

1. If $P(E) = 0.40$, $P(F) = 0.35$ and $P(E \cup F) = 0.55$, find $P(E / F)$.
2. If $P(A) = 0.4$, $P(B) = 0.8$, $P(B / A) = 0.6$, find $P(A / B)$ and $P(A \cup B)$.
3. In a certain college, 25% of the students failed in physics, 15% of the students failed in chemistry and 10% of the students failed in both physics and chemistry. A student selected at random.
 - (i) If he failed in chemistry, what is the probability that he failed in physics?
 - (ii) If he failed in physics, what is the probability that he failed in chemistry?
 - (iii) What is the probability that he failed in physics or chemistry?
4. A dice is rolled. If the outcome is an odd number, what is the probability that it is prime?
5. In a class, 40% students read statistics, 25% Mathematics and 15% both Mathematics and Statistics. One student is selected at random. Find probability.
 - (i) That he reads Statistics, if it is known that he reads Mathematics.
 - (ii) That he reads Mathematics, if it is known that he reads Statistics.
6. The probability that a person stopping at a petrol pump will get his tyres checked is 0.12, the probability that he will get his oil checked is 0.29, and the probability that he will get both checked is 0.07. Then
 - (i) What is the probability that a person stopping at this pump will have neither his tyres nor oil checked?
 - (ii) Find the probability that a person who has his oil checked will also have his tyres checked.
7. A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 4 has appeared at least once?
8. A bag contains 6 white and 9 black balls. Four balls are drawn at a time. Find the probability for the first draw to give four white and second draw to give four black balls in each of the following cases:
 - (i) The balls are replaced before the second draw.
 - (ii) The balls are not replaced before the second draw.
9. A bag contains 3 red and 7 black balls. Two balls are drawn at a random without replacement. If second selection given to be red. What is the probability that the first is also red.
10. A dice is rolled. If the outcome is an even number, what is the probability that it is prime.
11. A black and red die are rolled
 - (i) Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.
 - (ii) Find the conditional probability of obtaining the sum 8, given that red die resulted in a number less than 4.
12. Given that two numbers appearing on throwing two dice are different. Find the probability of the event 'the sum of the numbers on the dice is 4'.
13. Find the probability of drawing a diamond card in each of the two consecutive draws from a well shuffled pack of cards, if the card drawn is not replaced after the first draw.

14. A bag contains 5 white, 7 red and 8 black balls. If four balls are drawn one by one without replacement, find the probability of getting all white balls.
15. A bag contain 19 tickets, numbered from 1 to 19. A ticket is drawn and then another ticket is drawn without replacement. Find the probability that both tickets will shows even numbers.
16. Two balls are drawn from an urn containing 2 white, 3 red and 4 black balls one by one without replacement. What is the probability that at least one ball is red?
17. Two integers are selected at random from integers 1 to 11. If the sum is even, find the probability that both the numbers are odd.
18. A couple has two children. Find the probability that both are boys, if it is known that (i) one of the children is a boy; (ii) the older child is a boy.
19. A die marked 1, 2, 3 in red and 4, 5, 6 in green are tossed. Let A be the event 'number is even' and B be the event 'number is red'. Is A and B independent?
20. If each element of a second order determinant is either 0 or 1, what is the probability that the value of determinant is positive? (Assume that the individual entries of the determinant are chosen independently, each value being assumed with probability $\frac{1}{2}$).
21. An electronic assembly consists of two sub-systems say A and B, from the previous testing procedures, the following probabilities following probabilities are assumed to be known: $P(A \text{ fails}) = 0.2$,
 $P(B \text{ fails alone}) = 0.15$,
 $P(A \text{ and } B \text{ fails}) = 0.15$. Evaluate the following probabilities
 (i) $P(A \text{ fails} / B \text{ has failed})$
- (ii) $P(A \text{ fails alone})$
22. A problem in statistics is given to four students A, B, C and D. Their chances of solving it are $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$ respectively. What is the probability that the problem will be solved?
23. The probability of hitting a target by three marksmen is $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that one and only one of them will hit the target when they fire simultaneously.
24. A can hit a target 3 times in 6 shots, B can 2 times in 6 shots and C can 4 times in 4 shots. They fire a volley. What is the probability that at least 2 shots hit?
25. A candidate is selected for interview for three posts. For the first post there are 5 candidates, for the second there are 8 and for the third there are 7. What are the chance for his getting at least one post?
26. A student takes his examination in four subjects $\alpha, \beta, \gamma, \delta$. He estimates his chance of passing in α as $\frac{4}{5}$, in β as $\frac{3}{4}$, in γ as $\frac{5}{6}$ and in δ as $\frac{2}{3}$. To qualify he must pass in α and atleast two other subjects. What are the probability that he qualifies?
27. A speaks truth in 60% of the cases and B in 90% of the cases. In what percentage of cases are they likely to contradict each other in stating the same fact?
28. A man speaks truth in 80% of the cases and another in 90% of the cases. While stating the same fact, what is the probability that they (i) contradict (ii) agree?
29. An anti-aircraft gun can take maximum of four shots at an enemy place moving away from it. The probabilities of hitting the plane at

- the first, second, third and fourth shots are 0.4, 0.3, .02 and 0.1 respectively. What is the probability that the gun hits the plane?
30. A can solve 90% of the problems given in a book and B solve 70% . What is the probability that atleast one of them will solve a problem selected at random from the book?
 31. A bag contains 4 white and 3 black balls. Four balls are successively drawn out with replacement. Find the probability that they are alternately of different colours.
 32. Two cards are drawn from a well-shuffled pack of 52 cards, one after another without replacement. Find the probability that one of these is an ace and the other is a queen of the opposite shade.
 33. Three cards are drawn from a well-shuffled deck of cards, one after the other and with replacement. What is the probability that: (i) all the three cards are spades? (ii) first two cards are queen and the third card is black ace? (iii) first card is a jack, second is a red queen and third card is a king?
 34. A purse contains two silver and 4 copper coins. A second purse contains 4 silver and 3 copper coins. If a coin is pulled out at random from one of the two purses, what is the probability that it is a silver coin?
 35. A and B throw a coin alternately till one of them gets a head and wins the game. If A starts the game, find their respective properties of winning.
 36. Two persons A and B throws a die alternately till one of them gets a 'six' and win the game. Find their respective probabilities of winning.
 37. A and B throw with a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6 before A throws 6. If A begins, show that his chance of winning is $\frac{30}{61}$.
 38. A, B and C in order toss a coin. The first one to throw a head wins. What are their respective chances of winning? Assume that the game may continue indefinitely.
 39. One bag contains 3 black and 4 white balls and the other bag contains 4 black and 3 white balls. A die is rolled, if 2 or 5 comes up a ball is taken from the first bag, otherwise a ball is drawn from the second bag. Find the probability of choosing white ball.
 40. Suppose there is a chance for newly constructed building to collapse whether the design is faulty or not. The chance that the design is faulty is 10%. The chance that the building collapse is 95% if the design is faulty and otherwise it is 45% it seen that building is collapsed. What is the probability that it is due to faulty design?
 41. A company has two plants to manufacture scooters. Plant I manufactures 70% of scooters and plant II manufactures 30%. At plant I, 80% of the scooters are rated standard quality and at plant II, 90% of scooters are rated standard quality. A scooter is picked up at a random and is found to be standard quality. What is the probability that it has come from plant I.
 42. For three persons A, B, C the chances of being selected as manager of a firm are in ratio 4:1:2 respectively. The respective probabilities for them to introduce a radical change in marketing strategy are 0.3, 0.8 and 0.5. If the change does take place, find the probability that it is due to the appointment of B or C.
 43. In a certain recruitment test, there are multiple-choice questions. There are 4 possible answers to each question of which one is correct. The probability that a student knows the answer to a question is 90%. If he

- gets the correct answer to a question, what is the probability that he was guessing?
44. 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 heart. Find the probability of the missing card to be heart.
45. In a test, an examinee either guesses or copies or knows the answer to a multiple-choice question with four choices. The probability that he makes a guess is $\frac{1}{3}$ and the probability that he copies the answer is $\frac{1}{6}$. The probability that his answer is correct, given that he copied it, is $\frac{1}{8}$. Find the probability that he knew the answer to the question, given that he correctly answered it.
46. By examining the chest X-ray, the probability that T.B. is detected when a person is actually suffering is 0.99. The probability that the doctor diagnose incorrectly that a person has T.B. on the basis of X-ray is 0.001. In certain city 1 in 1000 persons suffer from T.B. A person selected at a random is diagnosed o have T.B. What is the chance that he actually has T.B.?
47. A soldiers fire three bullets on enemy. The probability that the enemy killed by one bullet is 0.7. What is the probability that enemy is still alive?
48. A random variable X has the following probability distribution:

	0	1	2	3	4	5
P(X)	$\frac{1}{15}$	k	$\frac{15k-2}{15}$	k	$\frac{15k-1}{15}$	$\frac{1}{15}$

Find k

49. In a hurdle race, a player has to cross 8 hurdles. The probability that he will clear each hurdle is $\frac{4}{5}$, what is the probability that he will knock down fewer than 2 hurdles.

50. Two urns A and B contain 6 black and 4 white, 4 black and 6 white balls respectively. Two balls are drawn from one of the urns. If both the balls drawn are white, find the probability that the balls are drawn from urn B.
51. Two aeroplanes X and Y bomb a target in succession. Their probabilities to hit correctly are 0.3 and 0.2 respectively. The second plane will bomb only if first miss the target. Find the probability that target is hit by Y plane.
52. A can hit the target 4 times in 5 shots B three times in 4 shots and C twice in three shots. They fire a volley. What is the probability that atleast two shots hit?
53. A man takes a step forward with probability 0.4 and backward with probability 0.6. Find the probability that at the end of eleven steps he is one steps away from the starting point.
54. Two cards are drawn from a pack of well shuffled 52 cards one by one with replacement. Getting an ace or a spade is considered a success. Find the probability distribution of number of success.
55. A card from a pack of 52 cards are lost. From the remaining cards of the pack, two cards are drawn. What is the probability that they both are diamonds.
56. If A and B are two independent events such that $P(\bar{A} \cap B) = \frac{2}{5}$ and $P(A \cap \bar{B}) = \frac{1}{6}$ then find $P(A)$ and $P(B)$.
57. Three cards from a pack of 52 cards are lost. One card is drawn from the remaining cards. If drawn card is heart, find the probability that the lost cards were all hearts.
58. Two cards are drawn from a well shuffled pack of 52 cards. Find the mean and variance for the number of face cards obtained.

59. A letter is known to have come from TATA NAGAR or from CALCUTTA on the envelope first two consecutive letters 'TA' are visible. What is the probability that the letter come from TATA NAGAR?
60. Two groups are competing for the position on the Board of Directors of a corporation. The probabilities that first and the second group 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 introduced was by the second group.
61. Two numbers are selected at random (without replacement) from positive integers 2, 3, 4, 5, 6, 7. Let X denotes the larger of the two numbers obtained. Find the mean and variance of the probability distribution of X.
62. An urn contains five balls. Two balls are drawn and are found to be white. What is the probability that all the balls are white?
63. Three critics review a book. Odds in favour of the book are 5:2, 4:3 and 3:4 respectively for the three critics. Find the probability that the majority are in favour of the book.
64. A box contains 2 Black, 4 White and 3 Red balls. One by one all balls are drawn without replacement and arranged in sequence of drawing. Find the probability that the drawn balls are in sequence of BBWWRRR.
65. A bag contains 3 White, 3Black and 2 Red balls. 3 balls are successively drawn without replacement. Find the probability that third ball is red.

Answers

1. $\frac{4}{7}$
2. 0.3, 0.96
3. $\frac{2}{3}, \frac{2}{5}, \frac{3}{10}$
4. $\frac{2}{3}$
5. $\frac{3}{5}, \frac{3}{8}$
6. 0.66, 0.24

7. $\frac{2}{5}$
8. $\frac{6}{5915}, \frac{3}{5915}$
9. $\frac{2}{9}$
10. $\frac{1}{3}$
11. $\frac{1}{3}, \frac{1}{9}$
12. $\frac{1}{15}$
13. $\frac{1}{17}$
14. $\frac{1}{989}$
15. $\frac{4}{19}$
16. $\frac{7}{12}$
17. $\frac{3}{5}$
18. $\frac{1}{3}, \frac{1}{2}$
20. $\frac{3}{16}$
21. 0.5, 0.05
22. $\frac{2}{3}$
23. $\frac{11}{24}$
24. $\frac{2}{3}$
25. $\frac{3}{5}$
26. $\frac{61}{90}$
27. 42%
28. $\frac{13}{50}, \frac{37}{50}$
29. 0.6976
30. $\frac{97}{100}$
31. $\frac{288}{2401}$
32. $\frac{4}{663}$
33. $\frac{1}{4394}, \frac{1}{641}, \frac{1}{4394}$
34. $\frac{19}{42}$
35. $\frac{2}{3}, \frac{1}{3}$
36. $\frac{6}{11}, \frac{5}{11}$
38. $\frac{4}{7}, \frac{2}{7}, \frac{1}{7}$
39. $\frac{10}{21}$
40. 0.19
41. 0.67
42. $\frac{3}{5}$
43. $\frac{1}{37}$
44. $\frac{11}{50}$
45. $\frac{24}{29}$
46. $\frac{110}{221}$

47. $(0.3)^3$

48. $\frac{4}{15}$

49. $\frac{12}{5} \left(\frac{4}{5}\right)^7$

50. $\frac{5}{7}$

51. $\frac{8}{25}$

52. $\frac{5}{6}$

53. ${}^{11}C_5(0.4)^5(0.6)^5$

54.

X	0	1	2
P(X)	$\frac{81}{169}$	$\frac{72}{169}$	$\frac{16}{169}$

55. $\frac{1}{17}$

56. $P(A) = \frac{1}{5}, P(B) = \frac{1}{6}$ or

$P(A) = \frac{5}{6}, P(B) = \frac{4}{5}$

57. $\frac{10}{49}$

58. $\frac{6}{13}, \frac{974}{2873}$

59. $\frac{7}{11}$

60. $\frac{2}{9}$

61. $\frac{17}{3}, \frac{14}{9}$

62. $\frac{1}{2}$

63. $\frac{209}{343}$

64. $\frac{1}{1260}$

65. $\frac{1}{4}$

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