place is occupied either by 0 or by 5.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 105 | 104 | 103 | 102 | 10 | 1 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 5 ways | 4 ways | 3 ways | 2 ways | 1 way | 1 way  (*i.e*. 5) |

*n* (*E*) = 5 × 4 × 3 × 2 × 1 × 1 = 120

∴ Required probability = 

14. (b) : Let *S* be the sample space then *n* (*S*) = Total number of numbers of four digits formed with the digits 1, 2, 3 and 4 without repetition.

= 4*P*4

= 4!

= 24

We know that a number is divisible by 4 if the last two digits of the number is divisible by 4.

Then,

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| ← 2! ways → | | ← 3 ways → | |

for divisible by 4, last two digits 12 or 24 or 32

Let *E* be the event that the number formed is divisible by 4.

∴ *n* (*E*) = 2! × 3 = 6

∴ Required probability *P* (*E*) = 

15. (a) : A three digit number can be formed with the given five digits in 5*P*3 ways, i.e. *n* (*S*) = 5*P*3 = 5 × 4 × 3

Any one of the two digits 4 and 8 should come at units place, which can be done in 2 ways. After filling up the units place, the remaining two places can be filled up with the remaining four digits in 4*P*2 ways;

*n* (*E*) = 2 × 4*P*2 = 2 × 4 × 3

∴ *P* (*E*) = 

16. (a) : A three digit number can be formed with the given five digits in 5*P*3 ways, i.e. *n* (*S*) = 5*P*3 = 5 × 4 × 3

*P* (not divisible by 2) = 1 − *P* (divisible by 2) = 1 − 

17. (c) : A three digit number can be formed with the given five digits in 5*P*3 ways, i.e. *n* (*S*) = 5*P*3 = 5 × 4 × 3

A number is divisible by 5, when its units digit is either 0 or 5.

We have not been provided the digit 0. So, the units place can be filled up with only 5, i.e., in 1 way. The rest two places can be filled up with the remaining 4 digits in 4*P*2 ways.

∴ *P* (*E*) = 

18. (d) : Let *X* be the number of defective bulbs in a sample of 5 bulbs.

∴ Required probability = *P* (*X* = 0)

= 

19. (a) : Here, number of boys = 100 − 55 = 45

Boys not studying statistics = 45 − 36 = 9

∴ Required probability = 

20. (b) : Passed students in 1st examination, *n* (*E*1) = 60

and passed students in 2nd examination, *n* (*E*2) = 50

Also, *n* (*E1* ∪ *E2*) = 30

∴ Failed students in 1st examination,  = 40

and failed students in 2nd examination,  = 50

Also,  = 70

∴ Failed students in both subjects,

 = 40 + 50 − 70 = 20

∴ Required probability =  = 0.2

21. (d) : Required probability = 

= 

22. (a) : Required probability = 2 [*P* (*W*) *P* (*B*) *P* (*W*) *P* (*B*)]

= 

[The first ball may be either black or white.]

23. (b) : ∴ Required probability, *P* (*E*) = 

24. (b) : Here, *P* (*A*) = 

and 

∴ Probability of winning atleast one game

= 1 − Probability of winning no game

= 1 − 

= 

∴ Required odds in favour of *A* = 316 : 27

25. (c) : Given, *P* (*A*) = 

and 

Probability of winning atleast two games = Probability of winning two games + Probability of winning

= 

( He can win two games in three ways)

= 

= 

∴ The odds in favour of *A*’s winning atleast two games

= 275 : 68

26. (d) : Given, *P* (*A*) = , *P* (*B*) = , *P* (*C*) =  = 1

⇒ 

∴ Required probability

= 

= 

= 

27. (b) : Given, *P*(*A*) = , *P*(*B*) = , *P*(*C*) =  = 1

∴ Required probability

= 

= 

28. (d) : Required probability = 

= 

29. (a) : Let *P* (*A*) = 

and *P* (*B*) = 

Also, *P* (*A**B*) = 

 *P* (*A**B*) = *P* (*A*) + *P* (*B*) − *P* (*A**B*)

= 

= 

30. (b) : Probability of sending a correct programme

= 1 − 

Probability that package is not damaged = 1 − 

Probability that there is not a short shipment = 1 − 

∴ Required probability = 

31. (c) : The probability that *P* fails to solve the problem is

1 − ****.

The probability that *Q* will fail to solve the problem is

1 − .

The probability that *R* will fail to solve the problem is

1 − .

The probability that all three will fail is .

The probability that the problem will be solved is:

1 − Probability that all three fail to solve the problem.

Therefore, the probability that the problem will be solved is

1 − .

32. (b) : *P*(Both getting selected) = 

33. (b) : *P* (At least one from Kerla) = 1 − *P* (None one from Kerla)

= 

34. (d) : Let *C*, *S*, *B*, *T* be the events of the person going by car, scooter, bus or train respectively.

Then, as per the given information *P*(*C*) = , *P*(*S*) = ,

*P*(*B*) =  and *P*(*T*) = .

Let ‘*O*’ be a new event of the person reaching the office in time.

*P*(*O*) = 

Probability that he will reach office in time if he travel by bus 

So,



= 

35. (b) : The probability of *A* losing the game is 1 − .

The probability of his losing all three games is

.

Hence, the probability of his winning at least one game is

1 − 

36. (b) : Given, part *A* is not defective *P* (*A*) = 

and parr *B* is not defective, *P* (*B*) = 

∴ Required probability = *P* (*A*) × *P* (*B*)

=  = 0.8645 = 0.86

37. (a) : Probability that the article will be defective

= 

= 

∴ Probability that the article will be non - defective

= 1 − 

= 0.8645

[**Note:** The article will be defective if any one of the part *A* and *B* is defective or both the parts are defective.**]**

38. (a) : Total number of way of arranging B, R, I, N, G = 5! = 120

Favourable cases = 1 (BRING)

So, Probability = ****

39. (b) : There are in all 10 different letters in the given word REGULATION.

Total number of words that can be formed with the help of the letters of the word REGULATION = 10!

∴ *n* (*S*) = 10!

Now, we have to find the total number of words in which there are exactly five letters between *T* and *R*.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| ↓ |  |  |  |  |  | ↓ |  |  |  |
| T |  |  |  |  |  | R |  |  |  |

‘T’ and ‘R’ may occupy (1 − 7), (2 − 8), (3 − 9) and (4 − 10) position. For each of the position remaining 8 letters can be arranged in 8! ways. Also ‘T’ and ‘R’ can interchange their positions.

∴ *n* (*E*) = 2! × 4 × 8!

∴ Required probability = 

40. (d) : Let *S* be the sample space and *E* be the event that the four persons get down at different floors.

Total number of floors excluding the ground floor = 6

Since each of the 4 persons can get down at any one of the 6 floors in 6 ways.

∴ *n* (*S*) = Total number of ways in which the 4 persons can get down = 64

and *n* (*E*) = number of ways in which the 4 persons can get down at 4 different floors out of 6 floors = 6*P*4

∴ Required probability, *P* (*E*) = 

41. (c) : Since, there are 15 cars in 25 places, total number of selection of places out of (25 − 1) places for (15 − 1) cars (except the owner’s car) is

25 − 1*C*15 − 1 = 24*C*14

If neighbouring places are empty, then 14 cars must be parked in (25 − 3 = 22) places. So, the favourable number of cases is

= 22*C*14

∴ Required probability = 

= 

42. (c) : Total number of ways 13 people can be arranged in a ring

= (13 − 1)!

= 12!

Favourable cases = 2! × 11*P*3 × 8! = 2! × 11!

∴ Required probability = 

43. (c) : Favourable cases = 2! × 8*P*4 × 4! = 2 × 8!

Total number of cases = 9!

∴ Required probability = 

44. (b) : Three letters can be placed in three envelopes in 3! ways. Therefore, the exhaustive number of cases = 6.

There is only one way of putting all the letters in the correct envelopse. Therefore, favourable number of cases = 1.

Hence, the required probability = .

45. (d) : Here, we consider *AB* as a one unit.

∴ Favourable number of cases = 3!

∴ Required probability = 

46. (c) : Any month out of 12 months can be chosen with probability =.

There are 7 possible ways in which the month can start and it will be a Thursday on 13th day if the first day of the month is

Saturday, whose probability is .

Hence, the required probability = .

47. (c) : Total number of ways in which 12 different balls can be distributed in four different boxes.

*n* (*S*) = 4 × 4 × 4 × ... × 4 = 412

Again, number of ways in which first box will contain exactly 4 balls is

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 3 | 4 |
| ↓ |  |  |  |
| 12*C*4 |  |  |  |

(First box can be filled in 12*C*4 ways)

Remaining 8 balls can be distributed in 3 boxes in 38 ways

∴ *n* (*E*) = 12*C*4 × 38

So, required probability = 

48. (b) : ∴ Required Probability = 

49. (a) : Probability of yellow face appearing on the dice,

*P*(*A*) = 

Probability of red face appearing *P*(*B*) =

Probability of blue face appearing, *P*(*C*) = 

Probability that yellow, red and blue appear in the first, second and third tosses = *P*(*A*) × *P*(*B*) × *P*(*C*)

= 

50. (c) : Total players = 15

Total number of selected players = 11

∴ *P* (selecting 11 players out of 15) = 15*C*11

*P*(atleast 3 bowlers)

= *P*(3 bowlers) + *P*(4 bowlers) + *P*(5 bowlers)

( Total number of bowlers = 5)

= 

= 

**Solution Exercise – Difficult**

1. (c) : Let *A* be the event that the first box is selected, *B* be the event that the second box is selected and *C* be the event that a red ball is selected.

*P* (*A*) = ; *P* (*B*) = 

; 

The probability of selecting the first box and choosing a red

ball is *P* (*A*  *C*) = *P* (*A*) × 

The probability of selecting the second box and choosing a red ball is *P* (*B*  *C*) = *P* (*B*) × 

Now, the events (*A*  *C*) and (*B*  *C*) are mutually exclusive events.

Required probability is

*P* (*A*  *C*) *∪* (*A*  *C*) = 

2. (c) : Since there are 3 different ways in which one throw of the given pair of dice has a total of 9.

Also, the probability of getting total of 9 is

= 

( (3, 6) (4, 5) (5, 4) (6, 3) are the numbers that make 9).

.

3. (a) : Total number of ways of choosing two squares is 64*C*2 = 2016.

Now, if the first square happens to be any of the four corner squares, the second square can be chosen in 2 ways for it to be adjacent to the first one.

If the first square is any of the 24 squares on the side of the chessboard (excluding the ones on the corners), the second square can be chosen in 3 ways. If the first square is any of the 36 remaining squares, the second square can be chosen in 4 ways. Thus, the number of favourable outcomes is

(4 × 2) + (24 × 3) + (36 × 4) = 224.

Therefore, the required probability is .

4. (a) : Let *E*1 be the event that the answer is guessed, *E*2 be the event that the answer is copied, *E*3 be the event that the examine knows the answer and *E* be the event that the examine answers correctly.

Given *P* (*E*1) = , *P* (*E*2) = ,

Assume that events *E*1, *E*2 & *E*3 are exhaustive.

∴ *P* (*E*1) + *P* (*E*2) + *P* (*E*3) = 1

∴ *P* (*E*3) = 1 − *P* (*E*1) − *P* (*E*2) = 1 − .

Now  = Probability of getting correct answer by guessing =  (Since 4 alternatives)

 = Probability of answering correctly by copying = and = Probability of answering correctly by knowing = 1 Clearly,  is the event he knew the answer to the question given that he correctly answered it.

∴ *P* = 

= 

5. (b) : Let *P* (*R*1) = 0.4, *P* (*R*2) = 0.5 and *P* (*R*3) = 0.8



∴ Required probability

= 

= 

= 0.4 × 0.5 × 0.2 + 0.4 × 0.5 × 0.8 + 0.6 × 0.5 × 0.8

= 0.04 + 0.16 + 0.24 = 0.44

6. (d) : Let a coin is tossed n times.

Probability of getting a head in a single coin, *p* =  and probability of getting a tail in a single coin, *q* = 

∴ 

⇒ n*C*4 = n*C*7

⇒ 

⇒ (*n* − 7) (*n* − 6) (*n* − 5) = 5 × 6 × 7

⇒ *n* = 12

∴ Required probability = 

= 

7. (c) : Required probability

= Probability that ball from bag *A* is red and both the balls from bag *B* are black

Or

Probability that ball from bag *A* is black and one black and one red is drawn from bag *B*

= 

= 

8. (c) : The product of four numbers will be positive in the following ways.

1. All the four numbers are positive, then probability

= 

2. All the four numbers are negative, then probability

= 

3. Two numbers are positive and two are negative, then, probability = 

Hence, required probability of the event

= 

= 

9. (c) : Probability of getting atleast 8 point = 1 − Probability of getting less than 8 points.

Probability of getting less than 8 points,

*P*(*A*) = Probability of getting ‘0’ points

+ Probability of getting 2 points

+ Probability of getting 4 points

+ Probability of getting 6 points

= (0.45)4 + (0.453 × 0.05) × + 0.452 × 0.052 ×  + 0.50 × 0.453 × + 0.452 × 0.05 × 0.50 × 

= 0.30527

∴ Required probability = 1 − 0.305 = 0.695

10. (a) : Numbers that are multiple of 11.



= 90 − 10 + 1

= 81

Numbers that are multiple of 99 (*i.e*. 9 and 11)



2, ............... 90

= 10 − 2 + 1

= 9

Probability that number is multiple of 11, *P*(*A*) = ****

Probability that number is multiple of 9 and 11,

*P*(*A**B*) = 

(*B* is the event of multiple of 9, but we do not need to find it separately).

Now, 

= 

11. (c) : They can be arranged in (14!) ways, and from question, the number of ways such that all the boys are together is (7!) (8!). Hence, required number of ways is .

12. (b) : Let us 1st arrange 4 females that can be done in (3!) ways now this will create 4 places in which males can be arranged in 2 ways only so that no pairs are together.

Hence, required number of ways = 2 × 3! = 12 ways.

Total number of ways = (8 − 1)! = 7!

∴ Required probability = 

13. (c) : Consider the two cases of getting 7 and 8 separately,

Getting 7:



= 

Getting 8:



= 

So, required probability is 

14. (d) : Possibilities of forming a six-digit number with digits 0, 1, 2, 3, 4, 5 is

*n*(*S*) = 5 × 5 × 4 × 3 × 2 × 1

= 600

(Since, ‘0’ cannot come at the sixth place).

The number is divisible by 2, if the unit’s place is occupied by either 0 or even number.

1st **case:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 5*W* | 4*W* | 3*W* | 2*W* | 1*W* | 0 |

*i.e*. 5 × 4 × 3 × 2 × 1 = 120

2nd **case:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 4*W* | 4*W* | 3*W* | 2*W* | 1*W* | 2 or 4 |

*i.e*. 4 × 4 × 3 × 2 × 2 = 192

∴ Required Probability = 

15. (d) : *n*(*S*) = 5 × 5 × 4 × 3 × 2 × 1

= 600

The number is divisible by 5 if the unit’s place is occupied either by ‘0’ or by ‘5’.

1st **case:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 5*W* | 4*W* | 3*W* | 2*W* | 1*W* | 0 |

*i.e*. 5 × 4 × 3 × 2 × 1 = 120

2nd **case:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 4*W* | 4*W* | 3*W* | 2*W* | 1*W* | 2 or 4 |

*i.e*. 4 × 4 × 3 × 2 × 1 = 96

∴ Required Probability = 

16. (c) : *n*(*S*) = 5 × 5 × 4 × 3 × 2 × 1

= 600

The number is divisible by 4 if the digits at unit’s and ten’s place together *i.e*. last two digits are divisible by 4.

Case **I:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 4*W* | 3*W* | 2*W* | 1*W* | 0 | 4 |
|  |  |  |  | 2 | 0 |
|  |  |  |  | 4 | 0 |
|  |  |  |  | ↓ | |
|  |  | 3 ways | | | |

*i.e*. 4 × 3 × 2 × 1 × 3 = 72

Case **II:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3*W* | 3*W* | 2*W* | 1*W* | 1 | 2 |
|  |  |  |  | 2 | 4 |
|  |  |  |  | 3 | 2 |
|  |  |  |  | 5 | 2 |
|  |  |  |  | ↓ | |
|  |  | 4 ways | | | |

*i.e*. 3 × 3 × 2 × 1 × 4 = 72

∴ Required Probability = 

17. (b) : *n*(*S*) = 5 × 5 × 4 × 3 × 2 × 1

= 600

The number is divisible by 8, when the last three digits are together divisible by 8.

Case **I:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 3*W* | 2*W* | 1*W* | 0 | 2 | 4 |
|  |  |  | 0 | 3 | 2 |
|  |  |  | 1 | 0 | 4 |
|  |  |  | 1 | 2 | 0 |
|  |  |  | 2 | 4 | 0 |
|  |  |  | 3 | 0 | 4 |
|  |  |  | 3 | 2 | 0 |
|  |  |  | 5 | 0 | 4 |
|  |  |  | 5 | 2 | 0 |
|  |  |  |  | ↓ | |
|  |  | 9 ways | | | |

*i.e*. 3 × 2 × 1 × 9 = 54

Case **II:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 2*W* | 2*W* | 1*W* | 1 | 5 | 2 |
|  |  |  | 2 | 1 | 2 |
|  |  |  | 3 | 5 | 2 |
|  |  |  | 4 | 3 | 2 |
|  |  |  | 5 | 1 | 2 |
|  |  |  | ↓ | | |
|  |  | 5 ways | | | |

*i.e*. 2 × 2 × 1 × 5 = 20

∴ Required Probability = 

18. (b) : Total number of items = 200

Number of defective items = 

*P*(Ist item is defective) = 

*P*(IInd item is defective) = 

So, Required probability

= 

19. (b) : *P*(*S*1 to be among the eight winners) = *P*(*S*1 wins) = 

(All players are equally likely to win this match.)

20. (d) : We can say that if *S*1 and *S*2 are in the same pair then exactly one wins.

Now, If *S*1 and *S*2 are in two pairs separately then we can say that one among the two (*i.e*. *S*1 and *S*2).

Will be winner among the eight. If *S*1 wins and *S*2 loses or *S*1 loses and *S*2 wins. Now the probability if *S*1 and *S*2 being in the same pair and one wins = *P*(same pair) × *P*(anyone win in the pair)

Probability of *S*1, *S*2 being the same pair = , where *n*(*E*) is the number of ways in which 16 persons can be divided in 8 pairs.

Therefore,

*n*(*E*) =  and *n*(*S*) = ,

now *P*(same pair) = 

The probability of any one winning in the pairs of *S*1 *S*2 = (certain event) = 1

The paris of *S*1 , *S*2 being in two pairs separately and *S*1 wins, *S*2  + the probability of *S*1 *S*2 being in two pairs separately and *S*1 loses and *S*2 wins

=  + 

Therefore, required probability

= 