MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

PROBABILITY

Examples

1. Two childern are selected at random from a group of 2 boys and 3 girls. Write down the sample space of this random experiment.

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2. A bag contains 3 red and 2 black balls, three balls are drawn at random from this bag. Write down the sample space associatad to this random

experiment of drawing 3 balls from the bag.

3. An unbiased coin is tossed . If the outcome of the random experiment of tossing the coin is head,we draw a ball from an urn containing 4 red and 3 white balls. But if the coin shows a tail, we throw an unbiased die. Find the sample space associated to this random experiment.

4. An unbiased die is thrown.If it shows an even face then we toss an unbiassed coin once. If it shows an odd face then the unbiased coin is tossed twice. Find the sample space associated with the random experiment.

5. An urn contains 1 white ball and 4 identical black balls, two balls are drown in succession from the urn (i) without replacemnet (ii) with replancement, find the sample spaces of the random experiments (i) and (ii).

6. Write down the sample spaces of the random experiments of

(i) tossing an unbiassed coin until a head appears,

(ii) throwing an unbiased die until a 2 turns up.

7. An unbiased coin is tossed . If the outcome is a tail, an unbiased dis is rolled . If the die shows an odd digit, the die is rolled again. Find the sample space associated with this random experiment

8. A ball is drawn at random from a bag containing 1 black ball and 1 green ball. If the drawn ball is black then it is replaced in the bag and again a ball is drawn from the bag. But if the first drawn ball is green, then a die is rolled .Write down the sample space associated with this random experiment.

9. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

Negation of B (i.e.not B)

10. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose

verbal descriptions are given below:

Only C occurs

11. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

Both B and C occur but not A

12. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

Exactly two events occur

13. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

At least one event occur

14. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

None occurs

15. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

Only C occurs

16. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

At least two events occur

17. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

Atmost two events occur

18. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose

verbal descriptions are given below:

Event of occurrence of A and B

19. In the random experiment of drawing a card from a well shuffed pack of 52 cards, let A,B,C and D be the events that the drawn card is a club, a diamond , a heart and a spade respectively. Examine whether the events A,B,C and D are mutually exclusive and exhaustive.

20. Two unbiased dice are thrown .Let A be the event that the sum of the digits shown on the two dice is 5 and B be the event that at least one of the dice shows up a 5.

Are the two events

i. mutually exclusice?

(ii) exhaustive?

Give arguments in support of your answer.

21. Describe the following events A,B, and C in the random experiment of tossing three unbiased coins :

A: event of getting two heads,

B: event of getting three heads.

C: event of getting atmost one head.

Show that

(i) B is a simple event while A and C are compound events,

(ii) events A,B,C are mutually exclusive and exhaustive.

22. Describe the following events A,B, and C in the random experiment of selecting two children from a group of 3 boys and 2 girls:

A= both selected children are boys.

B= selected children consists of one boy and one girl.

Which pair (or , pairs) of events is (are) mutually exclusive?

23. The numbers 2,3,4,5 and 6 written on five pieces of paper. Theses pieces of paper are put in a bag and then mixed thoroughly. A man draws at random two pieces of paper from the bag one after the other without replacement. Describe the following events associated with this random experiment :

A : the number on the first piece is less than the one on the second piece,

B: the sum of the numbers on the two pieces is 8 or 9 ,

C: the number on the first piece is odd and

D: the number on the second piece is greater than 4.

Is there any pair of events which are mutually exclusive?

24. Three unbaised coins are tossed simultaneously. Describe two events A and B which are mutually exclusive

25. Three fair coins are tossed once. Construct the sample space of the outcomes of the random experiment. Find the probability of getting two heads.

26. Two letters are drawn at random from the word HOME. Write down the sample space. Now find the probability that,

both the letters are vowels,

at least one is a vowels,

one of the letters chosen should be 'M'

27. If the letters of the word RAMESH be arranged at random, what is the probability that there are exactly 3 letters between A and E

28. Two balanced dice are thrown together. Write down the sample space. Now find the probability of obtaining (i) 4 in both the dice (ii) doublets and (iii) 2 in one and 5 in the other.

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29. Two unbiased dice are rolled together. Find the odds in favour of getting 2 digits, the sum of which is 7.

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30. What is the probability that if a fair coin is tossed six times we will get (i) exaclty two heads (ii) at least two heads?

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31. Four balanced dice are thrown together. Find the probability of getting different digits on the four dice.

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32. A bag contains 7 red and 5 white balls. 4 balls are drawn ar random. What is the probability that (i) all of them are red (ii) two of them would be red and two white?

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33. 3 cards are drawn at random from a pack of 52 cards. Find the probability of getting (i) 2 aces (ii) 2 spades (iii) 1 spade, 1 club 1 diamond (iv) 2 face cards (i.e., king, queen or jack) and (v) at least 1 king.

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34. The incidence of occupational disease is such that on the average 20% of workers suffer from it. If 10 workers are selected at random, find the probability that exactly 2 workers suffer from the disease.

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35. In a pack of 10 watches, 3 are known ot be defective. If 2 watches are selected at random from the pack, what is the probability that at least one is defective ?

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36. An urn contains N($= N_1 + N_2$) balls of which N_1 are white and N_2 red. If n balls are drawn at random, find the probability that among these exactly m balls are white.

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37. 40% of the students in a class are girls. If 60% and 70% fo the boys and the girls respectively of the class pass a certain test, what is the probability that a randomly selected student from the class will have passed the test?

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38. 4 boys and 2 girls occupy seats in a row at random. What is the probability that the girls occupy seats side by side?

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39. What is the chance that a leap year selected at random will contain 53 Sundays ?

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40. If 30 dates are named at random, what is the probability that 5 of them will be Sundays?

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41. In family there are 5 children. Find the probability that

(i) all of them will have different birthdays

(ii) two of them will have the same birthday and

(iii) at least two of them will have the same birthday (1 year = 365 days).

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42. It is known that a family has 3 childern and at least 1 of these 3 childern is boy. Find the probability that 2 of the 3 chilidren are boys.

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43. A 5 figure number is formed using the digits 0,1,2,3,4 without repetition. Find the probability of it being divisible by 4.

44. The three events A,B and C are mutually exclusive and exhaustive, if $P(B) = \dfrac{3}{2}P(A)$ and $P(C) = \dfrac{1}{3}P(A)$, find P(C).

45. Can the represent measures of probability ?

$P(A) = 0.4, P(A^c) = 0.52$

where A ∪ B ∪ C = S is the sure event and A,B,C are mutually exclusive.

46. Can the represent measures of probability ?

P(A) = 0.38, P(B) = 0.30, P(C) = 0.32

where A ∪ B ∪ C = S is the sure event and A,B,C are mutually exclusive.

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47. Can the represent measures of probability ?

P(A) = 0.5, P(B) = 0.4, P(B ∪ C) = 0.2

where A ∪ B ∪ C = S is the sure event and A,B,C are mutually exclusive.

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48. Can the represent measures of probability ?

P(A ∩ B) = 0.1, P(B) = 0.4, P(C) = 0.5

where A ∪ B ∪ C = S is the sure event and A,B,C are mutually exclusive.

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49. Can the represent measures of probability ?

P(A ∪ B) = 0.6, P(B) = 0.2, P(C) = 0.3

where A ∪ B ∪ C = S is the sure event and A,B,C are mutually exclusive.

50. If $P(A) = \dfrac{3}{4}$ and $P(B) = \dfrac{5}{8}$, show that,, $\dfrac{3}{8} \le P(A \cap B) \le \dfrac{5}{8}$,

Now if the value of $P(A \cap B)$ is taken to be $\dfrac{1}{2}$, calculate $P(A^c \cap B^c)$.

51. If $P(A - B) = \dfrac{1}{3}, P(A) = \dfrac{1}{2}$ and $P(B) = \dfrac{1}{3}$, calculate the

probability that our of the two events A and B , only B will occur.

52. If A and B are two events such that P(A) = P(B) = 1, then show that ,

P(A+B) = 1, P(AB) = 1

53. The probabilities of three events A,B,C are P(A) = 0.6, P(B) = 0.4 and P(C) = 0.5.If P(A $\cup$ B) = 0.8, P(A $\cap$ C) = 0.3 , P(A $\cap$ B $\cap$ C) = 0.2 and P(A $\cup$ B $\cup$ C) $\geq$ 0.85, show that, 0.2 $\leq$ $P(B \cap C)$ $\leq$ 0.35.

54. Two unbiased dice are thrown . Find the probabilty that the sum of the faces equals or exceeds 10.

55. A number is chosen at random from the first 50 positive integers. Find the probability that the chosen number is divisible by 4 or 5.

56. Two number are selected at random from 1,2,3,... 100 and are multiplied. Find the probability that the product thus obtained is divisible by 3.

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57. If from the numbers 1,2,3... 30 three are drawn at randomm find the probability that they are in G.P.

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58. Three contractors A,B,C are bidding for the construction of a new office building. The probability that C will get the contract is half the B's probability of getting the same: again, the probability that B will get the contract is $\frac{5}{7}$th of A's probability of getting the same. Find the probability of each to get the contract. (Assume that one of the three contractors A,B,C will get the contract.)

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59. Among the examinees in an examination, 25%, 30% and 45% failed in statistics, in mathematics and in at least one of statistics and mathematics respectively. An examincee is selected at random. Find the probability that he failed in statistics only.

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60. Out of 21 tickets marked with numbers , from 1 to 21 , three are drawn at random, find the probability that the three numbers on them are in A.P.

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Multiple Choice Typer Questions

1. If S is the sure event then-

    A. P(s) = 0

B. P(s) = 1

C. 0 $<$ P(s) $<$ 1

D. 1 $<$ P(s) $<$ 2

Answer: B

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2. If the events A,B, and C are mutully exclusive then $P(A \cup B \cup C) =$

A. P(A + B + C)

B. P(A) + P(B) + P(C) - $P(A \cap B \cap C)$

C. P(A) + P(B) + P(C) - $P(A \cap B)$ - $P(B \cap C)$

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

D. P(A) + P(B) + P(C)

Answer: D

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3. If the events A and B are not mutually exclusive then

P(A ∪ B) =

    A. P(A) + P(B)

    B. P(A) + P(B) + P(A ∩ B ∩ C)

    C. P(A) + P(B) - P(A ∩ B)

    D. P(A)-P(B)

Answer: C

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4. If the events A and B are mutually exclusive then-

    A. P(A ∩ B) = 0

    B. $P(A ∩ B)$ = 1

    C. 0 lt$P(A ∩ B)$ lt 1

D. 1 lt P(A ∩ B) lt 2

Answer: A

5. If the events A,B, and C are mutully exclusive then P(A $\cup$ B $\cup$ C) =

A. 0

B. 1

C. greater than 1

D. between 0 and 1

Answer: B

6. Two dice are rolled. The probability of getting a sum 7 is -

A. $\dfrac{5}{36}$

B. $\dfrac{6}{36}$

C. $\dfrac{7}{360}$

D. $\dfrac{8}{36}$

Answer: B

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7. For twos events A and B if $P(A \cup B) = \dfrac{3}{4}, P(A \cap B) = \dfrac{1}{4}, P(A) = \dfrac{2}{3}$ then $P(\overline{A} \cap B) =$

A. $\dfrac{5}{12}$

B. $\dfrac{3}{8}$

C. $\dfrac{1}{12}$

D. $\dfrac{7}{12}$

Answer: C

8. If the events A and B are equally likely, then P(A) =

A. P(B)

B. 0

C. 1

D. P(A ∪ B)

Answer: A

9. If the probability of occurrence of an event is $\frac{3}{7}$, then the odds in favour of the events are_

A. $3 : 7$

B. $7 : 3$

C. $3:4$

D. $4:3$

Answer: C

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10. If the odds in favour of an event are 7:3, then its probability of occurrence is -

A. $\dfrac{7}{3}$

B. $\dfrac{3}{7}$

C. $\dfrac{3}{10}$

D. $\dfrac{7}{10}$

Answer: D

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11. The number of equally likely event points contained in its sample space of an unbiased coin which is tossed three times in succession , is -

A. 6

B. 3

C. 8

D. 9

Answer: C

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12. The number of throwing n dice simultaneously, is -

A. 6n

B. n

C. 6^n

D. n^6

Answer: C

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13. If the probability of non-occurrence of an event is $\dfrac{4}{7}$ then the odds against the event are -

A. $4:7$

B. $7:4$

C. $4:3$

D. $3:4$

Answer: C

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14. If the odds against an event are $4:5$, then the probability of occurrence of the events is -

A. $\dfrac{5}{9}$

B. $\dfrac{4}{9}$

C. $\dfrac{4}{5}$

D. $\dfrac{1}{9}$

Answer: A

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15. A number is chosen at random from the first 11 natural numbers, then the probability that the chosen number is even, is -

A. $\dfrac{6}{11}$

B. $\dfrac{5}{6}$

C. $\dfrac{4}{11}$

D. $\dfrac{5}{11}$

Answer: D

16. An unbiased coin is tossed 3 times in succession, the probability of getting exactly one head is -

A. $\dfrac{1}{2}$

B. $\dfrac{5}{8}$

C. $\dfrac{3}{4}$

D. $\dfrac{3}{8}$

Answer: D

17. The probability of gettting 11 when an ordinary die is thrown twice is -

A. $\dfrac{1}{18}$

B. $\dfrac{1}{9}$

C. $\dfrac{1}{12}$

D. $\dfrac{5}{36}$

Answer: A

18. Two events A and B are mutually exclusive, if $P(A) = \dfrac{1}{2}$ and P(A ∪ B) $= \dfrac{2}{3}$, then the value of P(B) is -

A. $\dfrac{1}{4}$

B. $\dfrac{1}{6}$

C. $\dfrac{1}{3}$

D. $\dfrac{1}{5}$

Answer: B

19. Three events A,B and C are mutually exclusive and exhaustive: if P(A) = $\frac{3}{5}$ and $P(B) = \frac{1}{6}$ then the value of P(C) is -

A. $\frac{23}{30}$

B. $\frac{7}{30}$

C. $\frac{1}{10}$

D. $\frac{9}{10}$

Answer: B

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20. If $P(A \cap B) = \frac{5}{13}$, then the value of $P(A^c \cup B^c)$ is -

A. $\frac{4}{13}$

B. $\frac{6}{13}$

C. $\frac{7}{13}$

D. $\frac{8}{13}$

Answer: D

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1. Describe 'mutually exclusive' and 'mutually exhaustive' events and give examples with the help of a sample space.

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2. Describing a sample space, given examples of an elementary event, a sure event and an impossible event.

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3. Write down the classical (or mathematical) degintion of probability. State its limitations.

4. What do you mean by "odds in favour of an event" and " odds aginst an event " ?

5. Two events A and B are given. What conclusion can be made in each of the following cases:

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

6. Two events A and B are given. What conclusion can be made in each of the following cases:

P(A $\cup$ B) = 1

7. Two events A and B are given. What conclusion can be made in each of the following cases:

P(A) = P(B)

8. Two events A and B are given. What conclusion can be made in each of the following cases:

P(A $\cup$ B) = 1

9. Two events A and B are given. What conclusion can be made in each of the following cases:

P(A $\cap$ B) $\neq$ 0

10. Two events A and B are given. What conclusion can be made in each of the following cases:

P(A) ≠ P(B)

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11. If $\overline{A}$ and $\overline{B}$ are the events complementary to the events A and B respectively, prove that, $P(\overline{A}$ or $\overline{B}) = 1 - P(A \cap B)$.

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12. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

Only a

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13. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

Both A and B occur but not C.

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14. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

All the three events occus

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15. Let A,B,C be three arbitrary events connected with a random experment. Write down the set-theoretic notations of the events whose verbal descriptions are given below:

At least one event occur

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16. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

At least two events occur

17. Let A_1, A_2, A_3 be 3 evets related to a random experiment Under what conditions will be exhaustive and mutually exclusive?

18. Show that the probability that exaclty one of the events A and B occurs is P(A) + P(B) - 2P(AB).

19. Write down the sample spaces in each of the folloing random experiments:

Experiment of tossing an unbaised coin

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20. Write down the sample spaces in each of the folloing random experiments:

Experiment of tossing two balaned coins

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21. Write down the sample spaces in each of the folloing random experiments:

Experiment of throwing a coin 3 times in succession

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22. Write down the sample spaces in each of the folloing random experiments:

Experiment of rolling a balanced die

23. Write down the sample spaces in each of the folloing random experiments:

Experment of throwing a die two times in succession

24. Write down the sample spaces in each of the folloing random experiments:

An urn contains 2 red and 3 white balls , the experiment of drawing two balls from the urn

25. Write down the sample spaces in each of the folloing random experiments:

The experiment of tossing a coin until a tail appears.

26. A coin is tossed.if the outcome of the random experiment of tossing the coin is tail , we throw an unbiased die. But if the coin shows a head. We draw a ball from a bag containing 2 white and 3 back balls. Write down the sample space associated with this random experiment.

27. An unbiased coin is tossed. If the outcome of the random experiment of tossing the coin is tail, we throw an unbiased die. But if the coin shows a head, we draw ball froom a bag containning 2 white and 3 black balls. Write down the sample space associated with this random experiment

28. An unbiased die is rolled . If it shows an odd face, then we toss an unbiased coin once, if it shows an even face then the unbiased coin is tossed twice. Determine the sample space associated with this random experiment.

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29. A bag contains 1 red ball and 3 indentical white balls . Two balls are drawn in succession from the bag (i) without replacement (ii) replacement befor the second drawing. Find the sample spaces of the random experiment (i) and (ii).

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30. Find the sample space of the random experiment of throwing an unbiased die until a 1 turns up.

31. An unbiased coin is tossed. If the outcome is a head, an unbiased die is thrown. If the die shows an even face, the die is thrown again. Find the sample space associated with this random experiment .

32. A ball is drawn at random from a bag containing 1 black ball and 1 white ball. If the drawn ball is white , then it is replaced in the urn and again a ball is drawn from the urn . But if the first drawn ball is red , then a die is thrown. Find the sample space associated with this random experiment.

33. In the random rxperiment of rolling an unbiased die, let A be the event of getting a digit less than 4 and B be then event of getting a digit

greater than 3 , show that the events A and B are mutually exclusive and exhaustive.

34. In the random experiment of drawing a card from a well shuffed pack of 52 cards, let A,B,C and D be the events that the drawn card is a club, a diamond , a heart and a spade respectively. Examine whether the events A,B,C and D are mutually exclusive and exhaustive.

35. Let E denote the random experimnet of rolling two unbiased dice and A and B are two events connected with E. The event A occur if the sum of the digits shown on the two dice is 7 while the event B occurs if at least one of the dice shows up a 4. show that the events A and B neither mutually exclusive nor exhaustive.

36. Describe the following events A,B, and C in the random experiment of tossing three unbiased coins :

A: event of getting three tails

B: event of getting one head and

C: event of getting atmost one tail .

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37. Describe the following events A,B and C in the random experiment of selecting two children from a group of 2 boys and 3 girls:

A: both selected children are girls

B : at least one boy is selected

C: selected children consists of one boy and one girl.

Which pair (or, pairs) of events is (are) mutually exclusive?

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38. Three unbaised coins are tossed simultaneously. Describe two events A and B which are mutually exclusive,

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39. Three unbaised coins are tossed simultaneously. Describe two events E and F which are not mutually exclusive,

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40. Three unbaised coins are tossed simultaneously. Describe three events A, B and C which are mutually exclusive and exhaustive,

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41. Three unbaised coins are tossed simultaneously. Describe three events D, E and F which are mutually exclusive but not exhaustive

42. Can the following represent measures of probability :

P(A) = 0.2, P(B) = 0.7, P(C) = 0.1where (A $\cup$ B $\cup$ C) represents sure event

and A,B,C are mutually exclusive.

43. Can the following represent measures of probability :

P(A) = 0.4 , P(B) = 0.6 , P(C) = 0.2 where (A $\cup$ B $\cup$ C) represents sure

event and A,B,C are mutually exclusive.

44. Can the following represent measures of probability :

P(A $\cup$ B) =0.5, P(B) = 0.6, P(C)= 0.2where (A $\cup$ B $\cup$ C) represents sure

event and A,B,C are mutually exclusive.

45. Can the following represent measures of probability :

P(A) = 0.4 , P(B) = 0.6 , P(C) = 0.2 where (A ∪ B ∪ C) represents sure

event and A,B,C are mutually exclusive.

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46. Can the following represent measures of probability :

P(A) = 0.32, P(B) = 0.47, P(B ∪ C) = 0.68where (A ∪ B ∪ C) represents sure

event and A,B,C are mutually exclusive.

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47. Can the following represent measures of probability :

P(A) = 0.3, P(B') = 0.5, P(C') = 0.8 where (A ∪ B ∪ C) represents sure event

and A,B,C are mutually exclusive.

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48. For three mutually exclusive events X,Y and Z it is given that P(X) = 2P(Y) = 3P(Z) and $X \cup Y \cup Z$ = S where S denotes sure event. Find the value of P(X).

49. A number is chosen at random from the numbers 1, 2,..., 15. find the probability that the chosen number is (i) even (ii) odd and (iii) multiple of 3.

50. From a pack of 52 cards , 1 card is drawn at random. Find the chance of drawing a spade and also of not drawing a spade.

51. What is the probability of obtaining 7 points with the rolling of two dice?

52. What is the chance of picking a spade or an ace not of spade from a pack of 52 cards ?

53. A box contains 2 gold and 3 silver coins. Another box contains 3 gold and 3 silver coins. A box is chosen at random and a coin is drawn from it. If the selected coin is a gold coin, find the probability that it was drawn from the second box.

54. A fair die is thrown. Write down the sample space. What is the chance that either an odd number or a number greater than 4 will turn up ?

55. An unbiased coin is tossed two times. Write down the sample space. Hence , find the probability of getting exactly one head.

56. Given that a family of two children has a boy , what is the probability that the other also is a boy?

57. It is known that a family has 3 childern and at least 1 of these 3 childern is girl. Find the probability that all of the 3 chilidren are girl.

58. A and B are two events, not mutually exclusive, connected with a random experiment E. if $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$ and $P(A \cap B) = \frac{1}{2}$, Find the values of the following probabilites :

P(A ∪ B)

59. A and B are two events, not mutually exclusive, connected with a random experiment E. if $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$ and $P(A \cup B) = \frac{1}{2}$, Find the values of the following probabilites :

P(A ∩ B^c)

Where c stands for the complement.

60. A and B are two events, not mutually exclusive, connected with a random experiment E. if P(A) $= \dfrac{1}{4}$, $P(B) = \dfrac{2}{5}$ and $P(A \cup B) = \dfrac{1}{2}$,

Find the values of the following probabilites :

$P(A^c \cup B^c)$

Where c stands for the complement.

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61. A coin is tossed n times. Find the probability of odd numbers of heads.

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Short Answer Type Questions

1. For any two events A and B prove that, $P(A \cup B) \leq P(A) + P(B)$

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2. For any two events A and b prove that,

$$P(A) \geq P(A \cap B) \geq P(A) + P(B) - 1$$

3. For any two events A and b prove that,

$$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$$

4. Given $P(A) = a$, $P(B) = b$ and $P(A \cap B) = c$. Find the value

$$P(A^c \cup B^c)$$

5. Given $P(A) = a$, $P(B) = b$ and $P(A \cap B) = c$. Find the value

$$P(A^c \cup B)$$

6. Given $P(A) = a$, $P(B) = b$ and $P(A \cap B) = c$. Find the value $P(A^c \cap B^c)$

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7. Two fair dice are cast. Describe the sample space assoiated with it. Hence. Find the probability of obtaining a total of 5 points on these dice.

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8. If four unbiased coins are tossed, find the probability that there should be two talls.

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9. The distribution of weeky wages of 800 workers is given below : A worker is selected at random. Find the probability that his wages is (i) less than Rs. 200 (ii) more than Rs. 249 (iii) Rs. 100 and more but less than Rs.300.

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10. If the letters of the word TOWEL are arranged at random with no repetitions. What is the probability that there are exactly two letters between O and E ?

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11. Two balls are drawn at random from a bag containing 6 white and 4 black balls. Find the chance that one is white and the other is black.

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12. Three balls are drawn at random from a bag containing 8 black and 10 white balls. What is the chance that they are all white ? Also, find the odds in favour of the event and against the event .

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13. A box contains 10 balls of which 4 are black and 6 are red. Four balls are drawn at random. Find the probability of having exactly two red balls.

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14. An urn contains 5 black 6 red and 4 white balls.Five balls are drawn at random from the urn. Find the probability that all graduates? What is the probability of at least one graduate?

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15. 5 men in a company of 20 are graduates. If 3 men are picked out of the 20 at random, what is the probability that they are all graduates? What is the probability of at least one graduate?

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16. In a single cast with 3 dice what is the probability of throwing 3 sixes?

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17. In a single cast with 3 dice, find the chance of getting different digits.

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18. In a single cast with 3 dice, find the probability of getting same digits in two dice and different digit in the other.

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19. What is the chance of obtaining a sum of 8 in a single cast with two dice?

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20. Find the chance of throwing at least 8 in single cast with two dice.

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21. In a lot of 25 articles, 5 are defective. Four articles are drawn at random from the lot. Find the probability that exactly 2 of the drawn articles are defective.

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22. If an unbiased coin is tossed 7 times, find the probability of obtaining 4 'Hence and 3 'Tails'.

23. Eight unbiased coins are tossed at time . Show that the probabiility of obtaining 5 heads is exactly the same as the probability of obtaining 3 heads

24. In a family there are 4 children. Find the probability that (i) all of them will have different birthdays, (ii) two of them will have the same birthday (1 year = 365 days).

25. 5 sutdents A,B,C,D and E. occupy their seats at random in a bench. Find the probability that the students A and B are not consecutive.

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26. Five books on english and three books on mathematics are placed at random on a bookshelf . Find the probability that the books on mathematics are placed side by side.

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27. An executive committee of 6 is formed from 4 ladies and 7 gentlemen. Find the probability that the committee will consist of (i) exactly 2 lady members (ii) at least two lady members.

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28. Four cards are drawn at random from a full packet . Find the probability that two of then wil be spades.

29. A bag contains 10 rupee - coins, 7 fifty-paise coins and 4 twenty finve-paise coins. Fine the probability of drawing (i) a rupee-coin (ii) three rupee-coins and (iii) three coins, one of each type, in the random drawing of three coins from the bag.

30. What is the chance that a leap year selected at random will contain 53 Mondays? Find also the probability of having 53 Mondays in a year, which is not a leap year.

31. Two fair dice are thrown simultaneously. The two scores are then multiplied together. Calculate the probability that the product is (i) 12 and (ii) even.

32. Four one-rupee coins and three 50 paise coins are placed at random in line. Prove that the probability of the extreme coins being both 50 paise is $\dfrac{1}{7}$.

33. A box contains 40 envelopes of which 25 are ordinary (not meant for air mail) and 16 are unstamped, while the number of unstamped ordinary envelopes is 10. What is the probability that an envelope chosen from the box is a stamped air mail envelope?

34. In a group consisting of 80 men and 30 women, 15 per cent men and 40 per cent women are unemployed . Find the probability that a person selected at random is employed.

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35. Five Commerce and four Science students are arranged at random in a row. Find the probability so that the Commerce and Science students are placed alternately.

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36. Ten balls are distributed at random among three boxes. What is the probability that the first box will contain 3 balls?

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37. If the numbers 1,2,3....,n are arranged in a line at random what is the probability that the numbers 1 and 2 will appear next to each other?

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38. If P(A) $= \dfrac{1}{3}, P(B) = \dfrac{1}{2}, P(A \cap B) = \dfrac{1}{4}$,find the values of $P(B^c), P(A \cap B^c), P(A \cup B), P(A^c \cap B^c), P(A \cup B^c)$.

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39. Given that $P(E) = \dfrac{1}{3}, P(F) = \dfrac{1}{4}$ and $P(E \cap F) = \dfrac{1}{6}$, . Find the valu of $P(E^c \cup F)$.

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40. The probability that a contractor will get a plumbing contract is $\dfrac{2}{3}$ and the probability that he will not get an electric contract is $\dfrac{5}{9}$,if the

probability getting of at least one contract is $\dfrac{4}{5}$ then what is the probability that he will get both the contract?

41. A class consists of 30 boys and 20 girls of which half the boys, and half the girls have blue eyes. Find the probability that a student chosen at random is a boy or has blue eyes.

42. From 200 ticiets marked with the first 200 natural numbers, one is drawn at random , find the probability that it is multiple of 3 or 7.

43. There are 52 cards with each of two boys. Each draws a card at random. What is the probability that(i) both the cards will be king of

diamonds (ii) both be diamonds (iii) both will be kings?

44. If two numbers are selected at random from the numbers 1,2,3,4 determine the probability that their sum is odd when they are selected together.

45. A packer of 10 electronic components is known to include 3 defectives. If 4 components are random chosen and tested, what is the probability of finding among them not more than one defective?

46. A and B are two candidates seeking admission in joint Entrance. The probability that A is selected is 0.5 and the probability that both A and B

are selected is almost 0.3 . Is it prossible that the probability of B getting selected is 0.9?

Long Answer Type Questions

1. State and prove the " addition theorem" of probability for two mutually exclusive events.

2. Show that the non-mutually exclusive events A and B,

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

3. For any three events A, B and C, prove that.

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

$$- P(B \cap C) - P(C \cap A) + P(A \cap B \cap C).$$

4. Obtain $P(\overline{A} + B), P(A + \overline{B})$ in terms of P(A) , P(B) and P(AB), where $\overline{A}$ is the event complementary to the event A.

5. A five figure number is formed using the digits 5,6,7,8,0 without repetition. Find the probability of it being divisible by (i) 4 and (ii) 5.

6. Five different letters are put at random inside five addressed envelopes. Find the probability of putting exactly 2 letters in the correct envelopes.

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7. If 16 dates are named at random , what is the probability that 3 of them will be Sunday?

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8. A bag contains 50 tickets numbered 1,2,3,..., 50 , of which 5 are drawn at random and arranged in ascending order of their numbers $x_1 < x_2 < x_3 < x_4 < x_5$. What is the probability that $x_3 = 30$?

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9. X and Y stand in line at random with 10 other people what is the probability that there are 3 people between X and Y ?

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10. Twelve dissimilar balls are disributed at random into five boxes marked A,B,C,D,E. Find the probability that these boxes contain respectively 3,4,1,4,0, balls.

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11. Four different objects 1,2,3,4 are distributed at random on four places marked 1,2,3,4. what is the probability that no-object occupies the places corresponding to its numbers?

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12. From 100 tickets numbered $1, 2, 3, \ldots\ldots, 100$, four are drawn at random. What is the probability that 2 of them will bear numbers from 1 to 40 and the other 2 will bear any number from 41 to 100?

13. Events A,B,C are such that $P(A) = 0.3, P(B) = 0.4, P(C) = 0.8, P(A \cap B) = 0.08, P(A \cap C) = 0.2$ If $P(A \cup B \cup C) \geq 0.75$, Show that, $023 \leq P(B \cap C) \leq 0.48.$,

14. A,B,C and D are four mutually exclusive and exhuastive events. If the odds against the events B,C and D are $7 : 2$, $7 : 5$, and 13:5 respectively, find the odds in favour of the event A.

15. There unbiased dice are thrown at a time . What is the probability that the number 1 appears at lest once? Given that the number on the first die is 3. What is the probability that the sum of the numbers on the three dice is odd?

16. n biscuits are distributed at random among N different beggars, what is the probability that a particular beggar gets exactly r biscuits ?

Sample Questions For Competitive Exams

1. If A and B are two independent events of a random experiment and $P(A) = \frac{1}{2}/, P(B) = \frac{1}{5}$, then -

A. $P(A \cup B) = \frac{3}{5}$

B. $P\left(\dfrac{A \cup B}{A \cup B}\right) = 0$

C. $P\left(\dfrac{A}{A \cup B}\right) = \dfrac{5}{6}$

D. none of these

Answer: A,B,C

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2. If A and B are two events and P(A) $= \dfrac{3}{4}$, $P(B) = \dfrac{5}{8}$, then -

A. $P(A \cup B) \geq \dfrac{3}{4}$

B. $P(A' \cap B) \leq \dfrac{1}{4}$

C. $\dfrac{3}{8} \leq P(A \cap B) \leq \dfrac{5}{8}$

D. $\dfrac{3}{8} \leq P(A \cap B) \leq \dfrac{5}{8}$

Answer: A,B,C,D

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3. If A and B are two mutually exclusive events, then-

A. $P(A) \leq P(\overline{B})$

B. $P(A) > P(B)$

C. $P(B) \leq P(\overline{A})$

D. $P(A) < P(B)$

Answer: A,C

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4. A coin is tossed 2n times. The probability of getting head n times, is -

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5. For two events A and B , the correct statement is/ are -

A. $P(A \cap B) \geq P(A) + P(B) - 1$

B. $P(A \cap B) \leq P(A)$

C. $P(A' \cap B') \geq P(A') + P(B') - 1$

D. $P(A \cap B) = P(A). P(B)$

Answer: A,B,C

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6. If A and B are two events such that $P(A \cup B)$ = $\frac{3}{4}, P(A \cap B) = \frac{1}{2}$ and $P(A) = \frac{2}{3}$, then the value of 12 times of P(B) is -

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7. If A,B and C are three independent events such that $P(B) = \frac{3}{2}P(A)$ and $P(C) = \frac{1}{2}P(B)$, then the value of P(A) is $\frac{n}{13}$, find n -

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8. An ubiased die is thrown, getting an even number is 3 times the probability of getting an odd prime number then the number is-

9. A problem in mathematics is given to two students A and B. The probability of solving the problem is $\frac{3}{4}$ and $\frac{5}{7}$ respectively. If the probability that the problem is solved by both of them is $\frac{2n}{21}$, then the value of n is -

10. A fair coin is tossed 8 times, then the probability of getting 3H is $\frac{7n}{32}$, find n -

11. If the squares of a 8 × 8 chessboard are painted either red or black at random. The probability that not all the sqares in any column are alternate in colour is -

A. $\left(1 - \dfrac{1}{2^8}\right)^8$

B. $\dfrac{1}{2^{56}}$

C. $1 - \dfrac{1}{2^7}$

D. none of these

Answer: A

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12. If the squares of a 8 × 8 chessboard are painted either red or black at random. The probability that the chessboard contains equal number of red black square is -

A. $\dfrac{^{64}C_{32}}{2^{64}}$

B. $\dfrac{64!}{32!2^{64}}$

C. $\dfrac{2^{32} - 1}{2^{64}}$

D. none of these

Answer: A

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13. If the squares of a 8×8 chessboard are painted either red or black at random The probability that all the square in any column are of same colour and that of a row are alternate in colour is -

A. $\dfrac{1}{2^{64}}$

B. $\dfrac{1}{2^{63}}$

C. $\dfrac{1}{2}$

D. none of these

Answer: C

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14. Probability that husband is telling the truth is 0.8, and the probability that wife is telling the truth is 0.6 .what is the probability that both will give contradict options narrating on the same since

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15. Two dice are rolled.Let's r denotes the sum of the number appearing on the two dices , then calculate the probability that $\dfrac{r}{3}$ is an integer.

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16. Two dice are rolled the probability that the sum is neither 8 nor 9 is

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17. Each of the following question contain two statements- Statemnet I and statement II.

Each of the questions has following four choice A,B,C and D only one of which is correct.

Statement- I: If A,B,C the three mutually independent events, then A and B $\cup$ C are also independent events.

Statement- II: Two evetns A and B are independent if and only if $P(A \cap B) = P(A). P(B)$

A. Statement-I isi true, Statement- II is true and

Statement-II is a correct explandtion for Statement-I.

B. Statement-I isi true, Statement- II is true and

Statement-II is not a correct explandtion for Statement-I.

C. Statement-I isi true, Statement-II is false.

D. Statement-I isi false, Statement- II is true

Answer: A

18. Each of the following question contain two statements- Statemnet I and statement II.

Each of the questions has following four choice A,B,C and D only one of which is correct.

Statement - I $P(A) = 0.25$, $P(B) = 0.50$ and $P(A \cap B) = 0.14$, then the probability that neither A nor B occurs is 0.39.

Statement - II: $P(\overline{A \cup B}) = \overline{A} \cup \overline{B}$

A. Statement-I is true, Statement- II is true and

Statement-II is a correct explandtion for Statement-I.

B. Statement-I isi true, Statement- II is true and

Statement-II is not a correct explandtion for Statement-I.

C. Statement-I isi true, Statement-II is false.

D. Statement-I isi false, Statement- II is true

Answer: C

1. The three events A, B and C are mutually exclusive and exhaustive, If $P(B) = \dfrac{3}{2}P(A)$ and $P(C) = \dfrac{1}{3}P(B)$, find $P(C)$.

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2. Can the following represent measures of probability ?

$P(A) = 0.4, P(A^c) = 0.52$

where $A \cup B \cup C = S$ is the sure event that A, B, C are mutually exclusive.

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3. Can the following represent measures of probability ?

$P(A) = 0.38, P(B) = 0.30, P(C) = 0.32$

where $A \cup B \cup C = S$ is the sure event that A, B, C are mutually exclusive.

4. Can the following represent measures of probability ?

$$P(A) = 0.5, \ P(B) = 0.4, \ P(B \cup C) = 0.2$$

where $A \cup B \cup C = S$ is the sure event that A, B, C are mutually exclusive.

5. Can the following represent measures of probability ?

$$P(A \cap B) = 0.1, \ P(B) = 0.4, \ P(C) = 0.5$$

where $A \cup B \cup C = S$ is the sure event that A, B, C are mutually exclusive.

6. Can the following represent measures of probability ?

$$P(A \cup B) = 0.6, \ P(B) = 0.2, \ P(C) = 0.3$$

where $A \cup B \cup C = S$ is the sure event that A, B, C are mutually exclusive.

7. If $P(A) = \dfrac{2}{3}, P(B) = \dfrac{1}{2}$ and $P(A \cap B) = \dfrac{1}{6}$, find the value of $P(A \cup B), P(A/B), P(B/A), P(A \cap B^c), P(A^c \cap B^c)$ and $P(A^c \cup B^c)$

8. If $P(A) = \dfrac{2}{3}, P(B) = \dfrac{1}{2}$ and $P(A \cap B) = \dfrac{1}{6}$

State wheather the events A and B are

A. equally likely

B. mutually exclusive

C. exhaustive

D. independent.

Answer:

9. $P(A/B) = 0.75, P(B/A) = 0.6$ and $P(A) = 0.4.$ Evaluate $P(\overline{A}/\overline{B}).$

10. E_1 and E_2 are   two   independent   events   such   that $P(E_1) = 0.35$ and $P(E_1 \cup E_2) = 0.60,$ find $P(E_2).$

11. If $P(A/B) = \dfrac{1}{3}, P(B) = \dfrac{1}{4}$ and $P(A) = \dfrac{1}{2},$ find the probability that exactly one of the events A and B occurs.

12. If $P(A) = \dfrac{3}{4}$ and $P(B) = \dfrac{5}{8}$, show that, $\dfrac{3}{8} \leq P(A \cap B) \leq \dfrac{5}{8}$.

Now if the value of $P(A \cap B)$ is taken to be $\dfrac{1}{2}$, calculate $P(A^c \cap B^c)$.

13. A coin is tossed thrice. Let the event E be "the first throw results in a head" and the event F be "the last throw results in a tail." Find whether events E and F are independent.

14. If $P(A) = \dfrac{1}{4}, P(B) = \dfrac{1}{3}$ and $P(A - B) = \dfrac{1}{6}$, examine whether events A and B are independent.

15. If $P(A/B) = 1$ then prove that, $P(ABC) = P(BC)$.

16. Prove that, if $P(A/B) = P(A)$ then

$P(A^c/B) = P(A^c)$.

17. If $P(A - B) = \dfrac{1}{3}, P(A) = \dfrac{1}{2}$ and $P(B) = \dfrac{1}{3},$ calculate the probability that out of the two events A and B, only B will occur.

18. If A and B are two events such that $P(A) = P(B) = 1$, then show that, $P(A + B) = 1, P(AB) = 1$

19. If A and B are independent events with $P(A) > \dfrac{1}{2}$ and $P(B) > \dfrac{1}{2}$ and $P(A \cap B^c) = \dfrac{3}{25}$, $P(B \cap A^c) = \dfrac{8}{25}$, find out the values of P(A) and P(B).

20. If two events A and B are such as $P(A^c) = 0.3$, $P(B) = 0.4$ and $P(A \cap B^c) = 0.5$, find the value of $P[B/(A \cup B^c)]$.

21. If $P(A) = a$ and $P(B) = b$, show that, $P(A/B) \leq \dfrac{a}{b}$.

22. If $P(A) = P(A/B) = \dfrac{1}{4}$ and $P(B/A) = \dfrac{1}{2}$, check whether the following statements are true or false:

(a) A and B are mutually independent and

(b) $P(A^c / B) = \dfrac{3}{4}$.

23. The probabilities of three events A, B, C are $P(A) = 0.6$, $P(B) = 0.4$ and $P(C) = 0.5$. If $P(A \cup B) = 0.8$, $P(A \cap C) = 0.3$, $P(A \cap B \cap C) = 0.2$ and $P(A \cup B \cup$, show that, $0.2 \le P(B \cap C) \le 0.35$.

24. Given three arbitrary events A, B and C, express the following events in set-theoretic notation :

(i) only C occurs (ii) exactly two occur (iii) at least one occurs

25. The unbiased dice are thrown. Find the probability that the sum of the faces equals or exceeds 10.

26. A number is chosen at random from the first 50 positive integers. Find the probability that the chosen number is divisible by 4 or 5.

27. The odds in favour of an event are $4:3$. The odds against another independent event are $2:3$. What is the probability that at least one of the events will occur ?

28. Three indentical boxes contain red and white balls. The first box contains 3 red and 2 white, the second box 4 red and 5 white and the third box 2 red and 4 white balls. A box is chosen at random and a ball is drawn from it. If the drawn ball is red, what is the probability that the second box is chosen ?

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29. A bag contains 6 red and 4 balls. Two balls are drawn at random one after the other.Find the probability that both the drawn balls are white, when (i) the first drawn ball is not replaced before the second drawing, (ii) the first drawn ball is replaced before the second drawing.

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30. An insurance company insured 2000 scooter and 3000 motor cycles. Probability of an accident involving a scooter is 0.01 and that of a motor

cycle is 0.02. An insured vehicle met with an accident. Find the probability that the accident vehicle was a motor cycle.

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31. A machine operates only when all of its three components function. The probabilities of the failures of the first, second and third components are 0.14, 0.10 and 0.05 respectively. What is the probability that the machine will fail.

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32. Boxes I and II contain respectively 4 white, 3 red and 3 blue balls, and 5 white, 4 red and 3 blue balls. If one ball is drawn from each box, what is the probability that both the balls are of the same colour ?

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33. The odds against a man who is 45 years old, living till he is 70 are $7:5$ and the odds against his wife who is now 36, living till she is 61 are $5:3$. Find the probability that (a) the couple will be alive 25 years hence, (b) at least one of then will be alive 25 years hence.

34. Two groups are competing for the positions of the board of directors of a corporation. The probabilities that the first and the second groups will win are 0.6 and 0.4 respectively. Further, if the first group wins, the probability of introducing a new product is 0.7 and the corresponding probability is 0.3 if the second group wins. Find the probability that the new product is introduced was by the second group.

35. A picnic is arranged to be held on a particular day. The weather forecast says that there is 80% chance of rain on that day. If it rains, the

probability of a good picnic is 0.3 and if it does not, the probability is 0.9. What is the probability that the picnic will be good ?

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36. A speaks the truth in 60 percent of cases and B in 90 percent of cases. In what percentage of cases are they likely to contradict each other in stating the same fact ?

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37. Three contractors A, B, C are bidding for the construction of a new office building. The probability that C will get the contract is half the B's probability of getting the same, again, the probability that B will get the contract is $\frac{5}{7}$th of A's probability of getting the same. Find the probability of each to get the contract. (Assume that one of the three contractors A, B, C will get the contract.)

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38. A bag contains 8 white and 7 black balls. A ball is drawn at random from the bag and put into another bag which contains 5 white and 4 black balls. A ball is drawn randomly from the second bag. What is the probability that it is white ?

39. In a group of 20 males and 5 females, 10 males and 3 females are service holders. What is the probability that a person selected at random from the group, is a service holder, given that the selected person is a male ?

40. A pair of fair dice is thrown. Find the probability of getting a sum of 7, when it is known that the digit in the first die is greater than that of the second.

41. A die is thrown twice and the sum of the numbers appearing is observed to be 8. What is the conditional probability that the number 5 has appeared at least once ?

42. Three bags contain respectively 3 white, 2 red balls, 7 white, 3 red balls and 5 white, 3 red balls. If a bag is selected at random and one ball is drawn from it, what is the probability that it will be a white ball ?

43. A couple has 2 children. Find the probability that both are boys, if it is known that

(i) one of the children is a boy

(ii) the elder child is a boy

44. Among the examinees in an examination, 25%, 30% and 45% failed in statistics, in mathematics and in at least one of statistics and mathematics respectively. An examinee is selected at random. Find the probabilities that (i) he failed in statistics only (ii) he passed in statistics if it is known that he failed in mathematics.

45. Twelve cards numbered 1 to 12 are placed in a box, mixed up thoroughly and then a card is drawn at random from the box. If it is known that the number on the drawn card is more than 3, find the probability that it is an even number.

46. If three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls respectively, one ball is drawn at random, find the probability that the ball is black.

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47. A and B play alternately with a pair of unbiased dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, show that his chance of winning is $\dfrac{30}{61}$.

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48. $A_1, A_2, \ldots, A_n$ are independent events such that $P(A_i) = 1 - q_i, i = 1, 2, \ldots, n.$ Prove that,

$P(A_1 \cup A_2 \cup \ldots \cup A_n) = 1 - q_1 q_2 \ldots q_n.$

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49. Suppose that all the four possible outcomes e_1, e_2, e_3 and e_4 of an experiment are equally likely. Define the events A, B, C as

$A = \{e_1, e_4\}, B = \{e_2, e_4\}, C = \{e_3, e_4\}$

What can you say about the dependence or independence of the events A, B and C ?

50. Three urns A, B and C contain 6 red and 4 white, 2 red and 6 white and 1 red and 5 white balls respectively. An urn is chosen at random and a ball is drawn. If the ball drawn is found to be red, find the probability that the ball was drawn from the urn A.

51. Two urns contain respectively 2 red, 3 white and 3 red, 5 white balls. One ball is drawn at random from the first urn and transferred into the second. A ball is now drawn from the second urn and it turns out to be

red. What is the probability that the transferred ball from first urn was white ?

52. A factory has three machines X, Y and Z producing 1000, 2000 and 3000 bolts per day respectively. The machine X produces 1% defective balts, Y produces 1.5% defective bolts and Z produces 2% defective bolts. At the end of the day, a bolt is drawn at random and it is found to be defective. What is the probability that this defective bolt has been produced by the machine X ?

53. In a bulb factory, machines A, B and C manufacture 25% , 35% and 40% bulbs respectively. Out of thse bulbs 5% , 4% and 2% of the bulbs produced respectively by A, B and C are found to be defective. A bulb is picked up at random from the total production and found to be

defective. Find the probability that this bulb was produced by the machine B.

54. An insurance company insured 2000 scooter drivers. 4000 car drivers and 6000 truck drivers. The probabilities of an accident ionvolving a scooter, a car and a truck are $\dfrac{1}{100}$, $\dfrac{3}{100}$ and $\dfrac{3}{20}$ respectively. One of the insured persons meets an accident. What is the probability that he is scooter driver ?

55. A man is known to speak the truth 3 out of 4 times. He throws and unbiased die and reports that it is a six. Find the probability that it is actually six.

56. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find the probability of the lost card being a diamond.

57. A doctor is to visit a patient. From past experience, it is known that the probabilities that he will come by train, bus, scooter or by car are $\frac{3}{10}, \frac{1}{5}, \frac{1}{10}, \frac{2}{5}$ respectively. The probabilities that he will be late are $\frac{1}{4}, \frac{1}{3}, \frac{1}{12}$, if he comes by train, bus and scooter respectively, but if he comes by car he will not be late. When he arrives, he is late. What is the probability that he comes by train?

58. Urn A contains 1 white, 2 black and 3 red balls, urn B contains 2 white, 1 black and 1 red ball, and urn C contains 4 white, 5 black and 3 red balls. One urn is chosen at random and two balls are drawn. These happen to

be one white and one red. What is the probability that they come from

urn A ?

59. A car manufacturing factory has two plants X and Y. Plant X

manufactures 70% of the cars and plant Y manufactures 30%. At plant

X, 80% of the cars are rated of standard quality and at plant Y, 90% are

rated of standard quality. A car is picked up at random and is found to be

of standard quality. Find the probability that it has come from plant X.

60. There are three coins. One is two headed coin, another is a biased

coin that comes up head 75% of the time and third is an unbiased coin.

One of the three coins is chosen at random and tossed. If it shows head,

what is the probability that it was the two headed coin ?

1. Which of the following is true ?

A. The probability that a mineral sample will contain copper is 0.28

and the probability that it will contain copper and iron is 0.36 ,

B. If A and B are two independent events, then the two events A anb

B^c are also independent,

C. If A and B are two independent events then the two events A^c and

B^c are also independent,

D. If $P(A) \neq 0, P(B) \neq 0$ and the events A and B are independent,

then events A and B may be mutually exclusive.

Answer: C

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2. For any two events A and B, which of the following is true ?

A. $P(A \cup B) \le P(A) + P(B)$

B. $P(A/B) > P(B/A)$ if $P(A) < P(B)$

C. $P(A \cap B) \le P(A) + P(B) - 1$

D. $P(A^c \cup B^c) = 1 - P(A \cap B)$

Answer: A

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3. Which of the following is true ?

A. $P(A^c \cap B^c)$ represents the probability of non-occurrence of events

A or B.

B. If events A, B and C are mutually exclusive and S is the sure event,

then $P(A \cup B \cup C) = 1$.

C. $P(A^c \cup B^c)$ represents the probability of simultaneous occurrence

of events A and B.

D. If A is a simple event and B is a compound event connected with a

random experiment, then $P(A) > P(B)$.

Answer: B

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4. Which of the following is true ?

A. If the events A and B are dependent, then $P(A/B^c) = P(A)$,

B. If the events A and B are not mutually exclusive, then

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

C. The sample space of the random experiment of throwing n fair dice

simultaneously contains 6n equally likely event points.

D. If an unbiased coin is tossed five times in succession, then its sample space contains 32 equally likely event points.

Answer: D

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5. If the probability of occurrence of an event is $\dfrac{5}{8}$, then the odds in favour of the event are -

A. $5 : 13$

B. $5 : 3$

C. $3 : 5$

D. $8 : 13$

Answer: B

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6. If the odds in favour of an event are $9:4$, then its probability of occurrence is -

A. $\dfrac{9}{13}$

B. $\dfrac{4}{13}$

C. $\dfrac{4}{9}$

D. $\dfrac{5}{13}$

Answer: A

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7. If the probability of non-occurrence of an event is $\dfrac{4}{7}$, then the odds against the event are -

A. $4:7$

B. $7:4$

C. $4:3$

D. $3:4$

Answer: C

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8. If the odds against an event are $4:5$, then the probability of occurrence

of the event is -

A. $\dfrac{5}{9}$

B. $\dfrac{4}{9}$

C. $\dfrac{4}{5}$

D. $\dfrac{1}{9}$

Answer: A

9. A number is chosen at random from the first 11 natural numbers, then the probability that the chosen number is even is -

A. $\dfrac{6}{11}$

B. $\dfrac{5}{6}$

C. $\dfrac{4}{11}$

D. $\dfrac{5}{11}$

Answer: D

10. An unbiased coin is tossed 3 times in succession, then the probability of getting exactly one head is -

A. $\dfrac{1}{2}$

B. $\dfrac{5}{8}$

C. $\dfrac{3}{4}$

D. $\dfrac{3}{8}$

Answer: D

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11. The probability of getting 11 when an ordinary die is thrown twice is -

A. $\dfrac{1}{18}$

B. $\dfrac{1}{9}$

C. $\dfrac{1}{12}$

D. $\dfrac{5}{36}$

Answer: A

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12. Two events A and B are mutually exclusive, if $P(A) = \dfrac{1}{2}$ and $P(A \cup B) = \dfrac{2}{3}$, then the value of P(B) is -

A. $\dfrac{1}{4}$

B. $\dfrac{1}{6}$

C. $\dfrac{1}{3}$

D. $\dfrac{1}{5}$

Answer: B

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13. Two events A and B are independent, if $P(A) = \dfrac{3}{5}$ and $P(A \cap B) = \dfrac{4}{9}$, then the value of P(B) is -

A. $\dfrac{5}{9}$

B. $\dfrac{8}{9}$

C. $\dfrac{5}{27}$

D. $\dfrac{20}{27}$

Answer: D

---

14. If $P(A) = \dfrac{3}{7}, P(B) = \dfrac{4}{7}$ and $P(A \cap B) = \dfrac{2}{9}$, then the value of

$P(A/B)$ is -

A. $\dfrac{7}{18}$

B. $\dfrac{14}{27}$

C. $\dfrac{5}{18}$

D. $\dfrac{4}{9}$

Answer: A

15. Three events A, B and C are mutually exclusive and exhaustive, if $P(A) = \dfrac{3}{5}$ and $P(B) = \dfrac{1}{6}$, then the value of P(C) is -

A. $\dfrac{23}{30}$

B. $\dfrac{7}{30}$

C. $\dfrac{1}{10}$

D. $\dfrac{9}{10}$

Answer: B

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16. If $P(A \cap B) = \dfrac{5}{13}$, then the value of $P(A^c \cup B^c)$ is -

A. $\dfrac{4}{13}$

B. $\dfrac{6}{13}$

C. $\dfrac{7}{13}$

D. $\dfrac{8}{13}$

Answer: D

Exercise 1 A Very Short Answer Type Questions

1. Define conditional probability of event A, given that event B has occurred.

2. Two event A and B are given. What conclusion can be made in each of the following cases:

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

3. Two event A and B are given. What conclusion can be made in each of the following cases:

$P(A \cap B) = 0$

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4. Two event A and B are given. What conclusion can be made in each of the following cases:

$P(A) = P(B)$

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5. Two event A and B are given. What conclusion can be made in each of the following cases:

$P(A \cup B) = 1$

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6. Two event A and B are given. What conclusion can be made in each of the following cases:

$$P(A \cap B) \neq 0$$

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7. Two event A and B are given. What conclusion can be made in each of the following cases:

$$P(A/B) = P(A)$$

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8. Two event A and B are given. What conclusion can be made in each of the following cases:

$$P(A) \neq P(B)$$

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9. Two event A and B are given. What conclusion can be made in each of the following cases:

$$P(A \cap B) = P(A)P(B)$$

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10. If $\overline{A}$ and $\overline{B}$ are the events complementary to the events A and B respectively, prove that,

$$P(\overline{A} \text{ or } \overline{B}) = 1 - P(A)P(B/A).$$

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11. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

Only a

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12. Let A, B, C be three arbitrary events. Find expressions for the following events using the usual set theoretic notations:

Both A and B occur but not C.

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13. Let A,B,C be three arbitary events. Find expressions for the following events using the usual set theoretic notations :

All the three events occus

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14. A and B play alternately with an unbiased die. He who first throws a 'six' wins. If A begins, show that his chance of winning is $\dfrac{6}{11}$.

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15. A, B and C in order toss an unbiased coin. The first who throws 'head' wins. Find the respective probabilities of winning.

16. Let A_1, A_2, A_3 be 3 events related to a random experiment. Under what conditions will the events be exhaustive and mutually exclusive ?

17. Show that the probability that exactly one of the events A and B occurs is $P(A) + P(B) - 2P(AB)$.

18. Can the followings represent measures of probability :

$P(A) = 0.2, P(B) = 0.7, P(C) = 0.1$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

19. Can the followings represent measures of probability :

$P(A) = 0.4, P(B) = 0.6, P(C) = 0.2$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

20. Can the followings represent measures of probability :

$P(A \cup B) = 0.5, P(B) = 0.6, P(C) = 0.2$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

21. Can the followings represent measures of probability :

$P(A) = 0.4,\ P(B) = 0.5,\ P(B \cap C) = 0.1$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

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22. Can the followings represent measures of probability :

$P(A) = 0.32,\ P(B) = 0.47,\ P(B \cup C = 0.68$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

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23. Can the followings represent measures of probability :

$P(A) = 0.3,\ P(B') = 0.5,\ P(C') = 0.8$

where $(A \cup B \cup C)$ represents sure event and A, B, C are mutually exclusive.

24. For three mutually exclusive events X, Y and Z it is given that $P(X) = 2P(Y) = 3P(Z)$ and $X \cup Y \cup Z = S$, where S denotes sure event. Find the value of P(X).

25. If A and B are two events associated with a random experiment such that P(B) = 0.35, P(A or B) = 0.85 and P(A and B) = 0.15, find P(A).

26. A and B are two independent events with $P(A) = \dfrac{2}{5}$ and $P(B) = \dfrac{1}{3}$, evaluate $P(A \cup B)$.

27. A and B are two events, not mutually exclusive, connected with a random experiment E. If $P(A) = \dfrac{1}{4}, P(B) = \dfrac{2}{5}$ and $P(A \cup B) = \dfrac{1}{2}$, find the values of the following probabilities :

(i) $P(A \cap B)$

(ii) $P(A \cap B^c)$

(iii) $P(A^c \cup B^c)$

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28. If $P(\overline{A} \cup \overline{B}) = \dfrac{5}{6}, P(A) = \dfrac{1}{2}$ and $P(\overline{B}) = \dfrac{2}{3}$, are the events A and B independent ?

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Exercise 1 A Short Answer Type Questions

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1. A bag contains 5 red and 4 yellow balls. A ball is drawn at random from the bag and put into another bag which contains 3 red and 6 yellow balls.

A ball is drawn randomly from the second bag. What is the probability that it is yellow ?

2. Each of the two identical bags contain 5 white and 5 red balls. One ball is transferred at random without notice from the second bag to the first bag. Then one ball is drawn from the first bag. Find the probability that the ball drawn is a red ball.

3. A_1, A_2 and A_3 are three events. Show that the simultaneous occurrence of the events is

$$P(A_1 \cap A_2 \cap A_3) = P(A_1)P(A_2/A_1)P[A_3/(A_1 \cap A_2)]$$

State under which condition

$$P(A_1 \cap A_2 \cap A_3) = P(A_1)P(A_2)P(A_3)$$

4. For any two events A and B prove that, $P(A \cup B) \le P(A) + P(B)$.

5. For any two events A and B prove that, $P(A) \ge P(A \cap B) \ge P(A) + P(B) - 1$

6. For any two events A and B prove that, $P(A \cap B) \le P(A) \le P(A \cup B) \le P(A) + P(B)$

7. For any two events A and B prove that, $P(A/B) < P(B/A)$ if $P(A) < P(B)$

8. If A and B are two independent events, prove that the events (a) a^c and B^c (b) A^c and B (c) A and B^c are also independent.

9. An urn A contains 3 white and 5 red marbles. Another urn B contains 5 white and 3 red marbles. Two marbles are transferred from A to B and then one is drawn from B. What is the probability that it is red ?

10. A balanced coin is tossed three times in succession. Let A denote the event of getting 'head' in the first toss and B the event of getting 'tail' in the second toss. Prove that the events A and B are independent.

11. There are three bags each containing 5 red and 5 black balls. One ball is transferred blindly from the first to the second bag and then one ball is transferred blindly from the second to the third. A ball is now drawn from the third bag. Find the probability that the drawn ball is red.

12. Three boxes of the same appearance have the following proportions of white and black balls- box I: 1 white and 2 black, box II : 2 white and 1 black, box III : 2 white and 2 black. One of the boxes is selected at random and one ball is drawn randomly from it. It turns out to be white. What is the probability that the third box is chosen ?

13. A lot has 10% defective items .10 items are chosen randomly from the lot the probability that exactly 2 of the chosen items are defective

14. Given the P(A)=a, P(B)=b and $P(A \cap B) = c$. Find the value of $P(A^c \cup B^c)$

15. Given the P(A)=a, P(B)=b and $P(A \cap B) = c$. Find the value of $P(A^c \cup B)$

16. Given the P(A)=a, P(B)=b and $P(A \cap B) = c$. Find the value of $P(A^c \cap B^c)$

17. If $P(A) = \dfrac{1}{3}$, $P(B) = \dfrac{1}{2}$, $P(A \cap B) = \dfrac{1}{4}$, find the values of $P(B^c)$, $P(A \cap B^c)$, $P(A \cup B)$, $P(B/A)$, $P(A^c \cap B^c)$, $P(A \cup B^c)$.

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18. Given that $P(E) = \dfrac{1}{3}$, $P(F) = \dfrac{1}{4}$ and $P(E \cap F) = \dfrac{1}{6}$. Find the value of $P(E^c \cup F)$.

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19. Given that E and F are events such that $P(E) = 0.6$, $P(F) = 0.3$ and $P(E \cap F) = 0.2$, find $P(E/F)$ and $P(F/E)$

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20. Given that $P(A/B) = 0.8$, $P(B/A) = 0.6$ and $P(A^c \cup B^c) = 0.7$, find the value of $P(A/B^c)$.

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21. Given $P(A) = \dfrac{3}{7}$, $P(B) = \dfrac{4}{7}$ and $P(A+B) = \dfrac{7}{9}$ for two events A and B. Find $P(A/B)$ and $P(B/A)$. Are the events A and B independent ?

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22. Evaluate $P(A \cup B)$, if $2P(A) = P(B) = \dfrac{5}{13}$ and $P(A/B) = \dfrac{2}{5}$

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23. The odds against two events are $2:7$ and $7:5$ respectivel. If the events are independent, find the probability that at least one of them will occur.

24. Ramesh appears for an interview for two posts A and B, for which the selection is independent. The probability for his selection for post A is $\frac{1}{6}$ and for post B it is $\frac{1}{7}$. Find the probability that Ramesh is selected for at least one post.

25. The probability that a contractor will get a plumbing contract is $\frac{2}{3}$ and the probability that he will not get an electric contract is $\frac{5}{9}$. If the probability of getting at least one contract is $\frac{4}{5}$, what is the probability that he will get both the contract ?

26. A class consists of 30 boys and 20 girls of which half the boys and half the girls have blue eyes. Find the probability that a student chosen at

random is a boy or has blue eyes.

27. From 200 tickets marked with the first 200 natural numbers, one is drawn at random. Find the probability that it is multiple of 3 or 7.

28. A can solve 75% of the problems in this book and B can solve 70%. What is the probability that either A or B can solve a problem chosen at random ?

29. A can hit a target in 3 out of 4 shots and B can hit the target in 4 out of 5 shots. What is the probability of hitting the target ?

30. There are 52 cards with each of two boys. Each draws a card at random. What is the probability that (i) both the cards will be king of diamonds (ii) both will be diamonds (iii) both will be kings ?

31. If two numbers are selected at random from the numbers 1, 2, 3, 4 determine the probabilities that their sum is odd when they are selected (a) together (b) one by one with replacement.

32. A fair dice is rolled twice the probability that an odd number will follow and even number is

33. A packet of 10 electronic components is known to include 3 defectives. If 4 components are randomly chosen and tested, what is the probability of finding not more than one defective in the packet ?

34. It is 9 to 5 against a person who is 50 years living till he is 70 and 8 to 6 against a person who is 60 years living till he is 80. Find the probability that at least one of them will be alive after 20 years.

35. A speaks the truth 3 out of 4 times and B, 5 out of 6 times, what is the probability that they will contradict each other in stating the same fact ?

36. A and B are two candidates seeking admission in joint Entrance. The probability that A is selected is 0.5 and the probability that both A and B are selected is almost 0.3 . Is it prossible that the probability of B getting selected is 0.9?

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37. Out of 20 games of chess played between two players A and B, A won 12, B won 4 and 4 ended in a tie. In a tournament of three games find the probability that (i) B wins all three (ii) B wins at least one (iii) two games end in a tie.

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38. The probability that a teacher will give a surprise test during any class meeting is $\frac{1}{5}$. If a student is absent on two days, what is the probability that he will miss at least one test ?

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39. A number is chosen at random from the first n natural numbers and suppose, A and B denote the events that the chosen number is divisible by 2 and 3 respectively. Prove that the events A and B are independent if n = 96.

40. A can hit a target four times in 5 shots, B three times is 4 shots and C twice in 3 shots. They fire a volley, what is the probability that two shots at least hit ? And if two hit, what is the probability that it is C who has missed ?

41. A bag contains 5 white, 7 red and 3 black balls. If three balls are drawn one by one without replacement, find the probability that none is red.

Exercise 1 A Long Answer Type Questions

1. Three identical urns contain white and black balls. The first urn contains 2 white and 3 black balls, the second urn 3 white and 2 black balls and the third urn 1 black and 4 white balls. An urn is chosen at random and a ball is drawn from it. If the ball drawn is white, what is the probability that the first urn is chosen ?

2. A company has two plants to manufacture bicycles. The first plant manufactures 60% of the bicycles and the second plant 40%. Also 80% of the bicycles are rated of standard quality at the first plant and 90% of standard quality at the second plant. A cycle is picked up at random and found to be of standard quality. Find the probability that it comes from the second plant.

3. A bag A contains 1 white and 6 red balls. Another bag B contains 4 white and 3 red balls. One of bags is selected at random and a ball is drawn from it, which is found to be white. Find the probability that the ball drawn is from the bag A.

4. Show that for two non-mutually exclusive events A and B,

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

5. For any three events A, B and C, prove that.

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

$$- P(B \cap C) - P(C \cap A) + P(A \cap B \cap C).$$

6. 8 coins are tossed simultaneously ,what is the probability of getting 6 heads

7. If A, B and C are mutually independent events, prove that the events $(A \cup B)$ and C are also independent events.

8. Obtain $P(\overline{A} + B), P(A + \overline{B})$ in terms P(A)+P(B) and P(AB), where $\overline{A}$ is the event complementary to the event A.

9. If $P(A) = a, P(B) = b,$ then show that $P(A/B) > \dfrac{a + b - 1}{b}$.

10. If A and B are two events and $P(B) \neq 1$, prove that,

$$P(A/B^c) = \frac{P(A) - P(A \cap B)}{1 - P(B)}$$

Hence, deduce that, $P(A \cap B) > P(A) + P(B) - 1$.

11. If A and B are two mutually exclusive events and $P(A \cup B) \neq 0$, then

show that,

$$P[A/(A \cup B)] = \frac{P(A)}{P(A) + P(B)}.$$

12. X is taking up subjects - mathematics, physics and chemistry in the

examination. His probabilities of getting grade A in these subjects are 0.2,

0.3 and 0.5 respectively. Find the probability that he gets grade A in (i) all subjects (ii) no subject (iii) two subjects.

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13. Ram has two bags.One bag contains 5 white balls and 4 red balls and another bag contains 4 white balls and 2 red balls,if one ball is drawn from each bag the probability that one is white and one is red,is

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14. Let A and B be independent events with $P(A \cup B) = 0.58$ and $P(A \cap B) = 0.12$. Determine the possible values of P(A).

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15. Events A, B, C are such that

$P(A) = 0.3, P(B) = 0.4, P(C) = 0.8, P(A \cap B) = 0.08, P(A \cap C) = 0.2$

and $P(A \cap B \cap C) = 0.09$. If $P(A \cup B \cup C) \geq 0.75$, show that,

$0.23 \leq P(B \cap C) \leq 0.48$.

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16. A, B, C and D are four mutually exclusive and exhaustive events. If the odds against the events B, C and D are $7:2, 7:5$ and $13:5$ respectively, find the odds in favour of the event A.

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17. A problem on mathematics is given to three students A, B, C whose probabilities of solving it are $\frac{1}{3}, \frac{2}{5}$ and $\frac{3}{4}$ respectively. Find the probability that the problem is solved.

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18. A problem in mathematics is given to three students whose chances of solving it correctly are $\dfrac{1}{2}$, $\dfrac{1}{3}$ and $\dfrac{1}{4}$ respectively. What is the probability that only one of them solves it correctly ?

19. An instructor has a question bank consisting of 300 easy True/False questions, 200 difficult True/False questions, 500 easy multiple choice questions and 400 difficult multiple choice questions. If a question is selected at random from the question bank, what is the probability that it will be an easy question given that it is a multiple choice question ?

20. A candidate is selected for interview for three posts. For the first post there are 3 candidates, for the second there are 4 and for the third there are 2. What are the chances of his getting at least one post ?

21. A bag contains 2 red and 3 white balls and another bag contains 1 red and 2 white balls. If a bag is chosen at random and a ball is drawn from it, what is the probability that the ball is white ?

22. There are four boxes of one dozen eggs each. They contain 2, 3, 1, 0 spoiled eggs respectively. One box is selected at random and then an egg is taken at random. What is the probability that the egg is spoiled ?

23. Two consecutive drawings of a digit are made at random from the ten digits 0, 1, 2, ..., 9. Find the probability that the product of the chosen digits is zero, given that the first drawn digit is replaced before the second drawing.

24. Two digits are chosen at random from the digits 1, 2, 3, ..., 9, if the sum of the chosen digits is odd, find the probability that one of the chosen digit is 6.

25. The chance of an accident in three factories A, B, C in a year is 5 in 25, 6 in 36 and 8 in 64 respectively. Find the chances that an accident may happen in (i) at least one of them (ii) all of them.

26. The probability that a candidate passes in physics is 70% and that the passes in chemistry is 40%. What is the probability that the candidate passes in any one of the two subjects ?

27. A box contains 7 white and 5 black balls. If 3 balls are drawn simultaneously at random with out replacement, what is the probability that they are not all of the same colour ?

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28. An urn contains 4 red and 7 black balls. Two balls are drawn at random with replacement. Find the probability of getting (a) 2 red balls (b) 2 black balls (c) one red ball and one black ball.

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29. There are three persons aged 50, 60, and 70 years. The probability to live 10 years more is 0.8 for a 50 years old, 0.5 for as 60 years old and 0.2 for a 70 years old person. Find the probability that at least two of the three persons will remain alive 10 years hence.

30. The probabilities for A, B, and C hitting a target are $\dfrac{1}{3}, \dfrac{1}{5}$ and $\dfrac{1}{4}$ respectively. If they try together, find the probability of exactly one shot hitting the target.

31. The odds that a book will be favourably reviewed by three independent critics are 5 to 2, 4 to 3 and 3 to 4 respectively, what is the probability that of the three a majority will be favourable ?

32. Two sets of candidates are competing for the position on the board of directors of a company. The probabilities that the first and second sets will win are 0.6 and 0.4 respectively. If the first set wins, the probability of introducing a new product is 0.8 and the corresponding probability if the

second set wins is 0.3. What is the probability that the new product will

be introduced ?

33. A box contains 5 black and 5 red balls. The balls are randomly picked

one after another from the box, with out replacement . The probability of

both balls being rad is?

A. $\dfrac{1}{90}$

B. $\dfrac{1}{5}$

C. $\dfrac{19}{90}$

D. $\dfrac{2}{9}$

Answer: D

34. Two cards are drawn at random from a well-shuffled pack of 52 cards and thrown away. Find the probability of drawing an ace from the remaining 50 cards.

35. A pair of fair dice are thrown. Find the probability that the sum is 10 or greater if a 5 appears on the first die.

36. Three lots contain respectively 4%, 5% and 10% defective articles. One article is chosen at random from each lot. Find the probability of getting (a) exactly one defective (b) at least one defective article among the three articles drawn.

37. An anti-aircraft gun can take a maximum of four shots at an enemy plane moving away from it. The probabilities of hitting the plane at the first, second, third and fourth shot are 0.4, 0.3, 0.2 and 0.1 respectively. What is the probability that the gun hits the plane ?

38. An article manufactured by a company consists of two parts A and B. In the process of manufacture of part A 9 out of 100 are likely to be defective. Similarly, 5 out of 100 are likely to be defective in the manufacture of part B. Calculate the probability that assembled parts will not be defective.

39. Three groups of children contain respectively 3 girls and 1 boy, 2 girls and 2 boys and 1 girl and 3 boys. One child is selected at random from

each group. Find the chance that the selected group consists of 1 girl and 2 boys.

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40. A six faced die is so biased that it is twice as likely to show an even number as an odd. It is thrown twice. What is the probability that the sum of the numbers is even ?

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41. Three faces of a fair die are yellow, two faces red and one blue. The die is tossed three times. Find the probability that the colours yellow, red and blue appear in the 1st, 2nd and the 3rd tosses respectively.

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42. A and B play alternately with an unbiased die. He who first throws a 'six' wins. If A begins, show that his chance of winning is $\dfrac{6}{11}$.

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43. A, B and C in order toss an unbiased coin. The first who throws 'head' wins. Find the respective probabilities of winning.

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44. A bag contains 5 red and 4 yellow balls. A ball is drawn at random from the bag and put into another bag which contains 3 red and 6 yellow balls. A ball is drawn randomly from the second bag. What is the probability that it is yellow ?

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45. Each of the two identical bags contain 5 white and 5 red balls. One ball is transferred at random without notice from the second bag to the first bag. Then one ball is drawn from the first bag. Find the probability that the ball drawn is a red ball.

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46. An urn A contains 3 white and 5 red marbles. Another urn B contains 5 white and 3 red marbles. Two marbles are transferred from A to B and then one is drawn from B. What is the probability that it is red ?

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47. There are three bags each containing 5 red and 5 black balls. One ball is transferred blindly from the first to the second bag and then one ball is transferred blindly from the second to the third. A ball is now drawn from the third bag. Find the probability that the drawn ball is red.

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Exercise 1 B Long Answer Type Questions

1. Let A and B be events with

$P(A) = \dfrac{3}{8}, P(B) = \dfrac{5}{8}$ and $P(A \cup B) = \dfrac{3}{4}$ then $P(A \cap B) =$

A. $\dfrac{5}{8}$

B. $\dfrac{3}{8}$

C. $\dfrac{1}{4}$

D. $\dfrac{2}{3}$

Answer: C

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2. Three boxes of the same appearance have the following proportions of white and black balls- box I: 1 white and 2 black, box II : 2 white and 1

black, box III : 2 white and 2 black. One of the boxes is selected at random and one ball is drawn randomly from it. It turns out to be white. What is the probability that the third box is chosen ?

3. In a bolt factory, machines M_1, M_2, M_3 manufacture respectively 25, 35 and 40 percent of the total product. Of their output 5, 4 and 2 percent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine M_3 ?

4. A can hit a target four times in 5 shots, B three times is 4 shots and C twice in 3 shots. They fire a volley, what is the probability that two shots at least hit ? And if two hit, what is the probability that it is C who has missed ?

▶

5. Three identical urns contain white and black balls. The first urn contains 2 white and 3 black balls, the second urn 3 white and 2 black balls and the third urn 1 black and 4 white balls. An urn is chosen at random and a ball is drawn from it. If the ball drawn is white, what is the probability that the first urn is chosen ?

6. A bag A contains 2 white and 3 red balls, another bag B contains 4 white and 5 red balls. A bag is chosen at random and a ball is drawn from it. If the ball drawn is red, what is the probability that the bag B is chosen ?

7. A company has two plants to manufacture bicycles. The first plant manufactures 60% of the bicycles and the second plant 40%. Also 80% of the bicycles are rated of standard quality at the first plant and 90% of standard quality at the second plant. A cycle is picked up at random and found to be of standard quality. Find the probability that it comes from the second plant.

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8. A bag A contains 1 white and 6 red balls. Another bag B contains 4 white and 3 red balls. One of bags is selected at random and a ball is drawn from it, which is found to be white. Find the probability that the ball drawn is from the bag A.

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9. In a bolt factory, machines M_1, M_2 and M_3 manufacture respectively 2000, 2500 and 4000 bolts everyday. Of their output, 3%, 4% and

2.5% are defective bolts. One bolt is drawn at random from a day's production and is found to be defective. What is the probability that it was produced by machine M_2 ?

10. A box contains 2 gold and 3 silver coins. Another box contains 3 gold and 3 silver coins. A box is chosen at random and a coin is drawn from it. If the selected coin is a gold coin, find the probability that it was drawn from the second box.

11. There are two bags I and II. Bag I contains 3 white and 4 black and bag II contains 5 white and 6 black balls. One ball is drawn at random from one of the bags and is found to be white. Find the probability that is was drawn from bag I.

12. Three indentical boxes contain red and white balls. The first box contains 3 red and 2 white, the second box 4 red and 5 white and the third box 2 red and 4 white balls. A box is chosen at random and a ball is drawn from it. If the drawn ball is red, what is the probability that the second box is chosen ?

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13. An insurance company insured 2000 scooter and 3000 motor cycles. Probability of an accident involving a scooter is 0.01 and that of a motor cycle is 0.02. An insured vehicle met with an accident. Find the probability that the accident vehicle was a motor cycle.

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14. A speaks the truth 8 times out of 10 times. A die is thrown. He reports that it was 5. What is the probability that it was actually 5 ?

15. Two groups are competing for the positions of the board of directors of a corporation. The probabilities that the first and the second groups will win are 0.6 and 0.4 respectively. Further, if the first group wins, the probability of introducing a new product is 0.7 and the corresponding probability is 0.3 if the second group wins. Find the probability that the new product is introduced was by the second group.

16. There are 3 coins in a box. The probability of getting head is $\dfrac{2}{3}$ for two of them, while for remaining it is $\dfrac{1}{2}$. A coin is chosen at random and tossed 3 times, showing head in each case. What is the probability that the coin is unbiased ?

1. If A and B are independent events such that $0 < P(A) < 1$ and $0 < P(B) < 1$, then -

    A. A and B^c are independent

    B. A^c, B are independent

    C. A^c and B^c are independent

    D. A and B are mutually exclusive

Answer: A::B::C

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2. If the probability that exactly one of the two events A and B occurs is p and the probability that both A and B occur is q, then -

    A. $P(A \cup B) = p + q$

B. $P(A^c \cap B^c) = 1 - p - q$

C. $P(A) + P(B) = p + 2q$

D. None of these

Answer: A::B::C

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3. If A and B are two events, then probability that exactly one of them occurs is -

A. $P(A \cap B^c) + P(A^c \cap B)$

B. $P(A \cup B) - P(A \cap B)$

C. $P(A) + P(B) - 2P(A \cap B)$

D. $P(A^c) + P(B^c) - 2P(A^c \cap B^c)$

Answer: A::B::C::D

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4. If A and B are two independent events associated with an experiment such that $P(A) > 0$ and $P(B) > 0$, then -

A. $P(A - B) = P(A)(1 - P(B))$

B. $P(A \cap B) = 0$

C. $P(A^c \cap B^c) = (1 - P(A))(1 - P(B))$

D. None of these

Answer: A::C

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5. A and B are two independent events such that $P(A \cap B) = \dfrac{1}{12}$ and P (either A or B) $= \dfrac{1}{2}$, then -

A. $P(A \cup B) = \dfrac{1}{2}$

B. $P(A^c \cap B^c) = \dfrac{1}{7}$

C. $P(A) = \dfrac{1}{3}, P(B) = \dfrac{1}{4}$

D. $P(A) = \dfrac{1}{4}, P(B) = \dfrac{1}{3}$

Answer: A::B::C::D

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1. If $P(A \cap B) = \dfrac{1}{2}$ and $P(A^c \cap B^c) = \dfrac{1}{3}, P(A) = p$ and $P(B) = 2p$, then the value of p is $\dfrac{K}{18}$. Find the value of K.

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2. The probability that a leap year selected at random will contain 53 Sundays is $\dfrac{K}{7}$, then find the value of K.

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3. If there are 3 children in a family, then the probability that there is one girl in the family is $\dfrac{3}{n}$, find the value of n.

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4. If A and B are two events and $P(A) = \dfrac{3}{8}, P(B) = \dfrac{1}{2}, P(A \cap B) = \dfrac{1}{4}$ then the value of $P(A^c \cap B^c) = \dfrac{K}{8}$, find the value of K.

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5. There are four letters and four envelopes bearing addresses at random. The probability that the letters are placed in correct envelopes is $\dfrac{K}{24}$, then find the value of K.

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Sample Questions For Competitive Examination Comprehension Type

1. The probabilities that three students Subhas, Monisha and Satabdi can solve a problem independently are p, q and r respectively.

The chance that the problem is solved, is -

A. $(1 - p)(1 - q)(1 - r)$

B. pqr

C. $1 - (1 - p)(1 - q)(1 - r)$

D. none of these

Answer: C

2. The probabilities that three students Subhas, Monisha and Satabdi can solve a problem independently are p, q and r respectively.

The chance that only one of the three students solve the problem is -

A. $p + q + r$

B. $p(1 - q)(1 - r) + q(1 - p)(1 - r) + r(1 - p)(1 - q)$

C. $pq(1 - r) + qr(1 - p) + rp(1 - q)$

D. none of these

Answer: B

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3. The probabilities that three students Subhas, Monisha and Satabdi can solve a problem independently are p, q and r respectively.

The chance that exactly two of the three students solve the problem is -

A. $pq(1 - r) + qr(1 - p) + rp(1 - q)$

B. $pq + qr + rp$

C. $p(1 - q)(1 - r) + q(1 - r)(1 - p) + r(1 - p)(1 - q)$

D. none of these

Answer: A

4. Suppose E_1, E_2, E_3 be three mutually exclusive events such that $P(E_i) = p_i$ for $i = 1, 2, 3$

If $p_1 = \dfrac{1}{2}(1 - p)$, $p_2 = \dfrac{1}{3}(1 + 2p)$ and $p_3 = \dfrac{1}{5}(2 + 3p)$ then p belongs to -

A. $(-1, 2)$

B. $\left(-\dfrac{1}{3}, \dfrac{2}{3}\right)$

C. $\left(-1, \dfrac{1}{47}\right)$

D. $\left(-\dfrac{1}{2}, \dfrac{-7}{23}\right)$

Answer: D

5. Suppose E_1, E_2, E_3 be three mutually exclusive events such that $P(E_i) = p_i$ for $i = 1, 2, 3$

If p_1, p_2, p_3 are the roots of $27x^3 - 27x^2 + ax - 1 = 0$ the value of a is -

A. 9

B. 6

C. 3

D. 12

Answer: A

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6.   Let   A   and   B   be   events   with

$P(A) = \dfrac{3}{8}, P(B) = \dfrac{5}{8}$ and $P(A \cup B) = \dfrac{3}{4}$ then $P\left(\dfrac{A}{B}\right) =$

A. $\dfrac{3}{8}$

B. $\dfrac{1}{4}$

C. $\dfrac{2}{5}$

D. $\dfrac{2}{3}$

Answer: C

Sample Questions For Competitive Examination Assertion Reason Type

1. Statement-I : If $\frac{1}{5}(1+5p)$, $\frac{1}{3}(1+2p)$, $\frac{1}{3}(1-p)$ and $\frac{1}{5}(1-3p)$ are probabilities of four mutually exclusive events, then p can take infinite number of values.

Statement-II : If A, B, C and D are four mutually exclusive events, then $P(A)$, $P(B)$, $P(C)$, $P(D) \geq 0$ and $P(A) + P(B) + P(C) + P(D) \leq 1.$

A. Statement-I is True, Statement-II is True, Statement-II is a correct explanation for Statement-I

B. Statement-I is True, Statement-II is True, Statement-II is not a correct explanation for Statement-I

C. Statement-I is true, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: A

2. Consider the system of equations

$ax + by = 0$ and $cx + dy = 0$ where $a, b, c, d \in \{0, 1\}$

Statement-I: The probability that the system of equations has a unique

solution is $\dfrac{3}{8}$.

Statement-II: The probability that the system has solution is 1.

A. Statement-I is True, Statement-II is True, Statement-II is a correct

explanation for Statement-I

B. Statement-I is True, Statement-II is True, Statement-II is not a correct

explanation for Statement-I

C. Statement-I is true, Statement-II is False.

D. Statement-I is False, Statement-II is True.

Answer: B

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