



## MATHS

### BOOKS - NEW JYOTHI MATHS (TAMIL ENGLISH)

#### PROBABILITY

##### Solved Examples

1. If  $P(A) = \frac{7}{13}$ ,  $P(B) = \frac{9}{13}$  and  $P(B \cap A) = \frac{4}{13}$  evaluate  $P(A|B)$

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2. If  $P(A) = 0.6$ ,  $P(B) = 0.7$  and  $P(B \cup A) = 0.9$  then find  $P(A|B)$   
and  $P(B|A)$

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3. If  $P(A) = 0.8$ ,  $P(B) = 0.5$  and  $P(B|A) = 0.4$  Find i.  $P(A \cap B)$  ii.  $P(A|B)$  iii.

$P(A \cup B)$

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4. In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10% of girls study in class XII. What is the probability that a student chosen randomly studies in class XII given that the chosen student is a girl.

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5. Suppose 10 cards numbered 1 to 10 are placed in a box and shuffled and one card is drawn at random.

i. If A is the event that the number on the card is even, then write A.

ii. If B is the event that the number on the card is more than 3, find  $P(A|B)$

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6. A fair die is thrown twice. Let A denote the event that '4' has appeared atleast once. Let B denote the event that the sum of the outcomes in two trials is 6.

i Write down the set of favourable outcomes for the event A.

ii. Write down the set of favourable outcomes for the events B

iii Compute  $P(A|B)$ , the conditional probability of A given B.

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7. A die is thrown three times, A: 4 appears on the third toss, B: 6 and 5 appear respectively on first two tosses. Determine  $P(A|B)$

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8. The probability that a man buying a shirt is 0.2 and that for buying a trouser is 0.3. The probability that he will buy a shirt given that he buys a trouser is 0.4.

i. Find the probability that he will buy both a shirt and a trouser

ii. Find the probability that he will buy a trouser, given that he buys a shirt.

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9. Consider the experiment of tossing a coin. If the coin shows head, toss it again but if it shows tail, then throw a die. Find the conditional probability of the event that the die shows a number greater than 4 given that there is atleast one tail.

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**10.** An urn contains 10 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black?

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**11.** Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that

a. Both the balls are red.

b. One of them is black and the other is red

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**12.** A card is drawn from a well shuffled pack of cards.

i. What is the probability that the card drawn is an ace?

ii. If the first card is not replaced and a second card is drawn, what is the probability that both are aces

iii. If the first card is replaced and a second card is drawn, what is the probability that both are aces?

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**13.** Three cards are drawn successively, without replacement from a pack of 52 well shuffled cards. What is the probability that first two cards are kings and the third card is an ace?

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**14.** A box of oranges is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, the box is approved for sale, otherwise, it is rejected. Find the probability that a box containing 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale.

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15. Let  $A$  and  $B$  be two independent events such that

$$P(A) = \frac{1}{7}, P(B) = \frac{1}{5} \text{ Find}$$

i.  $P(A \cap B)$

ii.  $P(A \cup B)$

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16. Let  $E$  and  $F$  be events with  $P(E) = \frac{3}{5}$ ,  $P(F) = \frac{3}{10}$  and  $P(E \cap F) = \frac{1}{5}$  Are  $E$  and  $F$  independent?

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17. Two events  $E$  and  $F$  are such that  $P(E) = 0.6$ ,  $P(F) = 0.2$  and  $P(E \cup F) = 0.68$ . Are  $E$  and  $F$  are independent?

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18. Given that the events A and B are such that  $P(A) = \frac{1}{2}$ ,  $P(A \cup B) = \frac{3}{5}$  and  $P(B) = p$ . Find p if they are (i) mutually exclusive, (ii) independent.

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19. A die is thrown. E is the event "the number appearing is a multiple of 3" and F be the event "the number appearing is even". Find whether E and F are independent.

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20. An unbiased die is thrown twice. Let the event A be "odd number on the first throw" and B be the event odd number on the second throw. Check the independence of the events A and B

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**21.** Three coins are tossed simultaneously. Let the event E 'three heads or three tails', F 'at least two heads' and G 'at most two heads'. Of the pairs (E, F), (E, G) and (F, G), which are independent? which are dependent.

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**22.** If A and B are two independent events, then the probability of occurrence of at least one of A and B is given by  $1 - P(A)P(B)$ .

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**23.** Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that

- i both balls are red.
- ii. first ball is black and second is red.
- ii. one of them black and other is red.

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**24.** A and B try to solve a problem independently Probability that A solves the problem is  $\frac{1}{3}$  and that B solves the problem is  $\frac{1}{4}$ . Find the probability that

- i. Both of them solve the problem.
- ii. The problem is solved.

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**25.** A and B throw a die alternatively till one of them gets a '6' and wins the game. Find their respective probabilities of winning, if A starts first.

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**26.** Find the probability of drawing a one-rupee coin from a purse with two compartments one of which contains 3 fifty paise coins and 2 one rupee coins and other contains 2 fifty paise coins and 3 one-rupee coins

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**27.** A person has undertaken a construction job. The probabilities are 0.65 that there will be strike, 0.80 that the construction job will be completed on time if there is no strike and 0.32 that the construction job will be completed on time if there is a strike. Determine the probability that the construction job will be completed on time.

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**28.** Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the

bags and it is found to be red. Find the probability that it was drawn from Bag II.



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**29.** There are two identical boxes. Box I contains 5 red and 4 black balls, while Box II contains 3 red and 3 black balls. A person chosen a box at random and takes out a ball

- a. Find the probability that the ball drawn is red.
- b. If the ball drawn is black, what is the probability that it is drawn from Box II.



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**30.** Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that

- a. Both the balls are red.
- b. One of them is black and the other is red.



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**31.** Suppose that the reliability of a HIV test is specified as follows. Of people having HIV, 90% of the test detect the disease but 10% go undetected. Of people free of HIV, 99% of the test judged HIV (-ve) but 1% are diagnosed as showing HIV (+ ve). From a large population of which 0.1% have HIV, one person is selected at random, given the HIV test, and the pathologist report him/her as HIV (+ve) What is the probability that the person actually has HIV?



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**32.** A man speaks truth 3 out of 4 times. He throws a die and reports that it is a six. What is the probability that is a six?



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**33.** If a machine is correctly set up, it produces 90% acceptable items. If it is incorrectly set up, it produces only 40% acceptable items. Past experience shows that 80% of the set ups are correctly done. If after a certain set up, the machine produces 2 acceptable items, find the probability that the machine is correctly set up.

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**34.** Given three identical boxes I, II and III each containing two coins. In box I, both coins are gold coins, in box II, both are silver coins and in box III, there is one gold coin and one silver coin. A person chooses a box at random and takes out a coin. If the coin is gold, what is the probability that the other coin in the box is also gold.

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**35.** In a factory which manufactures bolts, machine A, B and C manufacture respectively 25%, 35% and 45% of the bolts. Of their outputs 5, 4 and 2 percent are respectively defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by machine B?

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

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37. Coloured balls are distributed in four boxes as shown in the following table.

Colour				
Box	Black	White	Red	Blue
I	3	4	5	6
II	2	2	2	2
III	1	2	3	1
IV	4	3	1	5

A box is selected at random and then a ball is randomly drawn from the selected box. The colour of the ball is black. What is the probability that ball drawn is from the box III?

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38. A bag contains 2 white and 1 red ball. One ball is drawn at random and then put back in the box after noting its colour. The process is repeated again. If  $X$  denotes the number of red balls recorded in the two draws, describe  $X$ .

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**39.** A person plays a game of tossing a coin thrice. For each head, he is given by ₹ 2 by the organiser of the game and for each tail, he has to pay ₹ 1.50 to the organiser. Let  $X$  denote the amount gained or lost by the person. Show that  $X$  is a random variable and exhibit as a function of the sample space of the experiment.



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**40.** Find the probability distribution of the number of heads in three tosses of a fair coin.



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**41.** Find the probability distribution of the number of heads in three tosses of a fair coin.

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**42.** Two cards are drawn successively with replacement from a pack of 52 cards. Find the probability distribution of the number of aces.

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**43.** Find the probability distribution of number of doublets in three throws of a pair of dice.

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**44.** A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails.

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45. Five defective bulbs are accidentally mixed with 20 good ones. It is not possible to just look at a bulb and tell whether or not it is defective. Find the probability distribution of the number of defective bulbs if 3 bulbs are drawn at random.

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46. A random variable  $X$  has the following probability distribution.

$X$	0	1	2	3	4	5	6	7
$P(X)$	0	$k$	$2k$	$2k$	$3k$	$k^2$	$2k^2$	$7k^2 + k$

i.  $k$ , ii.  $P(X < 3)$  iii.  $P(X > 6)$  iv.  $(P(0 < X < 3))$

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47. Let  $X$  denote the number of hours you study during a randomly selected school day. The probability that  $X$  can take the values  $x$ , has

the following form, where  $k$  is some unknown constant.

$$P(X = x) = \begin{cases} 0.1 & , x = 0 \\ kx & , x=1 \text{ or } 2 \\ k(5 - x) & , X=3 \text{ or } 4 \\ 0 & , \text{ otherwise} \end{cases}$$

i. Find the value of  $k$

ii. What is the probability that you study atleast two hours? Exactly 2 hours? Atmost 2 hours?

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**48.** Probability distribution of the random variable  $X$  is given in the table

$X = x_i$	0	1	2	3	4
$p_i$	$\frac{969}{2530}$	$\frac{1140}{2530}$	$\frac{380}{2530}$	$\frac{40}{2530}$	$\frac{1}{2530}$

i. Find  $x_i p_i$   $i = 0, 1, 2, 3, 4$

ii. Find the mean of  $X$ .

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49. A random variable  $X$  has the following probability distribution

$X$	0	1	2	3	4	5	6	7
$P(X)$	0	$k$	$2k$	$2k$	$3k$	$k^2$	$2k^2$	$7k^2+k$

i. Find the value of  $k$ .

ii. Find  $P(1 < X < 4)$ .

ii. Find the mean of the random variable  $X$ .

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50. A pair of dice is thrown and the random variable  $X$  is defined as the sum of numbers that appear on the two dice. Find the mean or expectation of  $X$ .

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**51.** In a game, a man wins a rupee for a six and loses a rupee for any other number when a fair die is thrown. The man decided to throw a die thrice but to quit as and when he gets a six. Find the expected value of the amount he wins/loses.

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**52.** Find the mean and variance of the number obtained on the throw of an unbiased die.

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**53.** Two cards are drawn simultaneously from a well shuffled pack of 52 cards. Find the mean, variance and standard deviation of the number of kings.

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54. The probability distribution of a random variable  $X$  taking values 1, 2, 3, 4, 5 is given

- find the value of  $p$ .
- Find the mean of  $X$
- Find the variance of  $X$

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55. The probability distribution of a random variable  $X$  is given below

$X$	0	1	2	3	4	5
$P(X)$	$k$	$2k$	$3k$	$4k$	$5k$	$5k$

- Find  $k$ .
- Find the variance of the random variable

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**56.** Six balls are drawn successively from an urn containing 7 red and 9 black balls. Tell whether or not the trials of drawing balls are Bernoulli trials when after each draw the ball drawn is

i. replaced

ii. not replaced in the urn.



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**57.** If a fair coin is tossed 10 times, find the probability of

i. exactly six heads

ii atleast six heads

iii atmost six heads



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**58.** Ten eggs are drawn successively with replacement from a lot containing 10% defective eggs. Find the probability that there is



at least one defective egg.

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**59.** A die is tossed thrice. Find the probability of getting an odd number at least once.

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**60.** A coin is tossed 4 times

- i. Find the probability of getting exactly 3 heads
- ii. Find the probability of getting at least 3 heads
- iii. Find the probability of getting at most 3 heads

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**61.** A fair die is thrown thrice. Getting 1 or 6 is considered as a success.

i. Find  $p$  and  $q$ , the probability of success and failure respectively in any one trial.

ii. Obtain the probability distribution of the successes.

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**62.** suppose  $X$  has a binomial distribution  $B(6, \frac{1}{2})$ . Show that  $X = 3$  is the most likely outcome.

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**63.** A binomial random variable  $X$  satisfies the relation  $9P(X = 4) = P(X = 2)$  when  $n = 6$ . Find the parameter  $p$ .

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64. The probability of a shooter hitting a target is  $\frac{3}{4}$ . How many minimum number of times must he/she fire so that the probability of hitting the target at least once is more than 0.99?

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65. Find the mean of the Binomial distribution  $B\left(4, \frac{1}{3}\right)$

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66. The mean and variance of a Binomial distribution  $X$  are 6 and  $\frac{12}{5}$  respectively.

i. Find the parameters  $n$  and  $p$  of  $X$

ii. Find  $P(X \geq 1)$  given  $(0.4)^{10} = 0.000105$

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67. If the mean and variance of a binomial distribution are 9 and 6

i. Find the distribution.

ii. Find  $P(X \geq 2)$

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## Solutions To Ncert Text Book Exercise 13.1

1. 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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2. Compute  $P(A|B)$ , if  $P(B) = 0.5$  and  $P(A \cap B) = 0.32$

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3. If  $P(A) = 0.8$ ,  $P(B) = 0.5$  and  $P(B|A) = 0.4$ , find

i.  $P(A \cap B)$  ii.  $P(A|B)$  iii.  $P(A \cup B)$

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4. Evaluate  $P(A \cup B)$  if  $2P(A) = P(B) = \frac{5}{13}$  and  $P(A/B) = \frac{2}{5}$ .

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5. If  $P(A) = \frac{6}{11}$ ,  $P(B) = \frac{5}{11}$  and  $P(A \cup B) = \frac{7}{11}$  find

i.  $P(A \cap B)$  ii.  $P(A|B)$  iii.  $P(B|A)$

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6. Determine  $P(E/F)$

A coin is tossed three times, where

i. E: head on third toss,

F: head on first two tosses

ii. E: atleast two heads,

F: atmost two heads

iii. E: atmost two tails,

F: atleast one tail



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7. Determine  $P(E/F)$

Two coins are tossed once, where

i. E: tail appears on one coin,

F: one coin shows head

ii E: no tail appears,

F: no head appears



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8. A die is thrown three times,

A: 4 appears on the third toss, B: 6 and 5 appear respectively on first two tosses Determine  $P(A|B)$ .

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9. Mother, father and son line up at random for a family picture

E: son on one end, F: father in middle

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10. A black and red dice are rolled.

a. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.

b. Find the conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.

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11. A fair die is rolled. Consider events  $E = \{1,3,5\}$ ,  $F = \{2,3\}$  and  $G = \{2,3,4,5\}$

i. Find  $P(E|F)$ , and  $P(F|E)$

ii.  $P(E|G)$  and  $P(G|E)$

iii.  $P(E \cup F | G)$  and  $P((E \cap F) | G)$



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12. Assume that each born child is equally likely to be a boy or a girl. If a family has two children what is the conditional probability that both are girls given that

i. the youngest is a girl

ii. At least one is a girl



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**13.** 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?

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**14.** Given that the two numbers appearing on throwing two dice are different. Find the probability of the event 'the sum of numbers on the dice is 4.

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**15.** Consider the experiment of throwing a die, if a multiple 3 comes up, throw the die again and if any other number comes, toss a coin.

Find the conditional probability of the event 'the coin shows a tail', given that 'atleast one die shows a 3'.

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16. If  $P(A) = \frac{1}{2}$ ,  $P(B)=0$ , then  $P(A|B)$  is

A. 0

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

C. not defined

D. 1

**Answer: C**

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17. If A and B are events such that  $P(A|B)= P(B|A)$ , then

A.  $A \subset B$  but  $A \neq B$

B.  $A=B$

C.  $A \cap B = \phi$

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

**Answer: D**

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## Solutions To Ncert Text Book Exercise 13 2

1. If  $P(A) = \frac{3}{5}$  and  $P(B) = \frac{1}{5}$  find  $P(A \cap B)$ . if A and B are independent events.

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2. Two cards are drawn successively with replacement from a pack of 52 cards. Find the probability distribution of the number of aces.

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3. A box of oranges is inspected by examining three randomly selected oranges drawn without replacement. If all the three oranges are good, the box is approved for sale, otherwise, it is rejected. Find the probability that a box containing 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale.

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4. A fair coin and an unbiased die are tossed. Let A be the event 'head appears on the coin' and B be the event '3 on the die'. Check whether A and B are independent events or not.

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5. A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event, 'the number is even,' and B be the event, 'the number is red'. Are A and B independent?

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6. Let E and F be events with  $P(E) = \frac{3}{5}$ ,  $P(F) = \frac{3}{10}$  and  $P(E \cap F) = \frac{1}{5}$ . Are E and F independent?

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7. Given that the events A and B are such that  $P(A) = \frac{1}{2}$ ,  $P(A \cup B) = \frac{3}{5}$  and  $P(B) = p$  Find p if they are (i) mutually exclusive, (ii) independent.

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8. Let A and B be independent events with  $P(A) = 0.3$  and  $P(B) = 0.4$ . Find

i.  $P(A \cap B)$  ii.  $P(A \cup B)$  iii.  $P(A|B)$  iv.  $P(B|A)$

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9. If A and B are two events such that  $P(A) = \frac{1}{4}$ ,  $P(B) = \frac{1}{2}$  and

$P(A \cap B) = \frac{1}{8}$  find  $P(\text{not A and not B})$ .

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10. Events A and B are such that  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{7}{12}$  and

$P(\text{not A or not B}) = \frac{1}{4}$  State whether A and B are independent?

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11. Given two independent events A and B such that  $P(A) = 0.3$ ,  $P(B) = 0.6$ . Find i.  $P(A \text{ and } B)$  ii.  $P(A \text{ and not } B)$   
iii.  $P(A \text{ or } B)$  iv.  $P(\text{ neither } A \text{ nor } B)$

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12. A die is tossed thrice. Find the probability of getting an odd number at least once.

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13. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that  
i. both balls are red.  
ii. first ball is black and second is red.  
iii. one of them black and other is red:

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**14.** Probability of solving specific problem independently by A and B are and  $\frac{1}{2}$  and  $\frac{1}{3}$  respectively. If both try to solve the problem independently, find the probability that

- i. the problem is solved
- ii. exactly one of them solves the problem

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**15.** One card is drawn at random from a well shuffled deck of 52 cards. In which of the following cases are the events E and F independent?

- i. E: 'the card drawn is a spade'  
F: 'the card drawn is an ace'
- ii. E: 'the card drawn is black'  
F: 'the card drawn is king'
- ii. E: 'the card drawn is a king or queen'  
F: 'the card drawn is a queen or jack'.





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**16.** In a hostel, 60% of the students read Hindi newspaper, 40% read English news, paper and 20% read both Hindi and English newspapers. A student is selected at random.

- i. Find the probability that she reads neither Hindi nor English newspapers.
- ii. If she reads Hindi newspaper, find the probability that she reads English newspaper.
- iii. If she reads English newspaper, find the probability that she reads Hindi newspaper.



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**17.** A pair of dice is rolled. Find the probability of obtaining an even prime number on each dice is

A. 0

B.  $\frac{1}{3}$

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

D.  $\frac{1}{36}$

**Answer: D**



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**18.** Two events A and B will be independent, if .....

A. A and B are mutually exclusive

B.  $P(A \cap B) = [1 - P(A)] [1 - P(B)]$

C.  $P(A) = P(B)$

D.  $P(A) + P(B) = 1$

**Answer: B**

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### Solutions To Ncert Text Book Exercise 13 3

1. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red?

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2. A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

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3. Of the students in a college, it is known that 60% reside in hostel and 40% are day scholars (not residing in hostel). Previous year results report that 30% of all students who reside in hostel attain A grade and 20% of day scholars attain A grade in their annual examination. At the end of the year, one student is chosen at random from the college and he has an A grade, what is the probability that the student is a hosteler?

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4. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let  $\frac{3}{4}$  be the probability that he knows the answer and  $\frac{1}{4}$  be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability  $\frac{1}{4}$  What is the probability that the student knows the answer given that he answer it correctly?

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5. A laboratory blood test is 99% effective in detecting a certain disease when it is in fact, present. However, the test also yield a false positive result for 0.5% of the healthy person tested (i.e. if a healthy person is tested, then with probability 0.005, the test will imply he has the disease). If 0.1 percent of the population actually has the disease, what is the probability that a person has the disease given that his test result is positive?

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6. There are three coins. One is a two headed coin (having head on both faces), another is a biased coin that comes up heads 75% of the time and third is an unbiased coin. One of the three coins is chosen at random and tossed, it shows head, what is the probability that it was the two headed coin?

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7. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accidents are 0.01, 0.03 and 0.15 respectively. One of the insured persons meets with an accident. What is the probability that he is a scooter driver?

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8. A factory has two machines A and B. Past record shows that machine A produced 60% of the items of output and machine B produced 40% of the items. Further, 2% of the items produced by machine A and 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B:

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9. Two groups are competing for the position on 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 introduced was by the second group.

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10. Suppose a girl throws a die. If she gets as 5 or 6, she tosses a coin three times and notes the number of heads. If she gets 1, 2, 3 or 4, she tosses a coin once and notes whether a head or tail is obtained. If she obtained exactly one head, what is the probability that she threw 1, 2, 3 or 4 with the die?

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**11.** A manufacturer has three machine operators A, B and C. The first operator A produces 1% defective items, whereas the other two operators B and C produce 5% and 7% defective items respectively. A is on the job for 50% of the time, B is on the job for 30% of the time and C is on the job for 20% of the time. A defective item is produced. What is the probability that it was produced by A?

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**12.** 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.

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**13.** Probability that A speaks truth is  $\frac{4}{5}$ . A coin is tossed. A reports that a head appears. The probability that there was head is



A.  $\frac{4}{5}$

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

C.  $\frac{1}{5}$

D.  $\frac{2}{5}$

**Answer: A**

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**14.** If  $A$  and  $B$  are two events such that  $A \subset B$  and  $P(B) \neq 0$ , then which of the following is correct ?

A.  $P(A | B) = \frac{P(B)}{P(A)}$

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

C.  $P(A | B) \geq P(A)$

D. None of these

Answer: C

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## Solutions To Ncert Text Book Exercise 13.4

1. State which of the following are not the probability distributions of a random variable. Give reasons for your answer.

i.

X	0	1	2
P(X)	0.4	0.4	0.2

ii.

X	0	1	2	3	4
P(X)	0.1	0.5	0.2	-0.1	0.3

iii.

Y	-1	0	1
P(Y)	0.6	0.1	0.2

iv.

Z	3	2	1	0	-1
P(Z)	0.3	0.2	0.4	0.1	0.05

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2. An urn contains 5 red and 2 black balls . Two balls are randomly drawn. Let  $X$  represent the numbers of blacks balls. What are the possible values of  $X$ ? is  $X$  is a random variable?

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3. Let  $X$  represent the difference between the number of head and the number of tails obtained when a coin is tossed 6 times. What are possible values of  $X$ ?

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4. Find the probability distribution of

i. number of head in two tosses of a coin.

ii. number of tails in the simultaneous tosses of three coins.

iii. number of heads in four tosses of a coin.

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5. Find the probability distribution of the number of successes in two tosses of a die, where a success is defined as

- i. number greater than 4
- ii. six appears on atleast one die



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6. From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs.



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7. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number

of tails.

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8. A random variable  $X$  has the following probability distribution.

$X$	0	1	2	3	4	5	6	7
$P(X)$	0	$k$	$2k$	$2k$	$3k$	$k^2$	$2k^2$	$7k^2 + k$

i.  $k$ , ii.  $P(X < 3)$  iii.  $P(X > 6)$  iv.  $(P(0 < X < 3))$

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9. The random variable  $X$  has a probability distribution  $P(X)$  of the following form, where  $k$  is some number.

$$P(X) = \begin{cases} k & , \quad \text{if } x = 0 \\ 2k & , \quad \text{if } x=1 \\ 3k & , \quad x=2 \\ 0 & , \quad \text{otherwise} \end{cases}$$

a. Determine the value of  $k$

b. Find  $P(X < 2)$ ,  $IP(X \leq 2)$ ,  $P(X > 2)$ .



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10. Find the mean number of heads in three tosses of a fair coin.



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11. Two dice are thrown simultaneously. If  $X$  denotes the number of sixes, find the expectation of  $X$ .



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12. Two numbers are selected at random (without replacement) from the first six positive integers. Let  $X$  denote the larger of the two numbers obtained. Find  $E(X)$



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**13.** Let  $X$  denote the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of  $X$ .

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**14.** A class has 15 students whose ages are 14, 17, 15, 14, 21, 17, 19, 20, 16, 18, 20, 17, 16, 19 and 20 years. One student is selected such a manner that each has the same chance of being chosen and the age  $X$  of the selected student is recorded. What is the probability distribution of the random variable  $X$ ? Find mean, variance and standard deviation of  $X$ .

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**15.** In a meeting, 70% of the members favour and 30% oppose a certain proposal. A member is selected at random and we take  $X=0$  if he opposed, and  $X = 1$  if he is in favour. Find  $E(X)$  and  $\text{Var}(X)$ .





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16. The mean of the numbers obtained on throwing a die having written 1 on three faces, 2 on two faces and 5 on one face is

A. 1

B. 2

C. 5

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

**Answer: B**



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17. Suppose that two cards are drawn at random from a deck of cards.

Let  $X$  be the number of aces obtained. then the value of  $E(X)$  is

A.  $\frac{37}{221}$



B.  $\frac{5}{13}$

C.  $\frac{1}{13}$

D.  $\frac{2}{13}$

**Answer: D**

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## Solutions To Ncert Text Book Exercise 13 5

1. A die is thrown 6 times If 'getting an odd number' is a success, what is the probability of

i. 5 successes?

ii. atleast 5, successes? iii. atmost 5 successes?

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2. A pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability of two successes.

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3. There are 5% defective items in a large bulk of items. What is the probability that a sample of 10 items will include not more than one defective items?

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4. Five cards are drawn successively with replacement from a well-shuffled deck of 52 cards . What is the probability that

i. all the five cards are spades?

ii only 3 cards are spades?

iii. none is a spade?

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5. The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. find the probability that out of 5 such bulbs.

i. none

ii. not more than one

iii. more than one

iv. atleast one

will fuse after 150 days of use.



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6. A bag consists of 10 balls each marked with one of the digits 0 to 9. If four balls are drawn successively with replacement from the bag, what is the probability that none is marked with the digit 0?



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7. In an examination 20 questions of true false type are asked. Suppose a student tosses a fair coin to determine his answer to each question. If the coin falls head, he answers 'true', if it falls tail, he answers 'false'. Find the probability that he answers atleast 12 questions correctly.

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8. Suppose  $X$  has binomial distribution  $B\left(6, \frac{1}{2}\right)$ . Show that  $X = 3$  is the most likely outcome.

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9. On a multiple choice examination with three possible answers for each of the five questions, what is the probability that a candidate would get four or more correct answers just by guessing?

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10. A person buys a lottery ticket in 50 lotteries, in each of which his chance of winning a prize is  $\frac{1}{100}$ . What is the probability that he will win a prize

- a. atleast once
- b. exactly once
- c. atleast twice?

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11. Find the probability of getting 5 exactly twice in 7 throws of a die.

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12. Find the probability of throwing atmost 2 sixes in 6 throws of a single die

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13. It is known that 10% of certain articles manufactured are defective. What is the probability that in a random sample of 12 such articles, 9 are defective?

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14. In a box containing 100 bulbs, 10 are defective. The probability that out of a sample of 5 bulbs, none is defective is

A.  $10^{-1}$

B.  $\left(\frac{1}{2}\right)^5$

C.  $\left(\frac{9}{10}\right)^5$

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

**Answer: c**

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15. The probability that a student is not a swimmer is  $\frac{1}{5}$ . Then the probability that out of five students, four are swimmers is

A.  ${}^5C_4 \left(\frac{4}{5}\right)^4 \frac{1}{5}$

B.  $\left(\frac{4}{5}\right)^4 \frac{1}{5}$

C.  ${}^5C_1 \frac{1}{5} \left(\frac{4}{5}\right)^4$

D. None of these

**Answer: a or c**

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### Additional Questions For Practice 13 1

1.  $P(A) = \frac{5}{12}$ ,  $P(B) = \frac{7}{12}$ ,  $P(A \cap B) = \frac{1}{4}$  Find  $P(A|B)$

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2. E and F are events such that  $P(E) = \frac{1}{3}P(F) = \frac{1}{4}$ ,  
 $P(E \cap F) = \frac{1}{5}$ . Find

i.  $P(E | F)$  ii.  $P(F | E)$  iii.  $P(E \cup F)$

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3. If A and B are two events such that  
 $P(A) = 0.4$ ,  $P(B) = 0.8$ ,  $P(B | A) = 0.6$ , find

i.  $P(A|B)$  ii.  $P(A \cup B)$

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4. If  $P(E) = 0.40$ ,  $P(F) = 0.35$  and  $P(E \cup F) = 0.55$ , find  
 $P(E | F)$ .

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5. If  $P(\bar{A}) = 0.7$ ,  $P(B) = 0.7$ ,  $P(B | A) = 0.5$ , find i.  $P(A | B)$ . ii.  $P(A \cup B)$

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6. E and F are events such that  $P(E) = \frac{1}{3}$ ,  $P(F) = \frac{1}{5}$ ,  $P(E \cup F) = \frac{11}{50}$ . Find  
i.  $P(E|F)$  ii.  $P(F|E)$ .

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7. In a class 30% students failed in English, 20% students failed in Hindi, 10% students failed in English and Hindi both. A student is chosen at random. What is the probability that he will fail in English if he has failed in Hindi?

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## Additional Questions For Practice 13 2

1. An urn contains 8 white balls and 6 black balls. Two balls are drawn from the urn one after another without replacement. What is the probability that both the drawn balls are white?

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2. Find the probability of drawing a diamond card in each of two consecutive draws from a well shuffled pack of cards, if the card drawn is not replaced after the first draw.

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3. A bag contains 19 tickets, numbered from 1 to 19. A ticket is drawn and then another ticket is drawn without replacement. Find the

probability that both show even numbers.

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4.  $P(A) = \frac{3}{5}$  and  $P(B) = \frac{1}{3}$ . Find  $P(A \text{ and } B)$  if A and B are independent events.

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5. If E and F are independent events such that  $P(E')=0.2$  and  $P(F')=0.5$ , find  $P(E \cap F)$

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6.  $P(A)=0.4$ ,  $P(B)=p$ ,  $P(A \cup B) = 0.6$  and A and B are independent. Then find the value of p.

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7. If  $E$  and  $F$  are independent events, show that  $P(E \cup F) = 1 - P(E')P(F')$ .

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8. A coin is tossed three times and all possible outcomes are assumed to be equally likely.  $E$  is the event: "exactly 2 heads or two tails have occurred" and  $F$  is the event: "at most one tail has occurred". Show that  $E$  and  $F$  are independent events.

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9. Consider the random experiment of throwing two dice. Let  $A$  be the event of getting the sum of 11 and  $B$  is the event of getting a number other than 5 on the first die. Are  $A$  and  $B$  independent events?

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**10.** A husband and wife appear for an interview for two vacancies in the same post. The probability of husband's selection is  $\frac{1}{7}$  and wife's rejection is  $\frac{4}{5}$ . Find the probability that

- i. both of them are selected.
- ii. only one of them is selected.
- iii. none of them is selected.
- iv. at least one of them is selected.



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**11.** A, B, C shoot to hit a target. If A hits the target 4 times in 5 trials, B hits it 3 times in 4 trials and C hits it 2 times in 3 trials. Find the probability that the target is hit by

- i. exactly 2 persons.
- ii. exactly 3 persons.
- iii. at least 2 persons.

iv. atmost 2 persons.

v. none.

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12. Let  $A$  and  $B$  be two independent events such that  $P(A) = \frac{1}{7}$  and  $P(B) = \frac{1}{5}$ . Find

i.  $P(A \cap B)$  ii.  $P(A \cup B)$  iii.  $P(A \cap B') \cup (B \cap A')$

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13. A bag contains 100 tickets numbered from 1 to 100. Four tickets are drawn successively with replacement from the bag. Find the probability that all the tickets bear even numbers.

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14. Let  $P(A) = \frac{3}{5}$  and  $P(B) = \frac{1}{3}$

i. Find  $P(A \cup B)$  if A and B are mutually exclusive events

ii. Find  $P(A \cap B)$  if A and B are independent events

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15. A and B try independently to solve a problem. Probability that A solves it is  $\frac{1}{3}$  and that B solves is  $\frac{3}{5}$ . Find the probability that the problem is solved

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### Additional Questions For Practice 13 3

1. There are two identical boxes. Box I contains 2 red and 3 white balls, while box II contains 1 red and 4 white balls. A person chooses a box at random and takes out a ball.

i Find the probability that the ball drawn is red.

ii. If the ball drawn is white, what is the probability that it is drawn from box II?

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2. In a factory which manufactures bulbs, machines X, Y and Z manufactures respectively 25%, 35% and 40% of the bulbs. Of their outputs 1, 2 and 3 percent re respectively defective bulbs. A bulb is drawn at random and is found to be defective. What is the probability that it is manufactured by the machine Y?

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3. There are two Urns. The first one contains 4 white and 6 blue balls and the other contains 4 white and 5 blue balls. One of the urns is selected at random and a ball is drawn. If the ball drawn is white, find the probability that it is drawn from the first urn.





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4. Assume that a factory has two machines. Past records show that machine I produces 20% of the output and machine II produces 80% of the item. Further, 6% of the items produced by machine I were defective and only 1% produced by machine II was defective. If a defective is drawn at random, what is the probability that it was produced by

(i) machine I

(i) machine II?



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5. A company has two plants to manufacture bicycles. The first plant manufactures 60% of the bicycles and the second plant 40%. 80% of the bicycles are rated of standard quality at the first plant and 90% of standard quality at the second plant. A bicycle is selected random and

found to be of standard quality. Find the probability that it comes from the second plant.

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6. A box contains 4 gold and 3 silver coins. Another box contains 3 gold and 5 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 from the second box.

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7. The contents of urns I, II and III are as follows

Urn I: 1 white, 2 black and 3 red balls

Urn II: 2 white, 1 black and 1 red balls

Urn III: 4 white, 5 black and 3 red balls. One urn is chosen at random and two balls are drawn. They happen to be white and red. What is the probability that they come from urn I, II or III?



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8. A factory has 3 machines X, Y and Z producing 1000, 2000 and 3000 bolts per day respectively. The machine X produces 1% defective bolt, Y produces 1.5% and Z produces 2% defective bolts. At the end of a day, a bolt is drawn at random and is found defective. What is the probability that this defective bolt has been produced by the machine X?



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9. Suppose that 5 males out of 100 and 25 females out of 1000 are colour blind. A colour blind person is chosen at random. What is the probability that a male is chosen (assume that the number of males and females are equal)?



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10. Find the probability distribution of the doublets in two throws of a pair of dice.

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### Additional Questions For Practice 13 4

1. A die is tossed once. If the random variable  $X$  is defined as,

$$P(X = x) = \begin{cases} 1 & , \text{ if the die results in an even number} \\ 0 & , \text{ if the die results in an odd number} \end{cases}$$

Find the probability distribution of  $X$ .

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2. Find the probability distribution of the number of doublets in four throws of a pair die.

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3. A random variable  $X$  has the following probability distribution.

i. k ii.  $P(X < 3)$  iii.  $P(0 < X < 5)$

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4. Find mean ( $\mu$ ), variance ( $\sigma^2$ ) and standard deviation ( $\sigma$ ) of the following probability distribution.

$x_i$	0	1	3	5
$p(x_i)$	0.2	0.5	0.2	0.1

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5. Two bad eggs are accidentally mixed with 10 good ones. 3 eggs are drawn at random with replacement from this lot.

i. Compute mean for the number of bad eggs drawn.

ii. Hence calculate variance and standard deviation .



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## Additional Questions For Practice 13 5

1. A pair of dice is thrown 10 times. If getting a doublet is considered as a success, find the probability of getting 4 successes.



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2. Five cards are drawn successively with replacement from a well shuffled pack of 52 cards. What is the probability that only 3 cards are spades?



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3. If 8 fair coins are tossed, what is the probability of getting,

i. exactly 3 heads

ii. not more than 3 heads

iii. atleast 6 heads



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4. A pair of dice is thrown 7 times. If getting total 7 is considered a success, what is the probability of

i. no successes

ii. 6 successes

iii. atleast 6 successes.



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5. It a fair coin is tossed 6 times, what is the probability of getting at least 3 heads?



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## Solutions To Ncert Miscellaneous Exercise

1. A and B are two events such that  $P(A) \neq 0$ . Find  $P(B|A)$ , if

i. A is a subset of B , ii.  $A \cap B = \emptyset$



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2. A couple has two children. Find the probability that both children are males, if it is known that atleast one of the children is male.

ii. Find the probability that both children are females, if it is known that the elder child is a female.



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3. Suppose that 5% of men and 0.25% of women have grey hair. A grey haired person is selected at random. What is the probability of this person being male? Assume that there are equal number of males and females.

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4. Suppose that 90% of people are right-handed. What is the probability that at most 6 of a random sample of 10 people are right-handed?

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5. An urn contains 25 balls of which 10 balls bear a mark 'X' and remaining 15 bear a mark 'Y'. A ball is drawn at random from the urn, its mark is noted down and it is replaced. If 6 balls are drawn in this way, find the probability that

i. all will bear 'X' mark

ii. not more than 2 will bear 'Y' mark

iii. atleast one ball will bear 'Y' mark

iv. the number of balls with 'X' marks and 'Y' mark will be equal

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6. In a hurdle race a player has to cross 10 hurdles . The probability that he will clear each hurdle is  $\frac{5}{6}$ . What is the probability that he will knock down less than 2 hurdles ?

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7. A die is thrown again and again until three sixes are obtained. Find the probability obtaining the six in the sixth throw of the die.

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8. If a leap year is selected at random, what is the chance that it will contain 53 Tuesdays?

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9. An experiment succeeds twice as often as it fails. Find the probability that in the next six trials, there will be at least 4 successes.

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10. How many times must a man toss a fair coin so that the probability of having at least one head is more than 90%?

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11. In a game, a man wins a rupee for a six and loses a rupee for any other number when a fair die is thrown. The man decided to throw a

die thrice but to quit as and when he gets a six . Find the expected value of the amount he wins/loses.

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12. Suppose we have four boxes A, B, C and D containing coloured marbles as given below:

Box	Marble colour		
	Red	White	Black
A	1	6	3
B	6	2	2
C	8	1	1
D	0	6	4

One of the boxes has been selected at random and a single marble is drawn from it. If the marble is red, what is the probability that it was drawn from box A? box B?

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**13.** Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduce the risk of heart attack by 30% and prescription of certain drug reduces its chance by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?

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**14.** If each element of a second order determinant is either zero or one, what is the probability that the value of the determinant is positive? (Assume that the individual entries of the determinant are chosen independently, each value being assumed with probability  $\frac{1}{2}$ )

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**15.** An electronic assembly consists of two sub-systems, say, A and B. From previous testing procedures, the following probabilities are assumed to be known.

$$P(\text{A fails}) = 0.2$$

$$P(\text{B fails alone}) = 0.15$$

$$P(\text{A and B fail}) = 0.15$$
 Evaluate the following probabilities

i.  $P(\text{A fails} | \text{B has failed})$

ii.  $P(\text{A fails alone})$

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**16.** Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be red in color. Find the probability that the transferred ball is black.

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17. If A, B are two events such that  $P(A) \neq 0$  and  $P(B|A) = 1$ , then

A.  $A \subset B$

B.  $B \subset A$

C.  $B = \phi$

D.  $A = \phi$

**Answer: a**



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18. If  $P(A | B) > P(A)$ , then which of the following is correct:

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

B.  $P(A \cap B) < P(A) \cdot P(B)$

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

D.  $P(B|A) = P(B)$

**Answer: c**



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**19.** If A and B are any two events such that  $P(A) + P(B) - P(A \text{ and } B) = P(A)$ , then

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

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

C.  $P(B|A) = 0$

D.  $P(A|B) = 0$

**Answer: b**



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1. If  $A$  and  $B$  are two events such that  $P(A) = 0.5$ ,  $P(B) = 0.6$ ,  $P(A \cup B) = 0.8$ , find  $P(A|B)$ .

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2. Find the binomial distribution whose mean is 10 and standard deviation is  $2\sqrt{2}$

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3. A purse contains 2 silver and 4 copper coins. Another purse contains 4 silver and 3 copper coins. If a coin is pulled at random from one of the two purses, what is the probability that it is a silver coin?

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4. If on an average 1 ship in every 10 sinks, find the chance that out of 5 ships atleast 4 will arrive safely.

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5. Three cards are drawn successively without replacement from a pack of 52 well shuffled cards. What is the probability that the first two cards are kings and the third is an ace?

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6. A bag X contains 2 white and 3 red balls and bag Y contains 4 white and 5 red balls. One ball is drawn at random from one bag and it is found to be red. Find the probability that it was drawn from bag Y.

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7. Find the probability distribution of the number of kings when 2 cards are drawn one by one without replacement from a pack of 52 playing cards,

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8. A random variable has the following distribution

X	-1	0	1	2
P(X)	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{3}$

i. Does it represent a probability function?

ii. If yes, find its mean and variance.

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1. It is known that 10% of certain articles manufactured are defective. What is the probability that in a random sample of 12 such articles, 9 are defective?

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2. Complete the following table

$P(A)$	$P(B)$	$P(A \cup B)$	$P(A \cap B)$	$P(B - A)$	$P(A - B)$	$P(A')$	$P(A/B)$
0.5	0.3	0.6					
	0.2	0.4	0.2				
	0.5		0.3			0.6	
0.5		0.7	0.4				

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## Continuous Evaluation Lab Work

1. Draw a tree diagram to represent the sample space in the following cases

i. A coin is tossed once

ii. A coin is tossed twice

iii. A coin is tossed 3 times

Generalise the number of outcomes when a coin is tossed  $n$  times.

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## Objective Type Questions And Solutions

1. The set  $E \cap F$  denotes the event

- A. Both E and F occurred
- B. Both E and F have not occurred
- C. E has occurred but F has not occurred
- D. None of these

**Answer: A**

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2.  $P(E \cap F)$  is equal to

A.  $P(E) \cdot P(F | E)$

B.  $P(F) \cdot P(E | F)$

C. Both (a) & (b)

D. None of these

**Answer: C**



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3. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss equals

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

B.  $\frac{1}{32}$

C.  $\frac{31}{32}$

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

**Answer: A**

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4. If A and B are any two events then  $P(\bar{A} \cap B) =$

A.  $P(\bar{A}) \cdot P(\bar{B})$

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

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

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

**Answer: D**

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5. Choose the correct answer

If A and B are events such that  $P(A|B) = P(B|A)$ , then

A. A sub B but  $A \neq B$

B.  $A = B$

C.  $A \cap B = \phi$

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

**Answer: D**

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6. A and B are two events such that  $P(A) > 0, P(B) \neq 1$  then

$P(\bar{A} | \bar{B})$  is equal to

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

B.  $1 - P(\bar{A} | B)$



C.  $\frac{1 - P(A \cup B)}{P(B)}$

D.  $\frac{P(\bar{A})}{P(B)}$

**Answer: C**

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7. Two events A and B will be independent if

A. A and B are mutually exclusive

B.  $P(A'B') = [1 - P(A)][1 - P(B)]$

C.  $P(A) = P(B)$

D.  $P(A) + P(B) = 1$

**Answer: A**

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8. if  $P(A) = \frac{4}{5}$  and  $P(A \cap B) = \frac{7}{10}$  then  $P(B|A)$  is equal to

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

B.  $\frac{1}{8}$

C.  $\frac{7}{8}$

D.  $\frac{17}{20}$

**Answer: C**



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9. If  $P(A) = \frac{2}{3}$ ,  $P(B) = \frac{1}{2}$  and  $P(A \cup B) = \frac{5}{6}$  then events A and

B are

A. mutually exclusive

B. independent as well as mutually exclusive

C. independent

D. dependent only on A

**Answer: C**

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**10.** If A and B are two independent events, then the probability of occurrence of atleast one of A and B is given by

A.  $1 - P(A) \cdot P(B)$

B.  $1 - P(A) \cdot P(B)'$

C.  $1 - P(A) \cdot P(B)'$

D.  $1 - P(A) \cdot P(B)'$

**Answer: D**

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11. Two events A and B will be independent, if

A. A and B are mutually exclusive

B.  $P(A'B') = [1 - P(A)][1 - P(B)]$

C.  $P(A) = P(B)$

D.  $P(A) + P(B) = 1$

**Answer: B**

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12. A pair of dice is rolled. Find the probability of obtaining an even prime number on each dice is

A. 0

B.  $\frac{1}{3}$

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

D.  $\frac{1}{36}$

**Answer: D**

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13. If three events of a sample space are E, F and G, then  $P(E \cap F \cap G)$  is equal to

A.  $P(E) \cdot P(F | E) \cdot P(G | E \cap F)$

B.  $P(E) \cdot P(F | E) \cdot P(G | F)$

C.  $P(E) \cdot P(E | F) \cdot P(E | F \cap G)$

D. None of these

**Answer: A**

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14. Two events A and B are independent then

A. A and B are mutually exclusive

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

C.  $P(A \cap B') = P(A) \cdot P(B')$

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

Answer: C



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15. If the events A and B are independent, then  $P(A \cap B)$  is equal to

A.  $P(A) + P(B)$

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

C.  $P(A) \cdot P(B)$

D.  $\frac{P(A)}{P(B)}$

**Answer: C**

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**16.** If  $X$  is a random variable with the following distribution

$X$	0	1	2	3
$P(X)$	$k$	$3k$	$3k$	$k$

then  $k$  is

- A.  $\frac{1}{8}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{6}$
- D.  $\frac{1}{2}$

**Answer: A**

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17. The probability distribution of a random variable X is given as

$x$	-5	-4	-3	-2	-1	0	1	2	3	4	5
$p(X=x)$	$p$	$2p$	$3p$	$4p$	$5p$	$7p$	$8p$	$9p$	$10p$	$11p$	$12p$

Then the value of  $p$  is

A.  $\frac{1}{72}$

B.  $\frac{3}{73}$

C.  $\frac{5}{72}$

D.  $\frac{1}{74}$

**Answer: A**

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18. The variance of the random variable X is equal to

A.  $E(X^2) + [E(X)]^2$

B.  $E(X) - E(X^2)$



C.  $E(X^2) - [E(X)]^2$

D.  $E(X^2) + [E(X)]^2$

**Answer: C**

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19. Which of the following is not a requirement of binomial distribution?

A. There are two outcomes for each trial

B. There are fixed number of trials

C. The outcomes must be dependent on each other

D. The probability of success must be same for all trials

**Answer: C**

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20. A pair of fair dice is thrown independently three times. The probability of getting a score of exactly 9 twice is

A.  $\frac{8}{729}$

B.  $\frac{8}{243}$

C.  $\frac{1}{729}$

D.  $\frac{8}{9}$

**Answer: B**

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## Examples

1. Three distinguishable fair coins are tossed once or A coin is tossed three times. Write the sample space.

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2. Consider the random experiment of rolling two dice. List the sample space.



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3. A coin is tossed and then a die is thrown. Describe the sample space.



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4. In each of the following experiments specify appropriate sample space

i. A boy has a 1 rupee coin, a 2 rupee coin and a 5 rupee coin in his pocket. He takes out two coins out of his pocket, one after the other.

ii. A person is noting down the number of accidents along a busy highway during a year.



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5. Consider the experiment in which a coin is tossed repeatedly until a tail comes up. Describe the sample space.



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6. 2 boys and 2 girls are in Room X, and 1 boy and 3 girls in Room Y. Specify the sample space for the experiment in which a room is selected and then a person.



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7. An experiment consists of tossing a coin and then throwing it second time if a head occurs. If a tail occurs on the first toss, then a die is rolled once. Find the sample space.



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**8.** Suppose 3 bulbs are selected at random from a lot. Each bulb is tested and classified as defective (D) or non-defective (N). Write the sample space of this experiment.

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**9.** A die is thrown repeatedly until a six comes up. What is the sample space for this experiment?

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**10.** An experiment involves rolling a pair of dice and recording the numbers that come up. Describe the following events:

A : the sum is greater than 8,

B : 2 occurs on either die

C : the sum is atleast 7 and a multiple of 3.

Which pairs of these events are mutually exclusive?



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**11.** Two dice are thrown. The events A, B and C are as follows:

A: getting an even number on the first die.

B: getting an odd number on the first die.

C: getting the sum of the numbers on the dice  $\leq 5$ , state true or false: (give reason for your answer)

i. A and B are mutually exclusive

ii. A and B are mutually exclusive and exhaustive

iii A= B'

iv. A and C are mutually exclusive

v. A and B' are mutually exclusive.

vi. A', B', C are mutually exclusive and exhaustive.



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12. A die is rolled. Let E be the event "die shows 4" and F be the event "die shows even number". Are E and F mutually exclusive?



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13. Three coins are tossed once. Let A denote the event 'three heads show', B denote the event "two heads and one tail show", C denote the event " three tails show and D denote the event 'a head shows on the first coin". Which events are (i) mutually exclusive? (ii) simple? (iii) compound?



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14. A coin is tossed 1000 times in which head occurs 450 times and tail occurs in 550 times. Find the probability of each event.



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15. Find the probability of getting head when a coin is tossed once.

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16. Which of the following cannot be valid assignment of probabilities for outcomes of sample space  $S = \{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7\}$ ?

Assignment	$\omega_1$	$\omega_2$	$\omega_3$	$\omega_4$	$\omega_5$	$\omega_6$	$\omega_7$
a	0.1	0.01	0.05	0.03	0.01	0.2	0.6
b	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$\frac{1}{7}$
c	0.1	0.2	0.3	0.4	0.5	0.6	0.7
d	-0.1	0.2	0.3	0.4	-0.2	0.1	0.3
e	$\frac{1}{14}$	$\frac{2}{14}$	$\frac{3}{14}$	$\frac{4}{14}$	$\frac{5}{14}$	$\frac{6}{14}$	$\frac{15}{14}$

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17. A coin is tossed twice, what is the probability that atleast one tail occurs?

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**18.** A card is selected from a pack of 52 cards.

- a. How many points are there in the sample space?
- b. Calculate the probability that the card is an ace of spades.
- c. Calculate the probability that the card is (i) an ace (ii) black card.

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**19.** A bag contains 9 balls of which 4 are red, 3 are white and 2 are green. If a ball is drawn at random, then

- i. calculate the probability that it is not white.
- ii. it is either white or green.

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**20.** A die is thrown, find the probability of following events:

- i. A prime number will appear
- ii. A number greater than or equal to 3 will appear

iii. A number less than or equal to one will appear

iv. A number more than 6 will appear

v. A number less than 6 will appear

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21. A committee of two persons is selected from two men and three women. What is the probability that the committee will have

i. no man ii. one man only iii. two men

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22. A bag contains 5 white, 6 black and 6 yellow balls. 3 balls are drawn at random. Find the probability that of the drawn balls

i. All are black.

ii. Exactly 2 yellow balls are present

iii . Atleast 2 yellow balls are present

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**23.** A bag contains 3 white, 4 black and 2 yellow balls. 2 balls are drawn at random.

- i. Find the probability that the two balls drawn are of the same colour.
- ii. Find the probability that none of the balls drawn are yellow in colour.

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**24.** A box contains 6 red, 5 blue and 4 green balls. 3 balls are drawn from the box. Find the probability that

- i. all are blue
- ii. all balls are either red or blue.
- iii. atleast one green ball.

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25. Three coins are tossed once. Find the probability of getting

- i. 3 heads ii. 2 heads iii. atleast 2 heads
- iv. atmost 2 heads V. no head vi. 3 tails
- vii. exactly two tails viii. no tail ix. atmost two tails

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26. Given  $P(A) = \frac{3}{5}$  and  $P(B) = \frac{1}{5}$  Find  $P(A \text{ or } B)$ , if A and B are mutually exclusive events.

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27. If  $\frac{2}{11}$  is the probability of an event, what is the probability of the event 'not A'.

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28. One card is drawn from a well shuffled deck of 52 cards. If each outcome is equally likely, calculate the probability that the card will be

i. a diamond

ii. not a diamond

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29. If  $P(A) = 0.5$ ,  $P(B) = 0.2$ , then find  $P(A \cup B)$  (Given that A and B are mutually exclusive).

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30. If A and B are two events of a random experiment such that

$P(A) = \frac{1}{4}$ ,  $P(B) = \frac{1}{2}$ ,  $P(A \text{ and } B) = \frac{1}{8}$  then find i.  $P(A \text{ or } B)$

ii.  $P(\text{not } A \text{ and not } B)$ .

iii.  $P(A \text{ and not } B)$ ,  $P(\text{not } A \text{ and } B)$

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**31.** If A and B are events such that  $P(A) = \frac{1}{5}$ ,  $P(B) = \frac{1}{3}$  and  $P(A \text{ and } B) = \frac{1}{15}$ .

i. Find  $P(A')$  and  $P(B')$ . ii. Find  $P(A \text{ or } B)$

iii. Find  $P(A \text{ and not } B)$ .

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**32.** A and B are two events such that  $P(A) = 0.5$ ,  $P(B) = 0.6$  and  $P(A \cap B) = 0.3$ .

a. Find  $P(A \cup B)$ . b. Find  $P(A - B)$ . c. Verify that  $P(A \cup B) = 1 - P(A')P(B')$ .

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**33.** A bag contains 9 discs of which 4 are red, 3 are blue and 2 are yellow. The discs are similar in shape and size. A disc is drawn at

random from the bag. Calculate the probability that it will be (i) red, (ii) yellow, (iii) blue, (iv) not blue, (v) either red or yellow.



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**34.** Two students A and B, appeared in an examination. The probability that A passes the examination is 0.25 and that B passes is 0.45. Also the probability that both will pass is 0.1. Find the probability that (i) both will not pass (ii) only one of them will pass.



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**35.** Two students Anil and Ashima appeared in an examination. The probability that Anil will qualify the examination is 0.05 and that Ashima will qualify the examination is 0.10. The probability that both will qualify the examination is 0.02. Find the probability that

a. Both Anil and Ashima will not qualify the examination.

b. At least one of them will not qualify the examination and

c. Only one of them will qualify the examination.



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**36.** Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) all Kings (ii) 3 Kings (iii) at least 3 Kings.



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**37.** In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that

- i. The student opted for NCC or NSS.
- ii. The student has opted neither NCC nor NSS.
- iii. The student has opted NSS but not NCC.



iv. The probability that the student has opted for exactly one of NCC or NSS.



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**38.** A fair coin with 1 marked on one face and 6 on the other and a fair die are both tossed. Find the probability that the sum of numbers that turn up is (i) 3 (ii) 12.



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**39.** There are four men and six women on the city council. If one council member is selected for a committee at random, how likely is it that it is a woman?



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**40.** In a lottery, a person chooses six different natural numbers at random from 1 to 20, and if these six numbers match with the six numbers already fixed by the lottery committee, he wins the prize. What is the probability of winning the prize in the game?

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**41.** Check whether the following probabilities  $P(A)$  and  $P(B)$  are consistently defined.

i.  $P(A) = 0.5, P(B) = 0.7, P(A \cap B) = 0.6$

ii.  $P(A) = 0.5, P(B) = 0.4, P(A \cup B) = 0.8$

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**42.** Events  $E$  and  $F$  are such that  $P(\text{not } E \text{ or not } F) = 0.25$ , State whether  $E$  and  $F$  are mutually exclusive.

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43. A and B are events such that  $P(A) = 0.42$ ,  $P(B) = 0.48$  and  $P(A \text{ and } B) = 0.16$ . Determine

(i)  $P(\text{not } A)$ , (ii)  $P(\text{not } B)$  (iii)  $P(A \text{ or } B)$  (iv)  $P(A \cup B)$



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44. In Class XI of a school 40% of the students study Mathematics and 30% study Biology. 10% of the class study both Mathematics and Biology. If a student is selected at random from the class, find the probability that he will be studying Mathematics or Biology.



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45. In an entrance test that is graded on the basis of two examinations, the probability of a randomly chosen student passing

the first examination is 0.8 and the probability of passing the second examination is 0.7. The probability of passing atleast one of them is 0.95. What is the probability of passing both?

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**46.** The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing the English examination is 0.75, what is the probability of passing the Hindi examination?

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**47.** A box contains 10 red marbles, 20 blue marbles and 30 green marbles. 5 marbles are drawn from the box, what is the probability that

(i) all will be blue? (ii) atleast one will be green?

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**48.** 4 cards are drawn from a well - shuffled deck of 52 cards. What is the probability of obtaining 3 diamonds and one spade?

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**49.** A die has two faces each with number '1', three faces each with number '2' and one face with number '3'. If die is rolled once, determine

i.  $P(2)$  ii.  $P(1 \text{ or } 3)$  iii.  $P(\text{not } 3)$

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**50.** In a certain lottery 10,000 tickets are sold and ten equal prizes are awarded. What is the probability of not getting a prize if you buy (a) one ticket (b) two tickets (c) 10 tickets?



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**51.** Out of 100 students, two sections of 40 and 60 are formed. If you and your friend are among the 100 students, what is the probability that

a. you both enter the same section? b. you both enter the different sections?



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**52.** Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contains exactly one letter. Find the probability that at least one letter is in its proper envelope.



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53. A and B are two events such that  $P(A) = 0.54$ ,  $P(B) = 0.69$  and  $P(A \cap B) = 0.35$ . Find i.  $P(A \cup B)$  ii.  $P(A' \cap B')$  iii.  $P(A \cap B')$  iv.  $P(B \cap A')$



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54. From the employees of a company, 5 persons are selected to represent them in the managing committee of the company, Particulars of five persons are as follows:

S. No.	Name	Sex	Age in years
i.	Harish	M	30
ii.	Rohan	M	33
iii.	Sheetal	F	46
iv.	Alis	F	28
v.	Salim	M	41

A person is selected at random from this group to act as a spokesperson. What is the probability that the spokesperson will be either male or over 35 years?



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55. If 4-digit numbers greater than 5,000 are randomly formed from the digits 0, 1, 3, 5, and 7, what is the probability of forming a number divisible by 5 when,

(i) the digits are repeated? (ii) the repetition of digits is not allowed?

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56. The number lock of a suitcase has 4 wheels, each labelled with ten digits i.e., from 0 to 9. The lock opens with a sequence of four digits with no repeats. What is the probability of a person getting the right sequence to open the suitcase?

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57. A letter is chosen at random from the word 'ASSASSINATION'. Find the probability that letter is (i) a vowel (ii) a consonant.



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## Exercise

1. If A and B are two given events, then  $P(A \cap B)$  is

- A. not less than  $P(A) + P(B) - 1$
- B. equal to  $P(A) + P(B) - P(A \cup B)$
- C. equal to  $P(A) + P(B) + P(A \cap B)$
- D. equal to  $P(A) + P(B) + P(A \cup B)$

**Answer: B**



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2. If  $A_1, A_2, \dots, A_n$  are any  $n$  events, then

A.

$$P(A_1 \cup A_2 \cup \dots \cup A_n) = P(A_1) + P(A_2) + \dots + P(A_n)$$

B.

$$P(A_1 \cup A_2 \cup \dots \cup A_n) > P(A_1) + P(A_2) + \dots + P(A_n)$$

C.

$$P(A_1 \cup A_2 \cup \dots \cup A_n) \leq P(A_1) + P(A_2) + \dots + P(A_n)$$

D.  $P(A_1) + P(A_2) + \dots + P(A_n) \geq 1$

**Answer: C**



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3. A drawer contains 5 brown socks and 4 blue socks well mixed. A man reaches the drawer and pulls out 2 socks at random. What is the

probability that they match?

A.  $\frac{4}{9}$

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

C.  $\frac{5}{9}$

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

**Answer: A**



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4. If A and B are any two events, the probability that exactly one of them occurs is

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

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

C.  $P(\bar{A}) + P(\bar{B}) + 2P(\bar{A} \cap \bar{B})$

$$D. P(A \cap \bar{B}) + P(\bar{A} \cap \bar{B})$$

**Answer: D**

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5. Two cards are drawn successively with replacement from well shuffled pack of 52 cards. The probability of drawing two aces is

A.  $\frac{1}{13}$

B.  $\frac{1}{13} \times \frac{1}{17}$

C.  $\frac{1}{52} \times \frac{1}{51}$

D.  $\frac{1}{13} \times \frac{1}{13}$

**Answer: D**

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6. From a set of 100 cards numbered 1 to 100, one card is drawn at random. The probability that the number obtained on the card is divisible by 6 or 8 but not by 24.

A.  $\frac{6}{25}$

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

C.  $\frac{1}{6}$

D.  $\frac{2}{5}$

**Answer: B**



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7. Three identical dice are rolled. The probability that the same number will appear on each of them is

A.  $\frac{1}{6}$

B.  $\frac{1}{36}$

C.  $\frac{1}{18}$

D.  $\frac{3}{28}$

**Answer: B**



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8. There are 6 girls and 5 boys who sit in a row. The probability that no two boys sit together is

A.  $\frac{6! \times 6!}{2! \times 11!}$

B.  $\frac{7! \times 5!}{2! \times 11!}$

C.  $\frac{6! \times 7!}{11!}$

D.  $\frac{6! \times 7!}{2! \times 11!}$

**Answer: D**



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9. Two dice are rolled one after another. The probability that the number on the first is smaller than the number on the second is

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

B.  $\frac{7}{18}$

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

D.  $\frac{5}{12}$

**Answer: D**



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10. The probability of obtaining sum 8 in a single throw of two dice is

A.  $\frac{1}{36}$

B.  $\frac{5}{36}$

C.  $\frac{4}{36}$

D.  $\frac{6}{36}$

**Answer: B**

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11. A and B toss a coin alternately till one of them tosses heads and wins the game. Their respective probabilities of winning are

A.  $\frac{1}{4}$  and  $\frac{3}{4}$

B.  $\frac{1}{2}$  and  $\frac{1}{2}$

C.  $\frac{2}{3}$  and  $\frac{1}{3}$

D.  $\frac{1}{5}$  and  $\frac{4}{5}$

**Answer: C**

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12. If birth to a male child and birth to a female child are equal probable, then what is the probability that atleast one of the three children born to a couple is male ?

A.  $\frac{4}{5}$

B.  $\frac{7}{8}$

C.  $\frac{8}{9}$

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

**Answer: B**



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13. Two persons A and B throw a die alternately till one of them gets 3 and wins the game, Find the respective probabilities of winning, if A beginning the game

A.  $\frac{7}{11}, \frac{4}{11}$

B.  $\frac{6}{11}, \frac{5}{11}$

C.  $\frac{5}{6}, \frac{1}{6}$

D.  $\frac{4}{7}, \frac{3}{7}$

**Answer: B**



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**14.** A bag contains 3 black, 3 white and 2 red balls. Three balls are drawn one by one without replacement. The probability that the third ball is red is equal to

A.  $\frac{2}{56}$

B.  $\frac{3}{56}$

C.  $\frac{1}{56}$

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

**Answer:**



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**15.** Out of 15 persons 10 can speak Hindi and 8 can speak English. If two persons are chosen at random, then the probability that one person speaks Hindi only and the other speaks Hindi and English

A.  $\frac{3}{5}$

B.  $\frac{7}{12}$

C.  $\frac{1}{5}$

D.  $\frac{2}{5}$

**Answer: C**



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16. A four figure number is formed of the figures 1,2,3,5 with no repetition. The probability that the number is divisible by 5 is

A.  $\frac{3}{4}$

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

C.  $\frac{1}{8}$

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

**Answer: B**



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17. Two events A and B have probabilities 0.25 and 0.50 respectively. The probability that both A and B occur is 0.14. Then the probability that neither A nor B occurs is

A. 0.39

B. 0.25

C. 0.11

D. 0.12

**Answer: A**



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**18.** Three numbers are chosen from 1 to 30. The probability that they are not consecutive is

A.  $\frac{144}{145}$

B.  $\frac{143}{145}$

C.  $\frac{142}{145}$

D.  $\frac{141}{145}$

**Answer: A**

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19.  $P(A \cup B) = \frac{3}{4}$ ,  $P(\bar{A}) = \frac{2}{3}$ , then  $P(\bar{A} \cap B)$  is equal to

A.  $\frac{1}{8}$

B.  $\frac{1}{12}$

C.  $\frac{7}{12}$

D.  $\frac{5}{12}$

**Answer: D**

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20. Out of 40 consecutive integers two are chosen at random, the probability that their sum is odd is

A.  $\frac{14}{29}$

B.  $\frac{20}{39}$

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

D.  $\frac{1}{39}$

**Answer: B**



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21. Three integers are chosen at random from the first 20 positive integers. The probability that their product is even is

A.  $\frac{2}{19}$

B.  $\frac{3}{29}$

C.  $\frac{17}{19}$

D.  $\frac{4}{29}$

**Answer: C**



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22. Hundred cards are numbered from 1 to 100. The probability that a randomly chosen card has a digit 5 is.

A.  $\frac{1}{50}$

B.  $\frac{1}{100}$

C.  $\frac{9}{100}$

D.  $\frac{19}{100}$

**Answer: D**

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23. Three six faced dice are tossed together, the probability that exactly two of the three numbers are equal is

A.  $\frac{165}{216}$



B.  $\frac{177}{216}$

C.  $\frac{51}{216}$

D.  $\frac{90}{216}$

**Answer: D**



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**24.** In order to get atleast once a head with probability  $\geq 0.9$ , the minimum number of times a coin needs to be tossed is

A. 3

B. 4

C. 5

D. 2

**Answer: B**



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25. Out of 13 applicants for a job, there are 5 women and 8 men. It is desired to select 2 persons for the job. The probability that at least one of the selected persons will be a woman is

A.  $\frac{25}{39}$

B.  $\frac{14}{39}$

C.  $\frac{5}{3}$

D.  $\frac{10}{13}$

**Answer: A**

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26. A pack of cards contains 4 aces, 4 kings, 4 queens and 4 jacks. Two cards are drawn at random. The probability that at least one of them

is an ace is

A.  $\frac{1}{5}$

B.  $\frac{3}{16}$

C.  $\frac{9}{20}$

D.  $\frac{1}{8}$

**Answer: C**



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27. A coin is tossed 3 times. The chance that head and tail show alternately is

A.  $\frac{1}{8}$

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

C.  $\frac{3}{8}$

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

**Answer: B**

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28. There are 4 letter and 4 envelopes. The probability that all the letters are put in same envelope

A.  $\frac{3}{32}$

B.  $\frac{1}{16}$

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

D.  $\left(\frac{1}{4}\right)^4$

**Answer: C**

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29. A bag contains 5 red and 3 white balls. Two balls are selected at random. Probability of getting balls of different colours is

A.  $\frac{15}{28}$

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

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

D.  $\frac{8}{28}$

**Answer: A**



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30. Two dice are thrown simultaneously. Then the probability of getting two odd numbers is

A.  $\frac{1}{6}$

B.  $\frac{2}{6}$

C.  $\frac{7}{36}$

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

**Answer: B**

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**31.** A letter is selected at random from the word MATHEMATICS. The probability that it is a vowel is

A.  $\frac{3}{11}$

B.  $\frac{4}{11}$

C.  $\frac{3}{8}$

D.  $\frac{4}{8}$

**Answer: D**

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32. The probability that a leap year selected at random contains 53

Mondays is

A.  $\frac{1}{7}$

B.  $\frac{2}{7}$

C.  $\frac{1}{14}$

D.  $\frac{3}{7}$

**Answer: B**



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33. A box contains 6 nails and 10 nuts. Half of the nails and half of the nuts are rusted, if one item is chosen at random, the probability that it is a rusted or is a nail

A.  $\frac{3}{16}$

B.  $\frac{5}{16}$

C.  $\frac{11}{16}$

D.  $\frac{14}{16}$

**Answer: C**



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**34.** Three vertices of a regular hexagon are chosen at random. The probability that the triangle so formed is equilateral is

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

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

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

D.  $\frac{1}{20}$

**Answer: C**



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35. A five digit number is formed by the digits 0, 1, 2, 3, 4 without repetition. The probability that the number formed is divisible by 4 is

A.  $\frac{7}{16}$

B.  $\frac{5}{16}$

C.  $\frac{3}{16}$

D.  $\frac{1}{16}$

**Answer: B**



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36. The probability of getting a sum equal to 7 or 11 in the tosses of 2 dice is

A.  $\frac{1}{6}$

B.  $\frac{1}{18}$

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

D.  $\frac{23}{108}$

**Answer: C**



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**37.** Three numbers are selected at random from the set  $\{1, 2, 3, \dots, 20\}$ .

The probability that they form an A.P is

A.  $\frac{1}{19}$

B.  $\frac{3}{38}$

C.  $\frac{1}{20}$

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

**Answer: B**



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**38.** Fifteen coupons are numbered 1 to 15 respectively. Seven coupons are selected at random one at a time with replacement. The probability that the largest number appearing in a selected coupon is not greater than 9 is

A.  $\left(\frac{9}{16}\right)^6$

B.  $\left(\frac{8}{15}\right)^7$

C.  $\left(\frac{3}{6}\right)^7$

D. None of these

**Answer: D**



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**39.** Two cards are drawn from a well shuffled deck of 52 cards. The probability that one is red and other is a queen is

A.  $\frac{4}{51}$

B.  $\frac{16}{221}$

C.  $\frac{50}{663}$

D.  $\frac{14}{269}$

**Answer: C**



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**40.** Cards are drawn one by one without replacement from a pack of 52 cards. The probability that 10 cards will precede the first ace is

A.  $\frac{241}{1456}$

B.  $\frac{164}{4165}$

C.  $\frac{451}{884}$

D.  $\frac{163}{4165}$

**Answer: B**



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41. The chance of an event happening is the square of the chance of a second event but the odds against the first are the cubes of the odds against the second. The chances of the events are

A.  $\frac{1}{9}, \frac{1}{3}$

B.  $\frac{1}{10}, \frac{1}{4}$

C.  $\frac{1}{4}, \frac{1}{2}$

D.  $\frac{1}{6}, \frac{1}{8}$

**Answer: A**



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1. In a non-leap year the probability of getting 53 Sundays or 53 Tuesdays or 53 Thursdays is

A.  $\frac{1}{7}$

B.  $\frac{2}{7}$

C.  $\frac{3}{7}$

D.  $\frac{4}{7}$

**Answer: C**



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2. The probability for a randomly chosen month to have its 10<sup>th</sup> day as Sunday is

A.  $\frac{1}{84}$

B.  $\frac{10}{12}$

C.  $\frac{10}{84}$

D.  $\frac{1}{7}$

**Answer: D**



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3. The probability that in a family of 5 members, exactly 2 members have birthday on sunday is

A.  $\frac{12 \times 5^3}{7^5}$

B.  $\frac{10 \times 6^2}{7^5}$

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

D.  $\frac{10 \times 6^3}{7^5}$

**Answer: D**



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4. Two numbers  $a$  and  $b$  are chosen at random from the set of first 30 natural numbers. The probability that  $a^2 - b^2$  is divisible by 3 is

A.  $\frac{47}{87}$

B.  $-\frac{47}{87}$

C.  $\frac{46}{47}$

D.  $\frac{45}{87}$

**Answer: A**

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5. If three natural numbers from 1 to 100 are selected randomly then probability that all are divisible by both 2 and 3 is

A.  $\frac{4}{105}$



B.  $\frac{4}{33}$

C.  $\frac{4}{35}$

D.  $\frac{4}{1155}$

**Answer: D**



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6. If A and B are any two events, then  $P(A \cap B') =$

A.  $P(A) + P(B')$

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

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

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

**Answer: D**



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7. A complete cycle of a traffic light takes 60 seconds. During each cycle, the light is green for 25 seconds, yellow for 5 seconds and red for 30 seconds. At a randomly chosen time, the probability that the light will not be green is

A.  $\frac{1}{3}$

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

C.  $\frac{4}{12}$

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

**Answer: D**



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8. If A and B are mutually exclusive events and if

$P(B) = \frac{1}{3}$ ,  $P(A \cup B) = \frac{13}{21}$  then P(A) is equal to

A.  $\frac{1}{7}$

B.  $\frac{4}{7}$

C.  $\frac{2}{7}$

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

**Answer: C**



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9. If two numbers  $p$  and  $q$  are chosen randomly from the set  $\{1, 2, 3, 4\}$  with replacement, then the probability that  $p^2 \geq 4q$  is equal to

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

B.  $\frac{3}{16}$

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

D.  $\frac{7}{16}$

**Answer: D**



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**10.** A die is rolled three times. The probability that the sum of three numbers obtained is 15, is equal to

A.  $\frac{5}{108}$

B.  $\frac{5}{216}$

C.  $\frac{11}{216}$

D.  $\frac{7}{108}$

**Answer: A**



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11. Five dice are tossed. What is the probability that the five numbers shown will be different?

A.  $\frac{5}{54}$

B.  $\frac{5}{18}$

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

D.  $\frac{5}{81}$

**Answer: A**



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12. If two dice are thrown simultaneously, then the probability that the sum of the numbers which come up on the dice to be more than 5 is

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

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

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

D.  $\frac{13}{18}$

**Answer: D**



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13. Let  $A$  and  $B$  be two events such that  $P(A \cup B) = P(A) + P(B) - P(A)P(B)$ . If  $0 < P(A) < 1$  and  $0 < P(B) < 1$ , then  $P(A \cup B)' =$

A.  $1 - P(A)$

B.  $1 - P(A')$

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

D.  $[1 - P(A)]P(B')$

Answer: D



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14. A and B are events such that  $P(A \cap B) = \frac{3}{4}$ ,  $P(A \cap B) = \frac{1}{4}$ ,  $P(\bar{A}) = \frac{2}{3}$  then  $P(\bar{A} \cap B)$  is

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

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

C.  $\frac{5}{8}$

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

Answer: A



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15. Events A, B, C are mutually exclusive events such that

$$P(A) = \frac{3x + 1}{3}, P(B) = \frac{1 - x}{4} \text{ and } P(C) = \frac{1 - 2x}{2}. \text{ Then}$$

set of possible values of x are in the interval

A.  $\left[\frac{1}{3}, \frac{2}{3}\right]$

B.  $\left[\frac{1}{3}, \frac{13}{3}\right]$

C.  $[0, 1]$

D.  $\left[\frac{1}{3}, \frac{1}{2}\right]$

**Answer: D**



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16. Five horses are in a race. Mr. A selects two of the horses at random and bets on them. The probability that Mr. A selected the winning horse is



A.  $\frac{3}{5}$

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

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

D.  $\frac{4}{5}$

**Answer: C**



**View Text Solution**

17. Three houses are available in a locality. Three persons apply for the houses. Each applies for one house without consulting others. The probability that all the three apply for the same house is

A.  $\frac{1}{9}$

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

C.  $\frac{7}{9}$

D.  $\frac{8}{9}$

**Answer: A**



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**18.** A die is thrown. Let  $A$  be the event that the number obtained is greater than 3. Let  $B$  be the event that the number obtained is less than 5. Then  $P(A \cup B)$  is

A.  $\frac{2}{5}$

B.  $\frac{3}{5}$

C. 0

D. 1

**Answer: D**



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19. An urn contains nine balls of which three are red, four are blue and two are green. Three balls are drawn at random without replacement from the urn. The probability that the three balls have different colours is

A.  $\frac{1}{3}$

B.  $\frac{2}{7}$

C.  $\frac{1}{21}$

D.  $\frac{2}{23}$

**Answer: B**



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20. Four numbers are chosen at random (without replacement) from the set  $\{1, 2, 3, \dots, 20\}$ .

Statement-1 : The probability that the chosen numbers when

arranged in some order will form an A.P. is  $\frac{1}{85}$ .

Statement-2: If the four chosen numbers form an A.P., then the set of all possible values of common difference is  $\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 5\}$ .

- A. Statement - 1 is true, statement- 2 is true
- B. Statement -1 is false, statement- 2 is false
- C. Statement - 1 is true, statement-2 is false
- D. Statement - 1 is false, statement- 2 is true

**Answer: C**



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