



## MATHS

### BOOKS - RS AGGARWAL MATHS (HINGLISH)

#### PROBABILITY DISTRIBUTION

##### Solved Examples

1. Find the mean, variance and standard deviation of the number of tails in two tosses of a coin.



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2. Find the mean, variance and standard deviation of the number heads when three coins are tossed.



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

$$X = \begin{cases} 1, & \text{if the die results in an even number} \\ 0, & \text{if the die results in an odd number} \end{cases} \quad \text{then find the mean}$$

and variance of  $X$ .

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4. Find the mean, variance, standard deviation of number 6 in the two throws of a dice.

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5. Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards. Find the mean and variance of the number of kings.

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6. Two cards are drawn simultaneously (or successively without replacement) from a well-shuffled pack of 52 cards. Find the mean and variance of the number of aces.

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7. Three defective bulbs are mixed with 7 good ones. Let  $X$  be the number of defective bulbs when 3 bulbs are drawn at random. Find the mean and variance of  $X$ .

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8. An urn contains 4 white and 3 red balls. Let  $X$  be the number of red balls in a random draw of 3 balls. Find the mean and variance of  $X$ .

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9. In a game 3 coins are tossed. A person is paid Rs. 5, if he gets all head or all tail and be in supposed pay Rs. 3 if he gets are head or 2 heads. What can be expert to win on an arrange per game.

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10. A coin is tossed 4 times . If  $x$  is the number of heads observed , find the probability distribution of  $X$ .

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11. Find the probability distribution of the number of sixes in three tosses of a die.

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**12.** Find the probability distribution of the number of doublets in four throws of a pair of dice.

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**13.** An unbiased coin is tossed 6 times .Find using binomial distribution , the probability of getting at least 5 heads .

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**14.** An unbiased coin is tossed 8 times . Find by using binomial distribution the probability of getting at least 3 heads

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**15.** Six coin are tossed simultaneously . Find the probability of getting  
(i) 3 heads (ii) no head (iii) at least one head

(iv) not more than 3 heads .



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**16.** A die is thrown 5 times . If getting an odd number is a success , find the probability of getting at least 4 successes.



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**17.** In 4 throws with a pair of dice , what is the probability of throwing doublets at least twice ?



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**18.** The bulbs produced in a factory are supposed to contain 5% defective bulbs . What is the probability that a sample of 10 bulbs will contain not more than 2 defective bulbs?



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19. If one out of 10 coming ships is wrecked. Find the probability that out of five coming ships at least 4 reach safely.

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20. If  $X$  follows a binomial distribution with mean 3 and variance  $(3/2)$  find

(i)  $P(X \geq 1)$  (ii)  $P(X \leq 5)$

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21. If  $X$  follow a binomial distribution with mean 4 and variance 2 find  $P(X \geq 5)$

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22. find the binomial distribution for which the mean and variance are 12 and 3 respectively .

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23. If the sum of the mean and variance of a binomial distribution for 5 trials is 1.8; find the distribution.

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24. The sum and the product of the mean and variance of a binomial distribution are 24 and 128 respectively . Find the distribution.

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25. In a binomial distribution , prove that mean  $>$  variance

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**26.** A die is tossed thrice. Getting an even number is considered a success

What is the variance of the binomial distribution ?

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**27.** A die is rolled 20 times . Getting a number greater than 4 is a success.

Find the mean and variance of the number of successes .

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**28.** A die is tossed 180 times. Find the expected number ( $\mu$ ) of times the face

with the number 5 will appear. Also find the standard deviation ( $\sigma$ ) and variance ( $\sigma^2$ )

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## Exercise 31

1. Find the mean and variance of the number of heads when two coins are tossed simultaneously.

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2. Find the mean and variance of the number of tails when three coins are tossed simultaneously.

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3. A die is tossed twice. 'Getting an odd number on a toss' is considered a success. Find the probability distribution of number of successes. Also, find the mean and variance of the number of successes.



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4. A die is tossed twice. 'Getting a number greater than 4' is considered a success. Find the probability distribution of number of successes. Also, find the mean and variance of the number of successes.



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5. A pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability distribution of number of successes. Also, find the mean and variance of number of successes.



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6. A coin is tossed 4 times. Let  $X$  denote the number of heads. Find the probability distribution of  $X$ . Also, find the mean and variance of  $X$ .



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7. Let  $X$  denote the number of times 'a total of 9' appears in two throws of a pair of dice. Find the probability distribution of  $X$ . Also, find the mean, variance and standard deviation of  $X$ .

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8. There are 5 cards numbered 1 to 5, one number on one card. Two cards are drawn at random without replacement. Let  $X$  denote the sum of the numbers on two cards drawn. Find the mean and variance.

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9. Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards. Find the mean and variance of the number of kings.

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**10.** A box contains 16 bulbs, out of which 4 bulbs are defective. Three bulbs are drawn at random from the box. Let  $X$  be the number of defective bulbs drawn. Find the mean and variance of  $X$ .

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**11.** 20% of the bulbs produced by a machine are defective. Find the probability distribution of the number of defective bulbs in a sample of 4 bulbs chosen at random.

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**12.** Four bad eggs are mixed with 10 good ones. Three eggs are drawn one by one without replacement. Let  $X$  be the number of bad eggs drawn. Find the mean and variance of  $X$ .

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**13.** Four rotten oranges are accidentally mixed with 16 good ones. Three oranges are drawn at random from the mixed lot. Let  $X$  be the number of rotten oranges drawn. Find the mean and variance of  $X$ .

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**14.** Three balls are drawn simultaneously from a bag containing 5 white and 4 red balls. Let  $X$  be the number of red balls drawn. Find the mean and variance of  $X$ .

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**15.** Two cards are drawn from a well shuffled pack of 52 cards. Find the mean and variance for the number of face cards obtained.

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16. Two cards are drawn successively with replacement from a well shuffled deck of 52 cards. Find the mean and standard deviation of the number of aces.

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17. Three cards are drawn successively with replacement from a well-shuffled deck of 52 cards. A random variable  $X$  denotes the number of hearts in the three cards drawn. determine the probability distribution of  $X$ .

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18. 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 if four bulbs are drawn from this lot.

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## Objective Questions

1. If  $A$  and  $B$  are mutually exclusive events such that

$$P(A) = 0.4, P(B) = x \text{ and}$$

$$P(A \cup B) = 0.5 \text{ then } x = ?$$

A. 0.2

B. 0.1

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

D. none of these

**Answer: B**

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2. If A and B are independent events such that  $P(A) = 0.4$ ,  $P(B) = x$  and

$P(A \cup B) = 0.5$  then  $x = ?$

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

B. 0.1

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

D. None of these

**Answer: C**



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3. If  $P(A) = 0.8$ ,  $P(B) = 0.5$  and  $P(B/A) = 0.4$  then  $P(A/B) = ?$

A. 0.32

B. 0.64

C. 0.16

D. 0.25

**Answer: B**



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4.

If

$P(A) = \frac{6}{11}$ ,  $P(B) = \frac{5}{11}$  and  $P(A \cup B) = \frac{7}{11}$ , then  $P(A/B) = ?$

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

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

C.  $\frac{6}{7}$

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

**Answer: D**



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5. If  $A$  and  $B$  are events such that

$$P(A) = \frac{1}{2}, P(B) = \frac{7}{12} \text{ and } P(A' \cup B') = \frac{1}{4}, \text{ then } A \text{ and } B \text{ are}$$

- A. independent
- B. mutually exclusive
- C. both  $a$  and  $b$
- D. none of these

**Answer: D**

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6. If it is given that the probability that  $A$  can solve the same problem is  $\frac{3}{5}$ . The probability that  $B$  can solve the same problem is  $\frac{2}{3}$ . The probability that at least one of  $A$  and  $B$  can solve a problem is

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

B.  $\frac{1}{15}$

C.  $\frac{13}{15}$

D.  $\frac{2}{15}$

**Answer: C**



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7. The probabilities of  $A$ ,  $B$  and  $C$  of solving a problem are  $\frac{1}{6}$ ,  $\frac{1}{5}$  and  $\frac{1}{3}$  respectively, What is the probability that the problem is solved ?

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

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

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

D. none of these

**Answer: B**



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8. A can hit a target 4 times in 5 shots B can hit 3 times in 4 shots and C can hit 2 times in 3 shots . The probability that B and C hit and A does not hit is

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

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

C.  $\frac{7}{10}$

D. none of these

**Answer: A**



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9. A machine operates only when all of its three components function. The probabilities of the failures of the first, second and third component are 0.2, 0.3 and 0.5 respectively. What is the probability that the machine will fail?

A. 0.70

B. 0.72

C. 0.07

D. none of these

**Answer: B**



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10. A die is rolled. If the outcome is an odd number, what is the probability that it is prime?

A.  $\frac{2}{3}$

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

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

D. none of these

**Answer: A**



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11. If A and B are events such that

$P(A) = 0.3$ ,  $P(B) = 0.2$  and  $P(A \cap B) = 0.1$  then

$P(\bar{A} \cap B) = ?$

A. 0.2

B. 0.1

C. 0.4

D. 0.5

**Answer: B**



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12.

If

$P(A) = \frac{1}{4}$ ,  $P(B) = \frac{1}{3}$  and  $P(A \cap B) = \frac{1}{5}$  then  $P(\bar{B}/\bar{A}) = ?$

A.  $\frac{11}{15}$

B.  $\frac{11}{45}$

C.  $\frac{23}{60}$

D.  $\frac{37}{45}$

Answer: D



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13. If A and B are events such that

$P(A) = 0.4$ ,  $P(B) = 0.8$  and  $P(B/A) = 0.6$  then  $P(A/B) = ?$



A. 0.2

B. 0.3

C. 0.4

D. 0.5

**Answer: B**



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14. If A and B are independent events then  $P(\bar{A} / \bar{B}) = ?$

A.  $1 - P(A)$

B.  $1 - P(B)$

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

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

**Answer: A**



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15. If A and B are two events such that  $P(A \cup B) = \frac{5}{6}$ ,  $P(A \cap B) = \frac{1}{3}$  and  $P(\bar{B}) = \frac{1}{2}$  then the events A and B are

- A. independent
- B. dependent
- C. mutually exclusive
- D. none of these

**Answer: A**



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16. A die is thrown twice and the sum of the number appearing is observed to be 7. What is the conditional probability that the number 2 has appeared at least once?

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

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

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

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

**Answer: B**



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17. Two numbers are selected at random from integers 1 through 9. If the sum is even, find the probability that both the numbers are odd.

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

B.  $\frac{2}{3}$

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

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

**Answer: D**



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**18.** In a class 40 % students read Mathematics, 25 % Biology and 15% both Mathematics and Biology. One student is selected at random. The probability that he reads Mathematics if it is known that he reads Biology is

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

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

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

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

**Answer: B**



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19. A family has 2 children. The probability that both of them are boys if it is known that one of them is a boy

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

B.  $\frac{2}{3}$

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

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

**Answer: A**



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20. An unbiased die is tossed twice. Find the probability of getting a 4, 5 or 6 on the first toss and a 1, 2, 3 or 4 on the second toss.

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

B.  $\frac{2}{3}$

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

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

**Answer: A**



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**21.** A coin is tossed 6 times . Find the probability of getting at least 3 heads .

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

B.  $\frac{21}{32}$

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

D.  $\frac{3}{64}$

**Answer: B**



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22. A coin is tossed 5 times. What is the probability that tail appears and odd number of times?

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

B.  $\frac{2}{15}$

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

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

**Answer: C**



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23. A coin is tossed 5 times . What is the probability that head appears an even number of times ?

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

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

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

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

**Answer: D**



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**24.** 8 coins are tossed simultaneously . The probability of getting 6 head is

A.  $\frac{7}{64}$

B.  $\frac{57}{64}$

C.  $\frac{37}{256}$

D.  $\frac{249}{256}$

**Answer: C**



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25. A die is thrown 5 times . If getting an odd number is a success , find the probability of getting at least 4 successes.

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

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

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

D.  $\frac{3}{20}$

**Answer: C**



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26. In 4 throws with a pair of dice , what is the probability of throwing doublets at least twice ?

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

B.  $\frac{17}{144}$

C.  $\frac{19}{144}$

D. None of these

**Answer: C**

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27. A pair of dice is thrown 7 times. If getting a total of 7 is considered a success, what is the probability of (i) no success? (ii) 6 success? (iii) at least 6 success? (iv) at most 6 successes?

A.  $\left(\frac{5}{6}\right)^7$

B.  $\left(\frac{1}{6}\right)^7$

C.  $\left(1 - \frac{1}{6^7}\right)$

D. none of these

**Answer: A**

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28. The probability that a man can hit a target is  $\frac{3}{4}$ . He tries 5 times.

The probability that he will hit the target at least three times is

A.  $\frac{459}{512}$

B.  $\frac{291}{364}$

C.  $\frac{321}{464}$

D. none of these

**Answer: A**

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29. The probability of any ship return safely to the port is  $\frac{1}{5}$ . Find the probability that the returning out of 5 ships, at least 3 ships returns safely. It is given that returning ships are independently.

A.  $\frac{1}{31}$

B.  $\frac{3}{52}$

C.  $\frac{181}{3125}$

D.  $\frac{184}{3125}$

**Answer: A**



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**30.** The probability that an event A happens in one trial of an experiment, is 0.4 There independent trials of the experiments are performed. The probability that the event A happens atleast once, is

A. 0.784

B. 0.936

C. 0.964

D. none of these

**Answer: A**

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### Exercise 32

1. A coin is tossed 6 times . Find the probability of getting at least 3 heads .

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2. A coin is tossed 5 times . What is the probability that a head appears an even number of times ?

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3. 7 coins are tossed simultaneously . What is the probability that a tail appears an odd number of times ?

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4. A coin is tossed 6 times. Find the probability of getting

(i) exactly 4 heads (ii) at least 1 head (iii) at most 4 heads .

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5. 10 coins are tossed simultaneously . Find the probability of getting

(i) exactly 3 heads (ii) not more than 4 heads

(iii) at least 4 heads .

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6. A die is thrown 6 times . If getting an even number is a success find the probability of getting .

(i) exactly 5 successes (ii) at least 5 successes

(iii) at most 5 successes .

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7. A die is thrown 4 times . Getting a 1 or a 6 is considered a success .

Find probability of getting .

(i) exactly 3 successes (ii) at least 2 successes

(ii) at most 2 successes .

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8. Find the probability of 4 turning up at east once in two tosses of a fair die.

A.  $\frac{8}{36}$

B.  $\frac{9}{36}$

C.  $\frac{10}{36}$

D.  $\frac{11}{36}$

**Answer: D**



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9. पासों के एक जोड़े को 4 बार उछाला जाता है। यदि पासों पर प्राप्त अंकों का दृिक होना एक सफलता मानी जाती है तो 2 सफलताओं की प्रायिकता ज्ञात कीजिए।



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10. A pair of dice is thrown 7 times. If getting a total of 7 is considered a success, what is the probability of (i) no success? (ii) 6 success? (iii) at least 6 success? (iv) at most 6 successes?



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**11.** There are 6% defective items in a large bulk of item. Find the probability that sample of 8 items will include not more than one defective items.

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**12.** In a box containing 60 bulbs 6 are defective . What is the probability that out of a sample of 5 bulbs (i) none is defective (ii) exactly 2 are defective ?

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**13.** The probability that a bulb produced by a factory will fuse after 6 months of use is 0.05 . Find the probability that out of 5 such bulbs (i) none will fuse after 6 months of use

(ii) at least one will fuse after 6 months of use

(iii) not more than one will fuse after 6 months of use.

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**14.** In the items produced by a factory there are 10% defective items. A sample of 6 items is randomly chosen. Find the probability that this sample contains (i) exactly 2 defective items (ii) not more than 2 defective items (iii) at least 3 defective items.

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**15.** Assume that on an average one telephone number out of 15, called between 3 p.m. and 4 p.m. on weekdays will be busy. What is the probability that if six randomly selected telephone numbers are called at least 3 of them will be busy?

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16. There cars participate in a race . The probability that any one of them has an accident is 0.1 . Find the probability that all the cars reach that finishing line without any accident .

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17. Past records show that 80% of the operations performed by a certain doctor were successful . If he performs 4 operations in a day what is the probability that at least 3 operations will be successful ?

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18. The probability of a man hitting man hitting target is 0.25. If he shoots 7 times, then what is the probability of his hitting atleast twice ?

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19. एक बाधा दौड़ में एक प्रतियोगी को 10 बाधाएं पार करनी है इसकी प्रायिकता कि वह प्रत्येक बाधा को पार कर लेगा  $\frac{5}{6}$  हैं इसकी क्या प्रायिकता है कि वह 2 से कम बाधाओं को गिरा देगा (नहीं पार कर पाएगा) ?

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20. A man can hit a bird once in 3 shots . On this assumption he fires 3 shots . What is the chance that at least one bird is hit ?

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21. If the probability that a man aged 60 will live to be 70 is 0.65 what is the probability that out of 10 men now 60 at least 8 will live to be 70 ?

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22. A bag contains 5 white 7 red and 8 black balls. If four balls are drawn one by one with replacement what is the probability that (i) none is the white (ii) all are white (ii) at least one is white ?

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23. A plicement fires 6 bullets at a burglar. The probability that the burglar will be hit by a bullet is 0.6 . What is the probability that the burglar is still unhurt ?

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24. A die is tossed thrice . A success I is or 6 on a toss. Find the mean and variance of successes.

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25. A die is thrown 100 times. Getting an even number is considered a successes. Find the mean and variance of successes.

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26. If the mean and variance of a binomial distribution are respectively 9 and 6, find the distribution.

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27. find the binomial distribution whose mean is 5 and variance is 2.5

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28. The mean and variance of a binomial distribution are 4 and  $\frac{4}{3}$  respectively, find  $P(X \geq 1)$ .

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29. For a binomial distribution the mean is 6 and the standard deviation is  $\sqrt{2}$ . Find the probability of getting 5 successes .

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30. In a binomial distribution the sum and product of the mean and the variance are  $\frac{25}{3}$  and  $\frac{50}{3}$  respectively. Find the distribution.

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

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**32.** Bring out the fallacy if any in the following statement :

The mean of a binomial distribution is 6 and its variance is 9.



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