Guide4BankExams'

Short Notes on

Probability

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Guide4BankExams' shortnotes on Probability

Basics :

1. **Random Experiment** : An experiment in which all possible out comes are known and the exact output cannot be predicated in advance is called *Random Experiment*.

   Ex: (i) Tossing a fair coin

   (ii) Rolling an unbiased dice

   (iii) Drawing a card from a pack of well shuffled cards

2. **Trail** : Conducting a Random Experiment once is known as a *Trail*

3. **Outcome**: The result of a Trail in the random experiment is called as *Outcome*

   Ex.: In tossing a single coin outcomes are H and T

4. **Sample Space** : A set of all possible outcomes of a random experiments is known as *Sample Space*

   Ex: (i) In the experiment of tossing a coin the sample space $S = \{H, T\}$

   (ii) If Two coins are tossed then $S = \{HH, HT, TH, TT\}$

   (iii) In throwing a die $S = \{1, 2, 3, 4, 5, 6\}$

5. **Event :** Any non-empty subset of a Sample Space is called an *Event*

   Ex: (i). in Tossing a single coin getting Head or Tail is an Event

   (ii)Getting an Ace (or) Diamond from a pack of 52 cards is an event

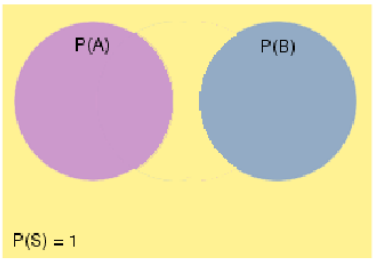
6. **Exhaustive Events :** The total number of possible outcomes of an experiment is known as *Exhaustive Events*

   Ex: In the experiment of throwing a die the total number of possible outcomes = 6

7. **Favourable Events :** The number of event which favour the happing of the events are known as *Favourable Cases (or) Events*

   Ex: In tossing two dice the number of cases favourable to getting the sum 3 is (2, 1), (1, 2) i.e., 2

8. **Mutually Exclusive Events :** If two events have no common outcomes then they are called *Mutually Exclusive.*



Ex: (i) In tossing a coin the events Head & Tail are mutually exclusive because Head & Tail cannot happen at the same time.

9. **Independent Events** : Two events are said to be *independent* if the happening of one event does not affect the happening of the other.

10. **Dependent Events** : Two events are said to be *dependent* if the happening of an event will affect the happing of the other event .

    Ex: If we draw a card from a pack of 52 cards and replace it before we draw a second card. The second card is independent of first one.

    If we don't replace the first card before the second draw. The second draw depends on the first one.

11. **Probability :** In an experiment if ' n ' is the number of exhaustive cases and 'm' is the number of favourable cases of an event A. Then the probability of event A is denoted by P(A) and is defined as

$$P(A)=\frac{Number\ of\ Favourable\ Cases}{Number\ of\ Exhaustive\ Cases}=\frac{m}{n}=\frac{n(A)}{n(S)}$$

    Ex: 1. Find the probability of getting a head in tossing a coin

    Sol: In tossing a single coin Sample Space $S=\{H,T\}$

$$\text{Probability of getting a Head} = \frac{n(H)}{n(S)}=\frac{1}{2}$$

12. **Axioms of Probability :**

    Let S be the sample space and A be the event i.e., $A \subseteq S$

    (i) $0 \le P(A) \le 1 \ , \forall A \subseteq S$

    (ii) $P(S) = 1$

    (iii) If A and B are mutually exclusive (Disjoint i.e., $A \cap B = \phi$)

$$P(A \cup B) = P(A) + P(B)$$

Results of Probability :

i) for any two events A & B

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

ii) If $\overline{A}$ denotes compliment of event A then

$$P(\overline{A}) = 1 - P(A)$$

iii) For any two events A & B

$$P(\overline{A} \cap B) = P(B) - P(A \cap B)$$

iv) For any three events A, B & C

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$$

Solved Examples:

Question 1: A die is rolled, find the probability that an even number is obtained.

Solution to Question 1:

- Let us first write the sample space S of the experiment.

  S = {1,2,3,4,5,6}

- Let E be the event "an even number is obtained" and write it down.

  E = {2,4,6}

- We now use the formula of the classical probability.

  P(E) = n(E) / n(S) = 3 / 6 = 1 / 2

Question 2: Two coins are tossed, find the probability that two heads are obtained.

Note: Each coin has two possible outcomes H (heads) and T (Tails).

Solution to Question 2:

- The sample space S is given by.

  S = {(H,T),(H,H),(T,H),(T,T)}

- Let E be the event "two heads are obtained".

  E = {(H,H)}

- We use the formula of the classical probability.

  P(E) = n(E) / n(S) = 1 / 4

Question 3: You toss a coin AND roll a die. What is the probability of getting a tail and a 4 on the die?

Solution to Question 3:

Probability of getting a tail when a single coin is tossed $= \frac{1}{2}$

Probability of getting 4 when a die is thrown = $\frac{1}{6}$

Required probability $= \frac{1}{2} X \frac{1}{6} = \frac{1}{12}$ (and means X)

Question 4: A number X is chosen at random from the numbers -3, -2, -1, 0, 1, 2, 3. What is the probability that $|x| < 2$

Solution to Question 4: X can take 7 values

To get $|x| < 2$ (i.e., -2 < x < +2) take -1, 0, 1

Probability($|x| < 2$) = $\frac{3}{7}$

Question 5: A number is selected from the numbers 1, 2, 3 and then a second number y is randomly selected from the numbers 1, 4, 9. What is the probability that the product xy of the two numbers will be less than 9 ?

Solution to Question 5: Number X can be selected in three ways and corresponding to each such way there are three ways of selecting number y.

Therefore, two numbers can be selected in 9 ways.

The favourable number of elementary events for which the product xy of the two numbers will less than 9 = $\{(1,1),(1,4),(2,1),(2,4),(3,1)\}$ = 5

Hence the required probability = $\frac{5}{9}$

Question 6: In a musical chair game the person playing the music has been advised to stop playing the music at any time within 2 minutes after she starts playing . What is the probability that the music will stop within the half minute after starting.

Solution to Question 6: Here the possible outcomes are all the numbers between 0 and 2. This is the portion of the number line from 0 to 2 as shown in figure.

Let A be the event that the music is stopped within the first half minute. Then

Outcomes favourable to event a are all points on the number line from O to Q i.e., from 0 o to ½

The total number of outcomes are the points on the number line from O to P i.e., 0 to 2

$$\therefore P(A) = \frac{Length\,of\,OQ}{Length\,of\,OP} = \frac{1/2}{2} = \frac{1}{4}$$

Question 7: Find the probability of having 53 Sundays in

(i) a leap year (ii) a non leap year

Solution to Question 7: An ordinary year has 365 days i.e., 52 weeks and 1 odd day

This day can be any one of the 7 days of the week,

$\therefore\ P(\text{that this day is Sunday}) = \frac{1}{7}$

Hence, $\therefore\ P(\text{an Ordinary Year has 53 Sundays}) = \frac{1}{7}$

A leap year has 366 days. i.e., 52 weeks and 2 odd days

This day can be any one of the 7 days of the week

$\therefore\ P(\text{that this day is Sunday}) = \frac{2}{7}$ Hence $\therefore\ P(\text{a leap Year has 53 Sundays}) = \frac{2}{7}$

Question 8: Two dice are rolled, find the probability that the sum is

a) equal to 1

b) equal to 4

c) less than 13

Solution to Question 8:

- a) The sample space S of two dice is shown below.

  S = { (1,1),(1,2),(1,3),(1,4),(1,5),(1,6)
  (2,1),(2,2),(2,3),(2,4),(2,5),(2,6)
  (3,1),(3,2),(3,3),(3,4),(3,5),(3,6)
  (4,1),(4,2),(4,3),(4,4),(4,5),(4,6)
  (5,1),(5,2),(5,3),(5,4),(5,5),(5,6)
  (6,1),(6,2),(6,3),(6,4),(6,5),(6,6) }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- Let E be the event "sum equal to 1". There are no outcomes which correspond to a sum equal to 1, hence

  P(E) = n(E) / n(S) = 0 / 36 = 0

- b) Three possible outcomes give a sum equal to 4: E = {(1,3),(2,2),(3,1)}, hence.

  P(E) = n(E) / n(S) = 3 / 36 = 1 / 12

- c) All possible outcomes, E = S, give a sum less than 13, hence.

  P(E) = n(E) / n(S) = 36 / 36 = 1

Question 9: A die is rolled and a coin is tossed, find the probability that the die shows an odd number and the coin shows a head.

Solution to Question 9:

- The sample space S of the experiment described in question 5 is as follows

  S = { (1,H),(2,H),(3,H),(4,H),(5,H),(6,H)
  (1,T),(2,T),(3,T),(4,T),(5,T),(6,T)}

- Let E be the event "the die shows an odd number and the coin shows a head". Event E may be described as follows

  E={(1,H),(3,H),(5,H)}

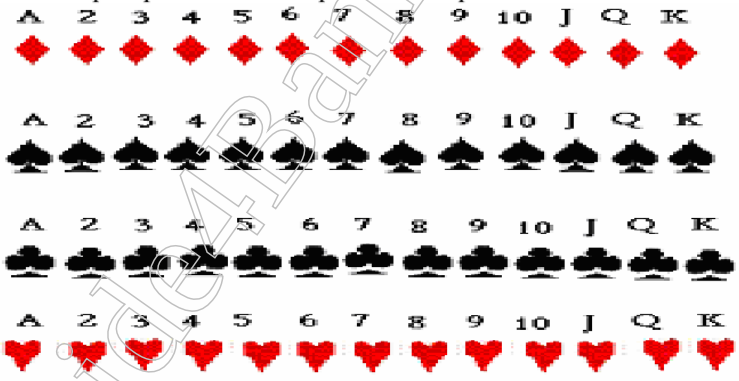
- The probability P(E) is given by

  P(E) = n(E) / n(S) = 3 / 12 = 1 / 4

Question 10: A card is drawn at random from a deck of cards. Find the probability of getting the 3 of diamond.

Solution to Question 10:

- The sample space S of the experiment in question 6 is shown below



- Let E be the event "getting the 3 of diamond". An examination of the sample space shows that there is one "3 of diamond" so that n(E) = 1 and n(S) = 52. Hence the probability of event E occurring is given by

  P(E) = 1 / 52

Question 11: A card is drawn at random from a deck of cards. Find the probability of getting a queen.

Solution to Question 11:

- The sample space S of the experiment in question 7 is shown above (see question 6)
- Let E be the event "getting a Queen". An examination of the sample space shows that there are 4 "Queens" so that n(E) = 4 and n(S) = 52. Hence the probability of event E occuring is given by

  P(E) = 4 / 52 = 1 / 13

Question 12: A jar contains 3 red marbles, 7 green marbles and 10 white marbles. If a marble is drawn from the jar at random, what is the probability that this marble is white?

Solution to Question 12:

- We first construct a table of frequencies that gives the marbles color distributions as follows

Color	frequency
red	3
green	7
white	10

- We now use the empirical formula of the probability

$$P(E) = \frac{\text{Frequency for white color}}{\text{Total frequencies in the above table}}$$

P(E) = 10 / 20 = 1 / 2

Question 13: The blood groups of 200 people is distributed as follows: 50 have type **A** blood, 65 have **B** blood type, 70 have **O** blood type and 15 have type **AB** blood. If a person from this group is selected at random, what is the probability that this person has O blood type?

Solution to Question 13:

- We construct a table of frequencies for the the blood groups as follows

group	frequency
A	50
B	65
O	70
AB	15

- We use the empirical formula of the probability

$$P(E) = \frac{\text{Frequency for O blood}}{\text{Total frequencies}}$$

P(E) = 70 / 200 = 0.35

Question 14: A bag contains 6 white and 4 black balls. Two balls are drawn at random. Find the probability that they are of the same colour.

Solution to Question 14: Let S be the Sample space. Then

n(S) = Number of ways of drawing 2 balls out of (6+4) $= {}^{10}C_2 = \frac{(10X9)}{(2X1)} = 45$

Let E = Event of getting both balls of the same colour . Then

N(E) = Number of ways of drawing (2 balls out 6)or (2 balls out of 4)

$$= ({}^{6}C_2 + {}^{4}C_2) = \frac{(6X5)}{(2X1)} + \frac{(4X3)}{(2X1)} = 21$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{21}{45} = \frac{7}{15}$$

Question 15: Two cards are drawn at random from a pack of 52 cards. What is the probability that either both are black and both are queen.

Solution to Question 15: we have $n(S) = {}^{52}C_2 = \frac{(52X51)}{(2X1)} = 1326$

Let A = event of getting both black cards

B = event of getting both queens

$\therefore A \cap B$ = event of getting queens of black cards

$$\therefore n(A) = {}^{26}C_2 = 325,\ n(B) = {}^{4}C_2 = 6,\ and\ n(A \cap B) = {}^{2}C_2 = 1$$

$$\therefore P(A) = \frac{n(A)}{n(S)} = \frac{325}{1326};\ P(B) = \frac{n(B)}{n(S)} = \frac{6}{1326};\ P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{1}{1326}$$

$$\therefore P(A \cup B) = P(A) + P(B) - P(A \cap B) = \left(\frac{325}{1326} + \frac{6}{1326} - \frac{1}{1326}\right) = \frac{55}{221}$$

Question 16:

A card is drawn from a deck of cards. Events E1, E2, E3, E4 and E5 are defined as follows:

E1: Getting an 8

E2: Getting a king

E3: Getting a face card

E4: Getting an ace

E5: Getting a heart

a) Are events E1 and E2 mutually exclusive?

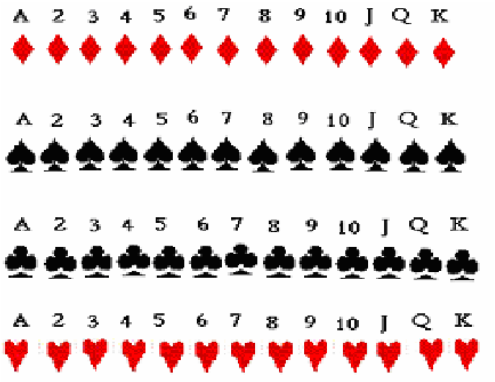
b) Are events E2 and E3 mutually exclusive?

c) Are events E3 and E4 mutually exclusive?

d) Are events E4 and E5 mutually exclusive?

e) Are events E5 and E1 mutually exclusive?

Solution to Question 16: The sample space of the experiment "card is drawn from a deck of cards" is shown below.



- a) E1 and E2 are **mutually exclusive** because there are no cards with an 8 and a king together.
- b) E2 and E3 are **not mutually exclusive** because a king is a face card.
- c) E3 and E4 are **mutually exclusive** because an ace is not a face card.
- d) E4 and E5 are **not mutually exclusive** because there is one card that has an ace and a heart.
- d) E5 and E1 are **not mutually exclusive** because there is one card that is an 8 of heart.

Question 17:

Two dice are rolled. We define events E1, E2, E3 and E4 as follows

E1: Getting a sum equal to 10

E2: Getting a double

E3: Getting a sum less than 4

E4: Getting a sum less to 7

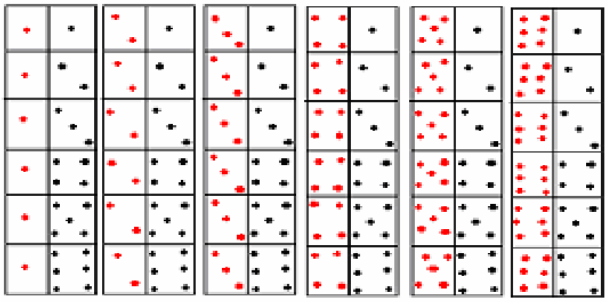
a) Are events E1 and E2 mutually exclusive?

b) Are events E2 and E3 mutually exclusive?

c) Are events E3 and E4 mutually exclusive?

d) Are events E4 and E1 mutually exclusive?

Solution to Question 17: The sample space of the experiment "2 dice" is shown below.



- a) E1 and E2 are **not mutually exclusive** because outcome (5,5) is a double and also gives a sum of 10. The two events may occur at the same time.
- b) E2 and E3 are **not mutually exclusive** because outcome (1,1) is a double and gives a sum of 2 and is less than 4. The two events E2 and E3 may occur at the same time.
- c) E3 and E4 are **not mutually exclusive** a sum can be less than 7 and less than 4 a the same time. Example outcome (1,2).
- d) E4 and E1 are **mutually exclusive** because a sum less than 7 cannot be equal to 10 at the same time. The two events cannot occur at the same time.

Exercise Problems :

1. In a simultaneous throw of tow coins the probability of getting at least one head is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$ [ ]

2. Three unbiased coins are tossed. What is the probability of getting at least 2 heads ?

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{8}$ [ ]

3. Three unbiased coins are tossed what is the probability of getting at most two heads?

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{3}{8}$ (d) $\frac{7}{8}$ [ ]

4. A die is rolled, find the probability that the number obtained is greater than 4.

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{3}{8}$ (d) $\frac{7}{8}$ [ ]

5. Two coins are tossed, find the probability that one head only is obtained.

(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{8}$ (d) $\frac{7}{8}$ [ ]

6. Two dice are rolled, find the probability that the sum is equal to 5.

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{1}{9}$ (d) $\frac{7}{8}$ [ ]

7. A card is drawn at random from a deck of cards. Find the probability of getting the King of heart.

(a) $\frac{1}{4}$ (b) $\frac{1}{13}$ (c) $\frac{3}{8}$ (d) $\frac{1}{52}$ [ ]

8. In a single throw of a die, what is the probability of getting a number greater than 4 ?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{1}{4}$ [ ]

9. In a simultaneous throw of two dice , what is the probability of getting a total of 7 ?

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$ [ ]

10. What is the probability of getting a sum 9 from two throws of a dice ?

(a) $\frac{1}{6}$ (b) $\frac{1}{8}$ (c) $\frac{1}{9}$ (d) $\frac{1}{12}$ [ ]

11. In a simultaneous throw of two dice, what is the probability of getting a doublet ?

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$ (c) $\frac{2}{3}$ (d) $\frac{3}{7}$ [ ]

12. In a simultaneous throw of two dice, what is the probability of getting a total of 10 or 11?

(a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{7}{12}$ (d) $\frac{5}{36}$ [ ]

13. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even ?

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{3}{8}$ (d) $\frac{5}{16}$ [ ]

14. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn bear a number which is multiple of 3 ?

(a) $\frac{3}{10}$ (b) $\frac{3}{20}$ (c) $\frac{2}{5}$ (d) $\frac{1}{2}$ [ ]

15. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn bear a number which is multiple of 3 or 5 ?

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{8}{15}$ (d) $\frac{9}{20}$ [ ]

16. In a lottery, there are 10 prizes and 25 blanks. A lottery is drawn at random. What is the probability of getting a prize?

(a) $\frac{1}{10}$ (b) $\frac{2}{5}$ (c) $\frac{2}{7}$ (d) $\frac{5}{7}$ [ ]

17. One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a FACE card ?

(a) $\frac{1}{13}$ (b) $\frac{4}{13}$ (c) $\frac{1}{4}$ (d) $\frac{9}{52}$ [ ]

18. A card is drawn from a pack of 52 cards. The probability of getting a queen of club or a king of heart is

(a) $\frac{1}{13}$ (b) $\frac{2}{13}$ (c) $\frac{1}{26}$ (d) $\frac{1}{52}$ [ ]

19. One card is drawn from a pack of 52 cards. What is the probability that the card drawn is either a red card or a king?

(a) $\frac{1}{2}$ (b) $\frac{6}{13}$ (c) $\frac{7}{13}$ (d) $\frac{27}{52}$ [ ]

20. From a pack of 52 cards, one card is drawn at random. What is the probability that the card drawn is a ten or a spade ?

(a) $\frac{4}{13}$ (b) $\frac{1}{4}$ (c) $\frac{1}{13}$ (d) $\frac{1}{26}$ [ ]

21. The probability that a card is drawn from a pack of 52 cards will be a diamond or a king is:

(a) $\frac{2}{13}$ (b) $\frac{4}{13}$ (c) $\frac{1}{13}$ (d) $\frac{1}{52}$ [ ]

22. From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings?

(a) $\frac{1}{15}$ (b) $\frac{25}{57}$ (c) $\frac{35}{256}$ (d) $\frac{1}{221}$ [ ]

23. Two cards are drawn together from a pack of 52 cards. The probability that one is a spade and one is a heart, is :

(a) $\frac{3}{20}$ (b) $\frac{29}{34}$ (c) $\frac{47}{100}$ (d) $\frac{13}{102}$ [ ]

24. Two cards are drawn from a pack of 52 cards. The probability that either both are read or both are kings, is:

(a) $\frac{7}{13}$ (b) $\frac{3}{26}$ (c) $\frac{63}{221}$ (d) $\frac{55}{221}$ [ ]

25. A bag contains 6 black and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white?

(a) $\frac{3}{4}$ (b) $\frac{4}{7}$ (c) $\frac{1}{8}$ (d) $\frac{3}{7}$ [ ]

26. A box contains 5 green. 4 yellow and 3 white marbles. Three marbles are drawn at random. What is the probability that they are not of the same colour ?

(a) $\frac{3}{44}$ (b) $\frac{3}{55}$ (c) $\frac{52}{55}$ (d) $\frac{41}{44}$ [ ]

27. A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. The probability that all of them are red, is ;

(a) $\frac{1}{22}$ (b) $\frac{3}{22}$ (c) $\frac{2}{91}$ (d) $\frac{2}{77}$ [ ]

28. A bag contains 6 white and 4 red balls. Three balls are drawn at random what is the probability that one ball is red and the other two are white?

(a) $\frac{1}{2}$ (b) $\frac{1}{12}$ (c) $\frac{3}{10}$ (d) $\frac{7}{12}$ [ ]

29. A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random . what is the probability that none of the balls drawn is blue?

(a) $\frac{10}{21}$ (b) $\frac{11}{21}$ (c) $\frac{2}{7}$ (d) $\frac{5}{7}$ [ ]

30. In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?

(a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{7}{19}$ (d) $\frac{8}{21}$ [ ]

31. A box contain 10 black and 10 white balls. The probability of drawing two balls of the same colour is :

(a) $\frac{9}{19}$ (b) $\frac{9}{38}$ (c) $\frac{10}{19}$ (d) $\frac{5}{19}$ [ ]

32. A box contain 4 red balls, 5 green balls and 6 white balls. A ball is drawn at random from the box. What is the probability that the ball drawn is either red or green ?

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{1}{5}$ (d) $\frac{7}{15}$ [ ]

33. In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1girl and 2 boys are selected is :

(a) $\frac{21}{46}$ (b) $\frac{25}{117}$ (c) $\frac{1}{50}$ (d) $\frac{3}{25}$ [ ]

34. Four persons are chosen at random from a group of 3 men , 2 women and 4 children. The chance that exactly 2 of them are children is:

(a) $\frac{1}{9}$ (b) $\frac{1}{5}$ (c) $\frac{1}{12}$ (d) $\frac{10}{21}$ [ ]

35. A box contains 20 electric bulbs, out of which 4 are defective. Two bulbs are chosen at random from this box. The probability that at least one these defective is:

(a) $\frac{4}{19}$ (b) $\frac{7}{19}$ (c) $\frac{12}{19}$ (d) $\frac{21}{95}$ [ ]

36. In a class, 30% of the students offered English, 20% offered Hindi and 10 % offered both. If a student is selected at random, what is the probability that he has offered English or Hindi ?

(a) $\frac{2}{5}$ (b) $\frac{3}{4}$ (c) $\frac{3}{5}$ (d) $\frac{3}{10}$ [ ]

37. Two dice are tossed. The probability that the total score is a prime number is;

(a) $\frac{1}{6}$ (b) $\frac{5}{12}$ (c) $\frac{1}{2}$ (d) $\frac{7}{9}$ [ ]

38. A speaks truth in 75% cases and B in 80% of the cases. In what percentage of cases are they like to contradict each other, narrating the same incident?

(a)5% (b)15% (c)35% (d)45% [ ]

39. A man and his wife appear in an interview for two vacancies in the same post. The probability of husband's selection is (1/ 7) and the probability of wife's selection is (1/5). What is the probability that only one of them is selected?

(a) $\frac{4}{5}$ (b) $\frac{2}{7}$ (c) $\frac{8}{15}$ (d) $\frac{4}{7}$ [ ]

40. A pair of dice is rolled. What is the probability of getting a sum of 2?

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{1}{36}$ (d) $\frac{4}{7}$ [ ]

41. A large basket of fruit contains 3 oranges, 2 apples and 5 bananas. If a piece of fruit is chosen at random, what is the probability of getting an orange or a banana?

(a) $\frac{4}{5}$ (b) $\frac{1}{2}$ (c) $\frac{1}{36}$ (d) $\frac{7}{10}$ [ ]

42. In a class of 30 students, there are 17 girls and 13 boys. Five are A students, and three of these students are girls. If a student is chosen at random, what is the probability of choosing a girl or an A student?

(a) $\frac{19}{30}$ (b) $\frac{11}{15}$ (c) $\frac{17}{180}$ (d) $\frac{17}{10}$ [ ]

43. In a shipment of 100 televisions, 6 are defective. If a person buys two televisions from that shipment, what is the probability that both are defective?

(a) $\frac{3}{100}$ (b) $\frac{9}{2500}$ (c) $\frac{17}{180}$ (d) $\frac{1}{330}$ [ ]

44. Which of the following are mutually exclusive events when a single card is chosen at random from a standard deck of 52 playing cards?

(a) Choosing a 7 or choosing a club (b) Choosing a 7 or choosing a jack.

(c) Choosing a 7 or choosing a heart. (d) None of the above [ ]

45. Which of the following are mutually exclusive events when a day of the week is chosen at random?

(a) Choosing a Monday or choosing a Wednesday.

(b) Choosing a Saturday or choosing a Sunday

(c) Choosing a weekday or choosing a weekend day (d) All of the above [ ]

46. A single letter is chosen at random from the word TEACHER. All of the following are mutually exclusive events except:

(a) Choosing a T or choosing a consonant (b) Choosing a T or choosing a vowel

(c) Choosing an E or choosing a C (d) None of the above [ ]

47. A dresser drawer contains one pair of socks with each of the following colors: blue, brown, red, white and black. Each pair is folded together in a matching set. You reach into the sock drawer and choose a pair of socks without looking. You replace this pair and then choose another pair of socks. What is the probability that you will choose the red pair of socks both times?

(a) $\frac{19}{30}$ (b) $\frac{1}{25}$ (c) $\frac{17}{15}$ (d) $\frac{1}{15}$ [ ]

48. A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza?

(a) $\frac{729}{1000}$ (b) $\frac{81}{1000}$ (c) $\frac{17}{100}$ (d) $\frac{125}{1000}$ [ ]

49. Mr. Parietti needs two students to help him with a science demonstration for his class of 18 girls and 12 boys. He randomly chooses one student who comes to the front of the room. He then chooses a second student from those still seated. What is the probability that both students chosen are girls?

(a) $\frac{72}{145}$ (b) $\frac{81}{45}$ (c) $\frac{51}{145}$ (d) $\frac{25}{145}$ [ ]

50. In a shipment of 20 computers, 3 are defective. Three computers are randomly selected and tested. What is the probability that all three are defective if the first and second ones are not replaced after being tested?

(a) $\frac{7}{145}$ (b) $\frac{1}{45}$ (c) $\frac{1}{1145}$ (d) $\frac{1}{1140}$ [ ]

Answers with Solutions :

1. (d)

   Here S = $\{HH, HT, TH, TT\}$

   Let E = event of getting at least one head = { HH, TH, HH}

   $$P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$$

2. (b)

   Here S = { TTT, TTH, THT, HTT, THH, HTH, HHT, HHH}

   Let E = event of getting at least two heads = { THH, HTH, HHT,HHH}

   $$P(E) = \frac{n(E)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

3. (d)

   Here S = { TTT, TTH, THT, HTT, THH, HTH, HHT, HHH}

   Let E = event of getting at most two heads

Then E = { TTT, TTH, THT, HTT, THH, HTH, HHT}

   $$P(E) = \frac{n(E)}{n(S)} = \frac{7}{8}$$

4. (a) 2 / 6 = 1 / 3
5. (b) 2 / 4 = 1 / 2
6. (c) 4 / 36 = 1 / 9
7. (d) 1 / 52
8. (b)

   When a die is thrown, we have S = { 1,2,3,4,5,6}

   Let E = event of getting at most two heads.

   Then E = {TTT,TTH,THT,HTT,THH,HTH,HHT}

   $$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

9. (a)

   We know that in a simultaneous throw of two dice, n(S) = 6X6 = 36

   Let E = event of getting a total of 7 = {(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)}

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

10. (c)

In two throws of a die, n(S) = 6X6=36

Let E = event of getting a sum 9 = { (3,6),(4,5), (5,4),(6,3)}

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

11. (a)

In two throws of a die, n(S) = 6X6=36

Let E = event of getting a doublet = { (1,1), (2,2),(3,3),(4,4),(5,5),(6,6)}

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

12. (d)

In two throws of a die, n(S) = 6X6=36

Let E = event of getting a total of 10 or 11 = {(4,6),(5,5),(6,4),(5,6),(6,5)}

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{36}$$

13. (b)

In a simultaneous throw of two dice, we have n(S) = (6X6) = 36

Let E = event of getting two numbers whose product is even

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

$\therefore n(E) = 27 \qquad \therefore P(E) = \frac{n(E)}{n(S)} = \frac{27}{36} = \frac{3}{4}$

14. (a)

Here, S = { 1,2,3,4,5,……..,20}

Let E = event of getting a multiple of 3 or 5 = { 3, 6, 9, 12, 15, 18}

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{6}{20} = \frac{3}{10}$$

15. (d)

Here, S = { 1,2,3,4,5,……..,20}

Let E = event of getting a multiple of 3 or 5 = { 3, 6, 9, 12, 15, 18, 5, 10, 15}

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{9}{20}$

16. (c)

P(getting a prize) $= \frac{10}{(10+25)} = \frac{2}{7}$

17. (b)

Clearly there are 52 cards, out of which there are 16 face cards

$\therefore$ P(getting a face card) $= \frac{16}{52} = \frac{4}{13}$

18. (c)

Here, n(S) = 52

Let E = event of getting a queen for club or a king of heart

Then, n(E) = 2

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$

19. (c)

Here, n(S) = 52

There are 26 red cards (including 2 kings) and there are 2 more kings.

Let E = event of getting a red card or a king

Then n(E) = 28

$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{28}{52} = \frac{7}{13}$

20. (a)

Here, n(S) = 52

There are 13 spades (including one ten) and there are 3 more tens.

Let E = event of getting a ten or a spade.

Then, n(E) = (13+3) = 16

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{16}{52} = \frac{4}{13}$$

21. (b)

Here, n(S) = 52

There are 13 cards of diamond (including one king) and there are 3 more kings.

Let E = event of getting diamond or a king

Then, n(E) = (31+3) = 16

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{16}{52} = \frac{4}{13}$$

22. (d)

Let s be the sample space. Then ,

$$n(S) = {}^{52}C_2 = 1326$$

Let E be the event of getting 2 kings out of 4

$$n(E) = {}^{4}C_2 = 6$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{6}{1326} = \frac{1}{221}$$

23. (d)

Let s be the sample space. Then ,

$$n(S) = {}^{52}C_2 = 1326$$

Let E = event of getting 1 spade and 1 heart

$\therefore$ n(E) = number of ways of choosing 1 spade out of 13 and 1 heart out 13

$$n(E) = {}^{13}C_1 X\ {}^{13}C_1 = 169$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{169}{1326} = \frac{13}{102}$$

24. (d)

Let s be the sample space. Then ,

$$n(S) = {}^{52}C_2 = 1326$$

Let E_1 = event of getting both red cards,

E_2 = event of getting both kings.

Then $E_1 \cap E_2$ = event of getting 2 kings of red cards.

$$\therefore \quad n(E_1) = {}^{26}C_2 = 325 \qquad n(E_2) = {}^{4}C_2 = 6$$

$$n(E_1 \cap E_2) = {}^{2}C_2 = 1$$

$$\therefore P(E_1) = \frac{n(E_1)}{n(S)} = \frac{325}{1326}; \quad \therefore P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{1326}$$

$$\therefore P(E_1 \cap E_2) = \frac{n(E_1 \cap E_2)}{n(S)} = \frac{1}{1326}$$

$$\therefore P(\text{both red or both kings}) = P(E_1 \cup E_2)$$

$$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

$$= \left(\frac{325}{1326} + \frac{6}{1326} - \frac{1}{1326}\right) = \frac{55}{221}$$

25. (b)

Total number of balls = (6+8) = 14

Number of white balls = 8

P(drawing a white ball) = $\frac{8}{14} = \frac{4}{7}$

26. (d)

Let S be the sample space. Then

n(S) = number of ways of drawing 3 marbles out of 12

$= {}^{12}C_3 = 220$

Let E be the event of drawing 3 balls of the same colour

Then, E = Event of drawing (3 balls out of 5) or (3 balls out of 40 or (3 balls out of 3)

$$n(E) = ({}^{5}C_3 + {}^{4}C_3 + {}^{3}C_3) = 15$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{15}{220} = \frac{3}{44}$$

$$\therefore \text{Required Probability} = (1 - \frac{3}{44}) = \frac{41}{44}$$

27. (c)

Let S be the sample space. Then

n(S) = number of ways of drawing 3 balls out of 15 = $^{15}C_3 = 455$

Let E = event of getting all the 3 red balls.

$$\therefore n(E) = {}^5C_3 = 10$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{10}{455} = \frac{2}{91}$$

28. (a)

Let S be the sample space. Then

n(s) = number of ways of drawing 3 balls out of 10

$$\therefore n(S) = {}^{10}C_3 = 120$$

let E = event of drawing 1 red and 2 white balls

$\therefore$ n(E) = Number of ways of drawing 1 red ball out of 4 and 2 white balls out of 6

$$n(E) = ({}^4C_1 + {}^6C_2) = 60$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{60}{120} = \frac{1}{2}$$

29. (a)

Total number of balls = (2+3+2) = 7

Let S be the sample space. Then

n(S) = Number of ways of drawing 2 balls out of 7 = $^7C_2 = 21$

Let E = event of drawing 2 balls, none of which is blue.

n(E) = Number of ways of drawing 2 balls out of (2+3) balls

$$\therefore n(E) = {}^5C_2 = 10$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{10}{21}$$

30. (d)

Total number of balls = (8+7+6) =21

Let E = event that the ball drawn is neither red nor green

= event that the ball drawn is red

$$\therefore n(E) = 8$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{8}{21}$$

31. (a)

Total number of balls = 20

Let S be the sample space. Then,

n(S) = Number of ways of drawing 2 balls out of 20 $= {}^{20}C_2 = 190$

Let E = event of drawing 2 balls of the same colour

$$n(E) = ({}^{10}C_2 + {}^{10}C_2) = 90$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{90}{190} = \frac{9}{19}$$

32. (b)

Total number of balls = (4+5+6) = 15

$$\therefore n(S) = 15$$

Let E_1 = event of drawing a red ball

And E_2 = event of drawing a green ball.

Then $E_1 \cap E_2 = \phi$

$$\therefore P(E_1 \cup E_2) = P(E_{11}) + P(E_2) = \frac{4}{15} + \frac{5}{15} = \frac{3}{5}$$

33. (a)

Let S be the sample space and E be the event of selecting 1 girl and 2 boys. Then

n(S) = Number of ways of selecting 3 students out of 25

$$\therefore n(S) = {}^{25}C_3 = 2300$$

$$n(E) = ({}^{10}C_1 + {}^{15}C_2) = 1050$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{1050}{2300} = \frac{21}{46}$$

34. (d)

Let S be the sample space and E be the event of choosing four persons such that 2 of them are children. Then,

n(S) = Number of ways of choosing 4 persons out of 9

$$\therefore n(S) = {}^{9}C_4 = 126$$

n(E) = Number of ways of choosing 3 children out of 4 and 2 persons out of (3+2) persons

$$n(E) = ({}^{4}C_2 + {}^{5}C_2) = 60$$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{60}{126} = \frac{10}{21}$$

35. (b)

P(None is defective) $= \frac{{}^{16}C_2}{{}^{20}C_2} = \frac{12}{19}$

P(at least one is defective) $= 1 - \frac{12}{19} = \frac{7}{19}$

36. (a)

$$P(E) = \frac{30}{100} = \frac{3}{10} \quad P(H) = \frac{20}{100} = \frac{1}{5} \quad P(E \cap H) = \frac{10}{100} = \frac{1}{10}$$

$$P(E \cup H) = P(E) + P(H) - P(E \cap H) = (\frac{3}{10} + \frac{1}{5} - \frac{1}{10}) = \frac{2}{5}$$

37. (b)

clearly n(S) = 6X6 = 36

Let E = Event that the sum is a prime number.

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

n(E) = 15

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

38. (c)

Let A = Event that A speaks the truth

And B = Event that B speaks the truth

Then, $P(A) = \frac{75}{100} = \frac{3}{4}$ $P(B) = \frac{80}{100} = \frac{4}{5}$

$\therefore P(\overline{A}) = (1 - \frac{3}{4}) = \frac{1}{4}$ and $P(\overline{B}) = (1 - \frac{4}{5}) = \frac{1}{5}$

P(A and B contradicts each other)

= P{(A speaks the truth and B tells a lie) or (A tells a lie and B Speaks the truth)}

$= P\{(A \text{ and } \overline{B}) \text{ or } (\overline{A} \text{ and } B)\}$

$= P\{(A \cap \overline{B}) \cup (\overline{A} \cap B)\}$

$= P(A).P(\overline{B}) + P(\overline{A}).P(B)$

$= (\frac{3}{4} X \frac{1}{5}) + (\frac{1}{4} X \frac{4}{5})$

$= \frac{7}{20}$

$= \frac{7}{20} X 100\% = 35\%$

$\therefore$ *A and B contradicts each other in* 35% *of the cases.*

39. (b)

Let A = Event that the husband is selected

And B = Event that the wife is selected.

Then, $P(A) = \frac{1}{7}$ *and* $P(B) = \frac{1}{5}$

$\therefore P(\overline{A}) = (1 - \frac{1}{7}) = \frac{6}{7}$ and $P(\overline{B}) = (1 - \frac{1}{5}) = \frac{4}{5}$

Required probability $= P\{(A \text{ and } \overline{B}) \text{ or } (\overline{A} \text{ and } B)\}$

$= P\{(A \cap \overline{B}) \cup (\overline{A} \cap B)\}$

$= P(A).P(\overline{B}) + P(\overline{A}).P(B)$

$= \left(\frac{1}{7} X \frac{4}{5}\right) + \left(\frac{1}{5} X \frac{6}{7}\right) = \frac{2}{7}$

40. (c)

41. (a)

42. (a)

43. (d)

44. (b)

45. (d)

46. (a)

47. (b)

P(red) = $\frac{1}{5}$

P(red and red) = P(red). P(red) = $\frac{1}{5} \cdot \frac{1}{5} = \frac{1}{25}$

48. (a)

P(student 1 likes pizza) = $\frac{9}{10}$

P(student 2 likes pizza) = $\frac{9}{10}$

P(student 3 likes pizza) = $\frac{9}{10}$

P(student 1 and student 2 and student 3 like pizza) = $\frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} = \frac{729}{1000}$

49. (c)

P(Girl 1 and Girl 2) = $\frac{18}{30} \cdot \frac{17}{29} = \frac{306}{780} = \frac{51}{145}$

50. (d)

P(3 defectives) = $\frac{3}{20} \cdot \frac{2}{19} \cdot \frac{1}{18} = \frac{1}{1140}$

Authors' Note

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