65. n=5, 4P(X=1)=P(X=2)

$$n.{}^5C_1q^4p^1={}^5C_2q^3p^2=P=\frac{2}{3}$$

70. $q=\frac{1}{10},p=\frac{9}{10},n=5$

$$P(X\ge 4)=\left(\frac{9}{10}\right)^4\left(\frac{5}{10}+\frac{9}{10}\right)=(1.4)\times(0.9)^4$$

73. $p=\frac{1}{20},q=\frac{19}{20},n=8$

$$p(x<2)={}^8C_0\left(\frac{19}{20}\right)^8\left(\frac{1}{20}\right)^0+{}^8C_1\left(\frac{19}{20}\right)^7\left(\frac{1}{20}\right)^1$$

$$=\frac{27\times 19^7}{20^8}$$

77. $p=\frac{2}{3},q=\frac{1}{3},n=4$

$$P(X>2)={}^4C_3\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^3+{}^4C_4\left(\frac{1}{3}\right)^0\left(\frac{2}{3}\right)^4=\frac{16}{27}$$

78. $np=2,npq=\frac{4}{3}\Rightarrow q=\frac{2}{3},p=\frac{1}{3},n=6$

$$P(X=x)={}^6C_x\left(\frac{1}{3}\right)^x\left(\frac{2}{3}\right)^{6-x}$$

88. $p=2q,p+q=1,q=\frac{1}{3},p=\frac{2}{3},n=10$

$$P(X=6)={}^{10}C_6\left(\frac{1}{3}\right)^4\left(\frac{2}{3}\right)^6$$

97. n=5, P(X=1)=0.4096, P(X=2)=0.2048

$$P(X=1)=2P(X=2)\Rightarrow 1-P=4P$$

$$P=\frac{1}{5}$$

98. $np=6,npq=2\Rightarrow n=9,p=\frac{2}{3},q=\frac{1}{3}$

$$P(5\le X\le 7)=\sum_{x=5}^{7}{}^9C_x\left(\frac{1}{3}\right)^{9-x}\left(\frac{2}{3}\right)^x$$

## LEVEL-2

1. For a binomial distribution if $p=\frac{1}{4},n=20$ the probability of mode is
1. ${}^{20}C_5\left(\frac{3}{4}\right)^5$ 2. ${}^{20}C_5\left(\frac{1}{4}\right)^5\left(\frac{3}{4}\right)^{15}$
3. ${}^{10}C_{10}\left(\frac{1}{4}\right)^{10}\left(\frac{3}{4}\right)^{10}$ 4. ${}^{10}C_{10}\left(\frac{3}{4}\right)^{10}$

2. Out of 10,000 families with 4 children each, the expected number of families all of whose children are daughters is
1. 225 2. 400 3. 625 4. 125

3. 4 unbiased coins are tossed 256 times. The expected frequency of x heads
1. $16\times{}^4C_x$ 2. $12\times{}^4C_x$ 3. $12\times{}^4C_0$ 4. $8\times{}^4C_0$

4. Out of 800 families with 4 children each the expected number of families having 2 boys and 2 girls
1. 100 2. 200 3. 300 4. 400

5. Out of 800 families with 4 children each, the expected number of families having atleast one boy is
1. 550 2. 50 3. 750 4. 300

6. A fair coin is tossed four times. The probability that heads exceed tails in number is
1. $\frac{5}{16}$ 2. $\frac{6}{16}$ 3. $\frac{7}{16}$ 4. $\frac{8}{16}$

7. The probability of expected number of boys in a family with 8 children assuming that the sex distributions are equally probable is
1. ${}^8C_2\left(\frac{1}{2}\right)^8$ 2. ${}^8C_3\left(\frac{1}{2}\right)^8$ 3. ${}^8C_4\left(\frac{1}{2}\right)^8$ 4. ${}^8C_5\left(\frac{1}{2}\right)^8$

8. 2K coins (K is an integer) each with probability P(O<P<1) of getting head are tossed together. If the probability of getting K heads is equal to the probability of getting K+1 heads, the value of P is
1. $\frac{K}{2K+1}$ 2. $\frac{K+1}{2K}$ 3. $\frac{K+1}{2K+1}$ 4. $\frac{2K}{K+1}$

9. One hundred identical coins each with probability P of showing up heads are tossed. If O<P<1 and the probability of heads showing on 50 coins is equal to that of heads showing on 51 coins then the value of P is
1. $\frac{50}{100}$ 2. $\frac{51}{101}$ 3. $\frac{52}{101}$ 3. $\frac{53}{101}$

10. 2K+1 coins (K is an integer) each with probability P(O<P<1) of getting head are tossed together. If the probability of getting K heads is equal to the probability of getting K+1 heads, the value of P is
1. $\frac{1}{4}$ 2. $\frac{1}{3}$ 3. $\frac{1}{2}$ 4. $\frac{1}{8}$

11. If 21 coins each with probability P(O<P<1) of getting head are tossed together. If the probability of getting 10 heads is equal to the probability of getting 11 heads, the value of P is
1. $\frac{1}{5}$ 2. $\frac{1}{3}$ 3. $\frac{1}{4}$ 4. $\frac{1}{2}$

12. A card is drawn and replaced in an ordinary pack of playing cards. The number of times a card must be drawn so that there is atleast even chance of drawing atleast one heart card is
1. 5 2. 4 3. 3 4. 2

13. A card is drawn and replaced in an ordinary pack of playing cards. The number of times a card must be drawn so that the probability of getting atleast a club card is greater than $\frac{3}{4}$
1. 7 2. 6 3. 5 4. 4

14. The probability of a man hitting the target is $\frac{1}{3}$. The number of times must one fire so that the probability of hitting the target atleast once is more than 90% is

1. 6  2. 5  3. 4  4. 3

15. Five coins whose faces are marked 2 and 3 are thrown. The chance of obtaining a total of 12 is

1. $\frac{11}{16}$  2. $\frac{15}{16}$  3. $\frac{5}{16}$  4. $\frac{1}{16}$

16. For a binomial distribution if $p=\frac{2}{3}$ and n=10 the probability of mode is

1. ${}^{10}C_4\left(\frac{1}{3}\right)^7\left(\frac{2}{3}\right)^3$  2. ${}^{10}C_7\left(\frac{2}{3}\right)^7\left(\frac{1}{3}\right)^3$

3. $\left(\frac{2}{3}\right)^7\left(\frac{1}{3}\right)^3$  4. $\left(\frac{1}{3}\right)^7\left(\frac{2}{3}\right)^3$

17. If for a B.D. $p=\frac{2}{3}$, n = 8, then the probability of mode is

1. ${}^{8}C_6\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^2$  2. ${}^{8}C_4\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^4$

3. ${}^{10}C_6\left(\frac{2}{3}\right)^6\left(\frac{1}{3}\right)^4$  4. ${}^{10}C_4\left(\frac{2}{3}\right)^4\left(\frac{1}{3}\right)^4$

18. A man takes a step forward with probability 0.4 and backwards with probability 0.6. The probability that at the end of eleven steps he is one step away from the starting point is

1. ${}^{11}C_6(0.4)^6(0.6)^6$  2. ${}^{11}C_5(0.4)^5(0.6)^5$

3. ${}^{11}C_5$  4. ${}^{11}C_6$

19. Twenty coins each with probability P(O<P<1) of showing head are tossed together. If the probability of getting 10 heads is equal to the probability of getting 11 heads, the value of P is

1. $\frac{9}{20}$  2/ $\frac{11}{20}$  3. $\frac{11}{21}$  4. $\frac{9}{21}$

20. 201 coins each with probability P(O<P<1) of showing head are tossed together. If the probability of getting 100 heads is equal to the probability of getting 101 heads, then the value of p is

1. $\frac{1}{4}$  2. $\frac{1}{3}$  3. $\frac{1}{2}$  4. $\frac{1}{6}$

21. n coins each with probability p of getting head are tossed together. The probability of getting odd number of heads is

1. $\frac{1-(q-p)^n}{2}$  2. $\frac{1+(q-p)^n}{2}$

3. $\frac{(q-p)^n}{2}$  4. $\frac{(q+p)^n}{2}$

22. Out of 2000 families with 4 children, the number of familes you expect to have atleast one boy is

1. 1875  2. 750  3. 1250  4. 625

23. Out of 2000 families with 4 children, the number of familes you expect to have two male children is

1. 1875  2. 750  3. 1250  4. 625

24. 8 unbiased coins are tossed at a time 512 times. The expected frequency of getting one head is

1. 4  2. 8  3. 16  4. 20

25. 6 symmetrical dice are thrown 1458 times. The number of times you expect three dice to show a four or five is

1. 160  2. 320  3. 480  4. 600

26. The probability of getting a total of 11 points once in two tosses of a pair of dice is

1. $\frac{17}{18}$  2. $\frac{1}{18}$  3. $\frac{17}{162}$  4. $\frac{1}{162}$

27. If a sex ratio of births is 49 girls to 51 boys, the probability that there will be 8 girls amongst 10 babies born on the same day in a maternity hospital

1. ${}^{10}C_8(0.51)^8(0.49)^2$  2. ${}^{10}C_8(0.49)^8(0.51)^2$

3. ${}^{10}C_8(0.49\times0.51)^8$  4. ${}^{10}C_8(0.49\times0.51)^2$

28. A variable takes the values 0, 1, 2, 3, ....n with frequencies proportional to the binomial coefficients ${}^nc_1, {}^nc_1, {}^nc_2, {}^nc_3, ....... {}^nc_n$ then the mean $\overline{x}=$

1. n  2. $\frac{n}{2}$  3. $\frac{n}{4}$  4. $\frac{n}{6}$

29. A variable takes the values 0, 1, 2, 3, ....n with frequencies proportional to the binomial coefficients ${}^nc_1, {}^nc_1, {}^nc_2, {}^nc_3, ....... {}^nc_n$ then variance $\sigma^2=$

1. n  2. $\frac{n}{2}$  3. $\frac{n}{4}$  4. $\frac{n}{6}$

30. If x is $B\left(x,n,\frac{1}{3}\right), P(x\geq1)>8$, the least value of n is

1. 3  2. 4  3. 5  4. 6

31. If x is a binomial variable with $p=\frac{1}{4}$, then the smallest value of n so that $P(x\geq1)>0.70$ is

1. 3  2. 4  3. 5  4. 6

32. The largest possible variance of a binomial variate is

1. n  2. $\frac{n}{2}$  3. $\frac{n}{4}$  4. $\frac{n}{6}$

33. If we take 1280 sets each of 10 tosses of a fair coin, the number of sets we expect to get 7 heads and 3 tails is

1. 450  2. 300  3. 150  4. 75

34. In a market region half of the households is known to use a particular brand of soap. In a household survey, a sample of 10 house holds are alloted to

each investigator and 2048 investigators are appointed for the survey. The number of investigators likely to report that there are three households is

1. 240 2. 352 3. 1696 4. 120

35. In a market region half of the households is known to use a particular brand of soap. In a household survey, a sample of 10 house holds are alloted to each investigator and 2048 investigators are appointed for the survey. The number of investigators likely to report that there are not more than 3 households is

1. 240 2. 352 3. 1696 4. 120

36. In a market region half of the households is known to use a particular brand of soap. In a household survey, a sample of 10 house holds are alloted to each investigator and 2048 investigators are appointed for the survey. The number of investigators likely to report that there are atleast 4 users is

1. 240 2. 352 3. 1696 4. 120

37. Assuming that half of the population are consumers of rice so that the chance of an individual being a consumer is $\frac{1}{2}$ and assuming that 1024 investigators each take 10 individuals to see whether they are consumers, the number of investigators you expect to report that three or less are consumers is

1. 360 2. 240 3. 120 4. 60

38. An irregular six faced die is thrown and the expectation that in 5 throws it will give 3 even numbers is twice the expectation that it will give 2 even numbers. The number of times in 6561 sets of 5 throws you expect to give no even numbers is

1. 16 2. 27 3. 18 4. 19

39. The least number of times a fair coin is to be tossed in order that the probability of getting atleast one head is at least 0.99 is

1. 5 2. 6 3. 7 4. 8

40. The number of symmetrical dice atleast must be thrown so that there is a better than even chance of obtaining atleast a six is

1. 2 2. 3 3. 4 4. 5

41. The probability of a man hitting the target is $\frac{1}{4}$. The number of times atleast must he fire so that the probability of his hitting the target atleast once is greater than $\frac{2}{3}$ is

1. 6 2. 5 3. 4 4. 3

42. The probability of a man hitting the target is $\frac{1}{3}$. The number of times he must fire so that the probability of hitting the target atleast once is more than 90% is

1. 5 2. 6 3. 7 4. 8

43. An arcade game is such that the probability of any person winning is always 0.3. The number of people play the game to ensure that the probability that atleast one person wins is greater than or equal to 0.96 is

1. 8 2. 9 3. 10 4. 12

44. If the probability of a male child is $\frac{1}{2}$, the probability that in a family of 4 children there will be atleast one boy and one girl is

1. $\frac{3}{8}$ 2. $\frac{5}{8}$ 3. $\frac{7}{8}$ 4. $\frac{1}{8}$

45. Suppose A and B are two equally strong table tennis players. Which of the following two events is more probable

a) A beats B in exactly 3 games out of 4

b) A beats B in exactly 5 games out of 8

1. a 2. b 3. a & b 4. None

46. Suppose A and B are two equally strong table tennis players. Which of the following two events is more probable. (a) A beats B in exactly 3 games out of 5 and (b) A beats B in exactly 5 games out of 8

1. a 2. b 3. a & b 4. None

47. A bag contains 13 balls numbered from 1 to 13. Suppose drawing of an even number is a success. Two balls are drawn with replacement from the bag. The probability of getting two successes is

1. $\frac{84}{169}$ 2. $\frac{49}{169}$ 3. $\frac{36}{169}$ 4. $\frac{120}{169}$

48. A bag contains 13 balls numbered from 1 to 13. Suppose drawing of an even number is a success. Two balls are drawn with replacement from the bag. The probability of getting exactly one success is

1. $\frac{84}{169}$ 2. $\frac{49}{169}$ 3. $\frac{36}{169}$ 4. $\frac{120}{169}$

49. A bag contains 13 balls numbered from 1 to 13. Suppose drawing of an even number is a success. Two balls are drawn with replacement from the bag. The probability of getting atleast one success is

1. $\frac{49}{169}$ 2. $\frac{84}{169}$ 3. $\frac{120}{169}$ 4. $\frac{36}{169}$

50. An urn contains 25 balls numbered 1 through 25. Suppose getting an odd number is a success. Two balls are drawn from the urn with replacement. The probability of getting at least one success is

1. $\frac{481}{625}$ 2. $\frac{312}{625}$ 3. $\frac{144}{625}$ 4. $\frac{244}{625}$

51. A coin whose faces are marked 3 & 5 is tossed 4 times. The probability that the sum of the numbers thrown is 12 is

1. $\frac{1}{16}$ 2. $\frac{5}{16}$ 3. $\frac{5}{8}$ 4. $\frac{1}{8}$

52. A coin whose faces are marked 3 & 5 is tossed 4 times. The probability that the sum of the numbers thrown is greater than 15

1. $\frac{11}{16}$ 2. $\frac{5}{16}$ 3. $\frac{5}{8}$ 4. $\frac{1}{16}$

53. A coin whose faces are marked 3 & 5 is tossed 4 times. The probability that the sum of the numbers

thrown is less than 15 is

1. $\frac{1}{16}$ 2. $\frac{5}{16}$ 3. $\frac{5}{8}$ 4. $\frac{11}{16}$

54. A coin is tossed n times. If the probability of getting head 6 times is equal to the probability of getting head 8 times then n =

1. 6 2. 8 3. 14 4. 10

55. A coin tossed n times. If the probability that 4, 5, 6 heads occur are in A.P., then n =

1. 14 2. 8 3. 15 4. 11

56. Suppose X follows binomial distribution with parameters n and p, where 0<p<1. If $\frac{P(x=r)}{P(x=n-r)}$ is independent of n and r, then p=

1. $\frac{1}{2}$ 2. $\frac{1}{2}$ 3. $\frac{1}{4}$ 4. 1

57. A symmetric die is thrown (2n+1) times. The probability of getting a prime score on the upturned face at most n times is

1. $\frac{1}{2}$ 2. $\frac{1}{3}$ 3. $\frac{1}{4}$ 4. $\frac{2}{3}$

58. Suppose X follows binomial distribution with parameters n = 100 and $p=\frac{1}{3}$ then P(x=r) is maximum when r =

1. 49 2. 50 3. 33 4. 34

59. Numbers are selected at random, one at a time, from the two digit numbers 00, 01, 02 ..... 99 with replacement. An event E occurs if and only if the product of two digits of a selected number is 18. If four numbers are selected, then the probability that the event occurs atleast 3 times is

1. $\frac{96}{(25)^4}$ 2. $\frac{97}{(25)^4}$ 3. $\frac{95}{(25)^4}$ 4. $\frac{94}{(28)^4}$

60. The sum and product of mean and variance of a binomial distribution are 24 and 128 respectively. The binomial distribution is

1. $\left(\frac{1}{2}+\frac{1}{2}\right)^{32}$ 2. $\left(\frac{3}{10}+\frac{7}{10}\right)^{32}$

3. $\left(\frac{1}{50}+\frac{49}{50}\right)^{32}$ 4. $\left(\frac{1}{3}+\frac{2}{3}\right)^{32}$

61. If X be B.V. with $E(X)=5$ and $E(X^2)-\{E(X)\}^2=4$, then the parameters of distribution are

1. $\frac{1}{4},20$ 2. $\frac{1}{5},20$ 3. $\frac{1}{5},25$ 4. $\frac{4}{5},25$

62. If the mean of binomial distribution is $\mu$, then the variance lies in the interval

1. $[0,\mu]$ 2. $(0,\mu]$ 3. $[0,\mu)$ 4. $[0,\sqrt{\mu})$

63. The probability of a bomb hitting a bridge is $\frac{1}{2}$ and two direct hits are needed to destroy it. The least number of bombs required so that the probability of the bridge being destroyed is greater than 0.9 is

1. 5 2. 6 3. 8 4. 7

64. X and Y are independent binomial variates $B\left(5,\frac{1}{2}\right)$ and $B\left(7,\frac{1}{2}\right)$ then $P(X+Y)=3$ is

1. $\frac{45}{1024}$ 2. $\frac{55}{1024}$ 3. $\frac{65}{1024}$ 4. $\frac{60}{1024}$

65. If X follows a binomial distribution with parameters n = 8 and $P=\frac{1}{2}$ then $P(|x-4|\le 2)=$

1. $\frac{119}{128}$ 2. $\frac{9}{128}$ 3. $\frac{101}{128}$ 4. $\frac{11}{128}$

## KEY

| | | | | |
|---|---|---|---|---|
| 1. 2 | 2. 3 | 3. 1 | 4. 3 | 5. 3 |
| 6. 1 | 7. 3 | 8. 3 | 9. 2 | 10. 3 |
| 11. 4 | 12. 3 | 13. 3 | 14. 1 | 15. 3 |
| 16. 2 | 17. 1 | 18. 2 | 19. 3 | 20. 3 |
| 21. 1 | 22. 1 | 23. 2 | 24. 3 | 25. 2 |
| 26. 3 | 27. 2 | 28. 2 | 29. 3 | 30. 2 |
| 31. 3 | 32. 3 | 33. 3 | 34. 1 | 35. 2 |
| 36. 3 | 37. 3 | 38. 2 | 39. 3 | 40. 3 |
| 41. 3 | 42. 2 | 43. 2 | 44. 3 | 45. 1 |
| 46. 1 | 47. 3 | 48. 1 | 49. 3 | 50. 1 |
| 51. 1 | 52. 1 | 53. 2 | 54. 3 | 55. 1 |
| 56. 1 | 57. 1 | 58. 3 | 59. 2 | 60. 1 |
| 61. 3 | 62. 3 | 63. 4 | 64. 2 | 65. 1 |

## HINTS

1. $p=\frac{1}{4},n=20,np+p=20\times\frac{1}{4}+\frac{1}{4}=5+\frac{1}{4}$

i.e., mode = 5

probability of mode $=P(X=5)={}^{20}C_5\left(\frac{3}{4}\right)^{15}\left(\frac{1}{4}\right)^5$

3. $n=4,p=\frac{1}{2},q=\frac{1}{2},N=256$

Expected frequency of X heads = N.P(X=0)

$=256.{}^4C_x\left(\frac{1}{2}\right)^{4-x}\left(\frac{1}{2}\right)^x=256.{}^4C_x\left(\frac{1}{2}\right)^4=16\times{}^4C_x$

7. Sex distributions are equally probable

$E(X)=\bar{x}=8\times\frac{1}{2}=4$

$p=q=\frac{1}{2},n=8,P(X=4)={}^8C_4.\left(\frac{1}{2}\right)^8$

12. $p=P(H)=\frac{1}{4},P(\bar{H})=q=\frac{3}{4}$

Let n be the least number of times card is to be drawn.

24. $n=8,N=512,p=\frac{1}{2},q=\frac{1}{2}$

$P(X=1)=\frac{8}{2^8}f(X=x)=N\times{}^nC_xp^xq^{n-x}$

Expected frequency of getting a head = 16

27. $n=10,p=\frac{49}{100},q=\frac{51}{100},$

$P(X=8)={}^{10}C_8(0.51)^2(0.49)^8$

30. $P(X\ge1)>0.8\Rightarrow1-P(X=0)>0.8$

$\Rightarrow\left(\frac{2}{3}\right)^n<0.2\Rightarrow$ Least value of n is 4

34. $p=\frac{1}{2},n=10,N=2048$

$N.P(X=3)=2048\times\frac{{}^{10}C_3}{2^{10}}=240$

35. $N.P(X>3)=2048\times\frac{\left({}^{10}C_0+{}^{10}C_1+{}^{10}C_2+{}^{10}C_3\right)}{2^{10}}=352$

36. $2048-352=1696$

38. $n=5,N=6561,p,q$

$P(X=3)=2P(X=2)$

${}^5C_3q^2p^3=2^5.C_2q^3p^2$

$p=2q,q=\frac{1}{3},p=\frac{2}{3};N.P(X=0)=27$

44. P(atleast one boy and girl)
=1-P(not even one boy) - P(not even one girl)
=1-P(x=0)-P(x=4)

45. $P(E_1)=\frac{{}^4C_3}{2^4}=\frac{4}{16}=\frac{8}{32}$

46. $P(E_2)=\frac{{}^8C_5}{2^8}=\frac{7}{32}$

a is more probable than b

54. ${}^nc_6={}^nc_8\Rightarrow n=6+8=14$

55. ${}^nc_4,{}^nc_5,{}^nc_6$ are in A.P. $(n-2r)^2=n+2,$ where r=5

56. $\frac{P(x=r)}{P(x=n-r)}=q^{n-2r}.p^{2r-n}$ is independent of n and r

$\Rightarrow p=\frac{1}{2}$

57. Let n=1, then $P(X\le1)=\frac{1}{2}$

58. P(x=r) is maximum at r=[np]

59. $p=\frac{1}{25};q=\frac{24}{25};n=4$

Required probability $p(x\ge3)=p(x=3)+p(x=4)$

60. $\bar{x}+\sigma^2=24.\bar{x}.\sigma^2=128,x^2-\sigma^2=8$

61. E(x) = np = 5, $E(x^2)=[E(x)]^2=npq=4$

62. $\sigma^2\in[0,\mu)$

63. $p=\frac{1}{2},q=\frac{1}{2},P(x\ge2)>0.9\Rightarrow(n+1)\frac{1}{2^n}<\frac{1}{10}$

## LEVEL - 4

1. A die is tossed twice. Getting 'an odd number' is termed a success. The probability distribution of number of successess (X) is formed. Then its mean, variance are
   1. 1, 1/2 2. 1/2, 1
   3. 1/2, 1/2 4. 1, 1
2. For a binomial distribution : n = 6 and 9. P(X = 4) = P (X = 2). Then we have
   1. $P(X=1)\le P(X=5)<P(X=3)$
   2. $P(X=5)>P(X=3)>P(X=1)$
   3. $P(X=5)<P(X=3)<P(X=1)$
   4. $P(X=5)+P(X=3)>P(X=1)$

## KEY

1. 1 2. 3

## LEVEL - 5

## COMPREHENSIVE QUESTIONS

I. In a market region one third of the house holds is known to use a particular brand of soap. In a household survey, a sample of 6 house holds an alloted to each investigator and 729 investigators are appointed for the survey.
From the given data

1. The number of invesigators likely to report that there are three house holds is
   1. 170 2. 160 3. 165 4. 175
2. The number of investigators likely to report that there are not more than 3 house holds is
   1. 656 2. 654 3. 653 4. 652
3. The number of investigators likely to report that there are atleast 2 house holds is
   1. 471 2. 472 3. 473 4. 474

## KEY

1. 2 2. 1 3. 3

## PREVIOUS EAMCET QUESTIONS 2005

1. For a binomial variate with n = 6, if $P(X=2)=9.\ P(X=4),$ then the variance is

1. 8/9  2. 1/4  3. 9/8  4. 4

**2002**

2. In a binomial distribution, the probability of getting a success is $\frac{1}{4}$ and the standard deviation is 3. Then its mean is
1. 12  2. 10  3. 8  4. 6

**2001**

3. For a binomial variate if n = 5 and P(x=1)=8P(x=3), then p=
1. $\frac{4}{5}$  2. $\frac{1}{5}$  3. $\frac{1}{3}$  4. $\frac{2}{3}$

**2000**

4. For a binomial distribution n = 10, q = 0.4, then its mean is
1. 1  2. 4  3. 6  4. 10

**1999**

5. If the mean of binomial distribution with 9 trials is 6 then its variance is
1. 2  2. 3  3. 4  4. $\sqrt{2}$

**1998**

6. The probability of a man hitting a target is $\frac{1}{4}$. If he fires 7 times, the probability of hitting the target at least twice is
1. $1-\frac{5}{2}\left(\frac{3}{4}\right)^6$  2. $1-\frac{15}{2}\left(\frac{3}{4}\right)^6$
3. $1-\frac{5\times 3^5}{6}$  4. $1-\left(\frac{3}{9}\right)^6$

**1997**

7. If the mean and variance of a binomial variate X are respectively $\frac{35}{6}$ and $\frac{35}{36}$ then the probability of X>6 is
1. $\frac{1}{6^7}$  2. $\frac{5^7}{6^7}$  3. $\frac{1}{7^7}$  4. $7.5.\frac{1}{6^7}+\frac{1}{6^7}$

**1996**

8. The mean and variance of a random variable X having binomial distributions are 4 and 2 respectively. Then P(X>6) =
1. $\frac{9}{128}$  2. $\frac{81}{128}$  3. $\frac{9}{256}$  4. $\frac{3}{11}$

**1996 (RE-EXAMINATION)**

9. If in a binomial distribution the mean is 20, standard deviation is $\sqrt{15}$, then p=
1. $\frac{3}{4}$  2. $\frac{1}{4}$  3. $\frac{1}{2}$  4. $\frac{1}{3}$

**1995**

10. In an experiment the success is twice that of failure. If the experiment is repeated 6 times, the probability that atleast 4 times favourable is
1. $\frac{64}{729}$  2. $\frac{192}{729}$  3. $\frac{240}{729}$  4. $\frac{496}{729}$

11. The probability that a candidate secures a seat in engineering through EAMCET is $\frac{1}{10}$. 7 candidates are selected at random from a centre, the probability that exactly two will get seats is
1. $15(0.1)^2(0.9)^5$  2. $20(0.1)^2(0.9)^5$
3. $21(0.1)^2(0.9)^5$  4. $23(0.1)^2(0.9)^2$

**1994**

12. X follows a binomial distribution with parameters n=6 and p, if 4P(X=4)=P(X=2) then p=
1. $\frac{1}{2}$  2. $\frac{1}{4}$  3. $\frac{1}{6}$  4. $\frac{1}{3}$

13. In a binomial distribution n=400, $p=\frac{1}{5}$ its standard deviation is
1. $10\sqrt{2}$  2. $\frac{1}{800}$  3. 4  4. 8

14. Let X be a binomially distributed variate with mean 10 and variance 5. Then P(X>10)=
1. $\frac{1}{2^{20}}\sum_{11}^{20}{}^{20}C_k$  2. $\frac{1}{2^{20}}\sum_{20}^{1}{}^{20}C_k$
3. $\frac{1}{2^{20}}\sum_{1}^{20}{}^{20}C_k$  4. $\sum_{11}^{20}{}^{20}C_k\frac{1}{2^k}\left(\frac{2}{3}\right)^{30-k}$

**1992**

15. Twenty identical coins each with probability p of showing heads are tossed. The probability of heads showing on 10 coins is same as that of heads showing on 11 coins then p =
1. $\frac{1}{2}$  2. $\frac{10}{21}$  3. $\frac{11}{21}$  4. None

16. If the mean of the binomial distribution is 25. Then standard deviation lies in the interval given below
1. [0, 5)  2. (0, 5]  3. [0, 25)  4. (0, 25]

**1991**

17. If the mean and variance of a binomial distribution are $\frac{15}{4}$ and $\frac{15}{16}$. The number of trials is
1. 5  2. 2  3. 4  4. 6

**1990**

18. For a binomial distribution $\overline{x}=4, \sigma=\sqrt{3}$. The probability mass function P(r)=
1. ${}^{12}C_r\left(\frac{1}{4}\right)^r\left(\frac{3}{4}\right)^{12-r}$  2. ${}^{12}C_r\left(\frac{3}{4}\right)^r\left(\frac{1}{4}\right)^{12-r}$

3. ${}^{16}C_r\left(\frac{1}{4}\right)^r\left(\frac{3}{4}\right)^{16-r}$ 4. ${}^{16}C_r\left(\frac{3}{4}\right)^r\left(\frac{1}{4}\right)^{n-r}$

## 1989

19. Out of 10,000 families with 4 children each, the expected number of families all of whose children are daughters is
1. 1875 2. 1250 3. 625 4. None

20. The probability that a bomb dropped from a plane strikes the target is $\frac{1}{5}$. The probability that out of six bombs dropped at least 2 bombs strike the target is
1. 0.345 2. 0.246 3. 0.543 4. 0.426

## 1988

21. In a binomial distribution mean is 5, and variance 4 then the number of trials is
1. 100 2. 50 3. 25 4. None

22. The probability of getting at least two heads when tossing a coin three times is
1. $\frac{1}{4}$ 2. $\frac{1}{3}$ 3. $\frac{1}{2}$ 4. None

## 1986

23. If the standard deviation of the binomial distribution $(q+p)^{16}$ is 2, then mean is
1. 2 2. 4 3. 8 4. None

## 1985

24. If the difference between the mean and variance of binomial distribution for 5 trials is $\frac{5}{9}$ the distribution is of the form
1. $\left(\frac{1}{3}+\frac{2}{3}\right)^5$ 2. $\left(\frac{2}{3}+\frac{1}{3}\right)^5$ 3. $\left(\frac{1}{4}+\frac{3}{4}\right)^6$ 4. None

## 1984

25. If in a binomial distribution $\bar{x}=6$ and $S.D.=\sqrt{2}$ then the binomial distribution is
1. $\left(\frac{2}{3}+\frac{1}{3}\right)^9$ 2. $\left(\frac{1}{3}+\frac{2}{3}\right)^9$ 3. $\left(\frac{1}{4}+\frac{3}{4}\right)^5$ 4. None

## 1983

26. The probability that in a family of 4 children there will be atleast one boy is
1. $\frac{11}{16}$ 2. $\frac{13}{16}$ 3. $\frac{15}{16}$ 4. None

27. If in a binomial distribution n = 20 and q = 0.75, then its mean is
1. 15 2. 10 3. 5 4. None

## KEY

| | | | | |
|---|---|---|---|---|
| 1. 3 | 2. 1 | 3. 2 | 4. 3 | 5. 1 |
| 6. 1 | 7. 2 | 8. 3 | 9. 2 | 10. 4 |
| 11. 3 | 12. 4 | 13. 4 | 14. 1 | 15. 3 |
| 16. 1 | 17. 1 | 18. 3 | 19. 3 | 20. 1 |
| 21. 3 | 22. 3 | 23. 3 | 24. 2 | 25. 2 |
| 26. 3 | 27. 3 | | | |

## AIEEE - 2004

1. The mean and the variance of a binomial distribution are 4 and 2 respectively. Then the probability of 2 successess is
1. 128/256 2. 219/256
3. 37/256 4. 28/256

## AIEEE - 2003

2. The mean and the variance of a random variable X having a binomial distribution are 4 and 2 respectively, then $P(X=1)$ is
1. 1/32 2. 1/16 3. 1/8 4. 1/4

## KEY

1. 4 2. 1

# POISSON DISTRIBUTION

In Binomial distribution we know that

$$P(X=x)={}^nC_x p^x q^{n-x}; \quad x=0,1,2,3,......n$$
$$p\ge 0, q\ge 0 \ \& \ p+q=1$$

In this, let

- The number of independent bernoullian trials n is indefinitely large i.e., $n\to\infty$.
- The probability of success p is infinitely small i.e., $p\to 0$.
- Even though $n\to\infty$, $p\to 0$, $np=\lambda=m$, a constant always. This contant must be a finite positive number. Then $\lim\limits_{n\to\infty}{}^nC_x p^x q^{n-x}=\frac{e^{-\lambda}\lambda^x}{\angle x}$ and this is called as poisson distribution.

$\therefore$ The P.D. is $P(X=x)=\frac{e^{-\lambda}\lambda^x}{\angle x}; x=0,1,2,3,4,......$

Here $\lambda$ is called the parameter of P.D. It was derived in 1837 by a French mathematician by name S.D. Poisson and hence the name.

- A discrete random variable X is said to follow poisson distribution with parameter $\lambda$ if its probability mass function is given by $P(X=x)=\frac{e^{-\lambda}\lambda^x}{\angle x}; x=0,1,2,3,......$

**THE CHARACTERISTICS OF P.D.:**

- The mean of random poisson variate X is $\lambda$. i.e., $\bar{x}=\lambda=np$.
- The variance of r.p.v. X is $\lambda$. i.e., $\sigma^2=\lambda$.
- The S.D. of r.p.v. X is $\sqrt{\lambda}$. i.e., $\sigma=\sqrt{\lambda}$.
- In poisson distribution mean and variance are equal. i.e., $\bar{x}=\sigma^2=\lambda$.

- The mode of poisson distribution depends on the value of $\lambda$

**CASE-I:** If $\lambda = K$, where K is an integer, then there will be two modes namely K and K-1 i.e., $\lambda$ & $\lambda - 1$ themselves. In this case the distribution is said to be Bi-modal poisson distribution.

**CASE-II:** If $\lambda = K + f$ where K is an integer and f is a proper fraction, then there will be only one mode namely K i.e., the integral part of $\lambda$ will be the mode. In this case the distribution is said to be Uni-modal poisson distribution.

- The expected frequency or the theoretical frequency of X successes in P.D. is given by

$$f(X=x) = N \times P(X=x) = \frac{N \times e^{-\lambda}\lambda^x}{\angle x};\ x = 0,1,2,3,......$$

and this is called as poisson frequency distribution.

## LEVEL-1

1. The probability of r successes in case of poisson distribution is
1. $\frac{e^{\gamma}m}{\angle \gamma}$ 2. $\frac{\gamma^m e^m}{\angle \gamma}$ 3. $\frac{e^m \gamma}{\angle \gamma}$ 4. $\frac{e^{-m}m^r}{\angle r}$

2. The parameter $\lambda$ of poisson distribution is always
1. zero 2. 1
3. $-1$ 4. a finite positive value

3. The variance of P.D. with parameter $\lambda$ is
1. $\lambda$ 2. $\sqrt{\lambda}$ 3. $\frac{1}{\lambda}$ 4. $\frac{1}{\sqrt{\lambda}}$

4. If X is a poisson variable with parameter 0.09, then its S.D. is
1. 0.009 2. 0.3 3. 0.03 4. 0.09

5. The S.D. of poisson distribuition whose mean is $\lambda$ is
1. $\lambda$ 2. $\sqrt{\lambda}$ 3. $\lambda^2$ 4. $\frac{1}{\sqrt{\lambda}}$

6. If the mean of P.D. is 3.5, then its mode is
1. 3 2. 4 3. 3.5 4. 5

7. If a poisson distribution has double modes at x = 1 and at x = 2, the mean of the distribution is
1. 1 2. 2 3. 1.5 4. 3

8. The mean of a bimodal poisson distribution if its modes are 2 and 3 is
1. 2.5 2. 2 3. 3 4. 4

9. If the mean of poisson distribution is 16, then its S.D. is
1. 16 2. 4 3. 10 4. 15

10. The standard deviation of P.D. is 1.5, then its mean is
1. 1.5 2. 2 3. 2.25 4. 3.25

11. If the mean of P.D. is 5, then the variance of the same distribution is
1. 25 2. 10 3. 5 4. 15

12. If $\bar{x}$ and $\sigma^2$ are mean and variance of poisson distribution, then
1. $\bar{x} > \sigma^2$ 2. $\bar{x} < \sigma^2$
3. $\bar{x} = \sigma^2$ 4. $\bar{x} + \sigma^2 = 1$

13. If for a poisson variable x, p(x=1)=2p(x=2), then the parameter $\lambda$ is
1. 0 2. 1 3. 2 4. 3

14. If n and p are the parameters of B.D., then the mean of poisson distribution is
1. $n \div p$ 2. $p \div m$ 3. $np$ 4. $p / n$

15. In a poisson distribution if P(X=0)=2P(X=1), then the mean of the distribution is
1. 2 2. 1 3. $\frac{1}{2}$ 4. 3

16. If a random variable X follows a P.D. such that $P(X=1) = P(X=2)$, then P(X=0)=
1. $e^2$ 2. $\frac{1}{e^2}$ 3. $\frac{1}{e}$ 4. e

17. If X is a poisson variate such that $P(X=2) = 9P(X=4) + 90P(X=6)$, then the mean of X is
1. 3 2. 2 3. 1 4. 0

18. A company knows on the basis of past experience that 2% of its blades are defective. The probability of having 3 defective blades in a sample of 100 blades if $e^{-2} = 0.1353$ is
1. 0.1353 2. 0.1804 3. 0.2706 4. 0.3606

19. If for a poisson distribution P(X=0)=0.2, then the variance of the distribution is
1. 5 2. $\log_{10} 5$ 3. $\log_e 5$ 4. $\log_5 e$

20. If the probability that a poisson variable X takes a positive value $(\geq 1)$ is $1 - e^{-1.5}$ then the variance of the distribution is
1. 4, 5 2. 3 3. 1.5 4. 0

21. A random variable X follows poisson distribution such that $P(X=k) = P(X=k+1)$ then the parameter of the distribution $\lambda =$
1. K 2. K+1 3. $\frac{K}{2}$ 4. $\frac{K+1}{2}$

22. If in a poisson frequency distribution, the frequency of 3 successes is $\frac{2}{3}$ times the frequency of 4 successes, the mean of the distribution is
1. $\frac{2}{3}$ 2. $\frac{1}{3}$ 3. 6 4. $\sqrt{6}$

23. If X is a poisson variate with parameter 1.5, then P(X>1) is

1. $1-e^{-1.5}$ 2. $e^{-1.5}(2.5)$

3. $1-e^{-1.5}(2.5)$ 4. $1-e^{-1.5}(3.5)$

24. Suppose X is a poisson variable such that $P(X=2)=\frac{2}{3}P(X=1)$, then P(X=0) is

1. $\frac{3}{4}$ 2. $e^{\frac{4}{3}}$ 3. $e^{\frac{-4}{3}}$ 4. $\frac{1}{2}$

25. If X is a poisson variable such that $P(X=2)=\frac{2}{3}P(X=1)$ then p(x=3) is

1. $e^{\frac{-4}{3}}$ 2. $\frac{64}{162}e^{\frac{-4}{3}}$

3. $e^{\frac{-3}{4}}$ 4. $e^{\frac{-3}{4}}$

26. If X is a poisson variable such that $E(X^2)=6$, then E(X) is

1. 2 2. 3 3. 4 4. 5

27. If X is a poisson variable such that $2P(X=0)+P(X=2)=2P(X=1)$, then E(X)=

1. 4 2. 3 3. 2 4. 1

28. If X is a poisson variate such that $P(X=0)=0.1, P(X=2)=0.2$ then the parameter $\lambda$ is

1. 2 2. 4 3. 5 4. 3

29. If X is a poisson variate such that $P(X=0)=\frac{1}{2}$, the variance of X is

1. $\frac{1}{2}$ 2. 2 3. $\log_e 2$ 4. 3

30. If 2% of pipes manufactured by a company are defective, the probability that in a sample of 1000 pipes exactly 6 pipes are defective is

1. $\frac{e^{-2}2^6}{\angle 6}$ 2. $\frac{e^{-20}20^6}{\angle 6}$ 3. $e^{-20}$ 4. $e^{-2}$

31. If 3% of electric bulbs manufactured by a company are defective; the probability that in a sample of 100 bulbs exactly five are defective is

1. $\frac{e^{-0.03}(0.03)^5}{\angle 5}$ 2. $\frac{e^{-0.3}0.3^5}{\angle 5}$

3. $\frac{e^{-3}3^5}{\angle 5}$ 4. $\frac{e^{-0.3}3^{-5}}{\angle 5}$

32. In a big city 5 accidents take place over a period of 100 days. If the numebr of accidents follows P.D. the probability that there will be 2 accidents in a day is

1. $\frac{e^{-5}5^2}{\angle 2}$ 2. $\frac{e^{-0.5}5^2}{\angle 2}$

3. $\frac{e^{-0.05}(0.05)^2}{\angle 2}$ 4. $\frac{e^{5}5^2}{\angle 2}$

33. In a town 10 accidents take place in a span of 50 days. Assuming that number of accidents follows P.D., the probability that there will be atleast one accident on a selected day at random is

1. $\frac{e^{-0.02}.2^1}{\angle 1}$ 2. $1-e^{-0.2}$ 3. $e^{-0.2}$ 4. $e^{-1.2}$

34. A manufactured product on an average has 2 defects per unit of product produced. If the number of defects follows P.D., the probability of finding zero defects

1. $e^{-2}$ 2. $1-e^{-2}$ 3. $\frac{e^{-2}2^1}{\angle 1}$ 4. $e^{-0.02}$

35. A manufactured product on an average has 2 defects per unit of product produced. If the number of defects follows P.D., the probability of finding atleast one defect

1. $e^{-2}$ 2. $1-e^{-2}$ 3. $\frac{e^{-2}2^1}{\angle 1}$ 4. $e^{-0.02}$

36. A car hire firm has 2 cars which it hires out day by day. If the number of demands for a car on each day follows poisson distribution with parameter 1.5, then the probability that neither car is used is

1. $e^{-1.5}$ 2. $1.5\times e^{-1.5}$

3. $1-2.5\times e^{-1.5}$ 4. $1-1.5\times e^{-1.5}$

37. A car hire firm has 2 cars which it hires out day by day. If the number of demands for a car on each day follows poisson distribution with parameter 1.5, then the probability that only one car is used is

1. $e^{-1.5}$ 2. $1.5\times e^{-1.5}$

3. $1-2.5\times e^{-1.5}$ 4. $1-1.5\times e^{-1.5}$

38. A car hire firm has 2 cars which it hires out day by day. If the number of demands for a car on each day follows poisson distribution with parameter 1.5, then the probability that both the cars is used is

1. $1.12\times e^{-1.5}$ 2. $1-2.5\times e^{-1.5}$

3. $1-3.625\times e^{-1.5}$ 4. $3.625\times e^{-1.5}$

39. A car hire firm has 2 cars which it hires out day by day. If the number of demands for a car on each day follows poisson distribution with parameter 1.5, then the probability that some demand is refused is

1. $1.12\times e^{-1.5}$ 2. $1-2.5\times e^{-1.5}$

3. $1-3.625\times e^{-1.5}$ 4. $3.625\times e^{-1.5}$

40. If the number of telephone calls coming into a telephone exchange between 10 AM and 11 AM follows P.D. with parameter 2 then the probability of obtaining zero calls in that time interval is

1. $e^{-2}$ 2. $1-e^{-2}$ 3. $2.e^{-2}$ 4. $3.e^{-2}$

41. If the number of telephone calls coming into a telephone exchange between 10 AM and 11 AM follows P.D. with parameter 2 then the probability of obtaining atleast one call in that time interval is

1. $1.e^{-2}$ 2. $\left(1-e^{-2}\right)$ 3. $2.e^{-2}$ 4. $3.e^{-2}$

42. A telephone switch board receiving number of phone calls follows poisson distribution with parameter 3 per hour. The probability that it receives 5 calls in 2 hours duration is

1. $\frac{e^{-3}3^5}{\angle 5}$ 2. $1-\frac{e^{-3}3^5}{\angle 5}$ 3. $\frac{e^{-6}6^5}{\angle 5}$ 4. $1-\frac{e^{-6}6^5}{\angle 5}$

43. Suppose 300 misprints are distributed randomly throughout a book of 500 pages. The probability that a given page contains, at least one misprint is

1. $1.e^{-0.6}$ 2. $1-e^{-0.6}$

3. $(0.6)\times e^{-0.6}$ 4. $(0.06)\times e^{-0.6}$

44. Suppose 220 misprints are distributed randomly throughout a book of 200 pages. The probability that a given page contains, no misprint is

1. $1.e^{-0.22}$ 2. $1-e^{-0.22}$ 3. $e^{-1.1}$ 4. $e^{-2.1}$

45. Suppose 2% of the people on the average are left handed. The probability of 3 or more left handed among 100 people is

1. $3e^{-2}$ 2. $4e^{-2}$ 3. $1-5\times e^{-2}$ 4. $5\times e^{-2}$

46. Suppose there is an average of 2 suicides per year per 50,000 population. In a city of 1,00,000 the probability that in a given year there are, zero suicides is

1. $1.e^{-2}$ 2. $1-e^{-2}$ 3. $e^{-4}$ 4. $1-e^{-4}$

47. If X is a poisson variate such that $P(X=0)=P(X=1)=k$, then the value of k is

1. e 2. 1 3. $\frac{1}{e}$ 4. $\frac{2}{e}$

48. For a poisson distribution if $P(X=1)=P(X=2)$, then $P(X=4)=$

1. $\frac{4e^{-2}}{3}$ 2. $\frac{3e^{-2}}{4}$ 3. $\frac{2e^{-2}}{3}$ 4. $\frac{3e^{-2}}{2}$

49. A company knows on the basis of past experience that 2% of the blades are defective. The probability of having 3 defective blades in a sample of 100 blades is

1. $e^{-2}2^3$ 2. $\frac{e^{-2}2^3}{\angle 3}$ 3. $\frac{e^{-3}3^2}{\angle 2}$ 4. $\frac{e^{-3}3^{-2}}{\angle 2}$

50. A manufacturing concern employing a large number of workers finds that, over a period of time, the average absentee rate is two workers per shift. The probability that exactly two workers will be absent in a chosen shift at random is

1. $\frac{e^{-2}2^2}{\angle 2}$ 2. $\frac{e^{-2}2^3}{\angle 3}$ 3. $e^{-2}$ 4. $e^{-3}$

51. If X is a poisson variate with parameter $\frac{3}{2}$, find $P(X\geq 2)$

1. $\frac{5}{2}e^{\frac{-3}{2}}$ 2. $1-\frac{5}{2}e^{\frac{-3}{2}}$ 3. $1-e^{\frac{-3}{2}}$ 4. $e^{\frac{-3}{2}}$

52. It is known that the probability that an item produced by a certain machine will be defective is 0.01 use PD. to find the probability that in a random sample of 100 items selected at random from the total output there are not more than one defective item is

1. $\frac{3}{e}$ 2. $\frac{2}{e}$ 3. $\frac{1}{e}$ 4. $\frac{4}{e}$

53. If X is a random poisson variate such that 2P(X=0)+P(X=2)=2P(X=1) then E(X)=

1. 4 2. 3 3. 2 4. 1

54. If X is a random poisson variate such that $P(X=0)=0.1, P(X=2)=0.2$, then the parameter $\lambda$ is

1. 4 2. 2 3. 1 4. 3

55. If X is a random poisson variate such that $P(X=0)=\frac{1}{e}$, then the variance of the same distribution is

1. 1 2. 2 3. 3 4. 4

56. If the 1st two terms of a poisson distribution are equal to k, find k

1. e 2. $\frac{1}{e}$ 3. 1 4. 2

57. If X is a random poisson variate such that $E\left(X^2\right)=6$, then $E(X)=$

1. -3 2. 2 3. -3 & 2 4. -2

58. If a random variable X follows P.D. such that $P(X=1)=P(X=2)$, then $P(X=0)=$

1. 2 2. $e^{-2}$ 3. $2e^{-2}$ 4. $3e^{-2}$

59. If X is a random poisson variate such that $\alpha=P(X=1)=P(X=2)$, then p(X=4)=

1. $2\alpha$ 2. $\frac{\alpha}{3}$ 3. $\alpha e^{-2}$ 4. $\alpha e^{2}$

60. If X is a poisson variate such that P(X=0)=P(X=1), then P(X=2)=

1. $\frac{e}{2}$ 2. $\frac{e}{6}$ 3. $\frac{1}{6e}$ 4. $\frac{1}{2e}$

61. If a random variable X, follow P.D. such that P(X=1)=P(X=2), then its mean and variance are

1. 1, 1 2. 2,2 3. $2,\sqrt{3}$ 4. 2, 4

62. Suppose on an average 5 out of 2000 houses get damaged due to fire accident during summer. Out of 10,000 houses in a locality, the probability that exactly 10 houses will get damaged during summer is

1. $\frac{e^{-5}5^{10}}{\angle 10}$ 2. $\frac{e^{-10}10^{10}}{\angle 10}$ 3. $\frac{e^{-25}25^{10}}{\angle 10}$ 3. $\frac{e^{-15}15^{10}}{\angle 10}$

## KEY

| | | | | |
|---|---|---|---|---|
| 1. 4 | 2. 4 | 3. 1 | 4. 2 | 5. 2 |
| 6. 1 | 7. 2 | 8. 3 | 9. 2 | 10. 3 |
| 11. 3 | 12. 3 | 13. 2 | 14. 3 | 15. 3 |
| 16. 2 | 17. 3 | 18. 2 | 19. 3 | 20. 3 |
| 21. 2 | 22. 3 | 23. 3 | 24. 3 | 25. 2 |
| 26. 1 | 27. 3 | 28. 1 | 29. 3 | 30. 2 |
| 31. 3 | 32. 3 | 33. 2 | 34. 1 | 35. 2 |
| 36. 1 | 37. 2 | 38. 2 | 39. 3 | 40. 1 |
| 41. 2 | 42. 3 | 43. 2 | 44. 3 | 45. 3 |
| 46. 3 | 47. 3 | 48. 3 | 49. 2 | 50. 1 |
| 51. 2 | 52. 2 | 53. 3 | 54. 2 | 55. 1 |
| 56. 2 | 57. 2 | 58. 2 | 59. 2 | 60. 4 |
| 61. 2 | 62. 3 | | | |

## HINTS

6. $\lambda = 3.5, \text{mod}\,e = ?$ $\lambda = 3 + 0.5; \lambda = k + f$

$\therefore$ mode = 3

13. $P(X=1) = 2P(X=2) \Rightarrow \lambda = 1$

16. $P(X=1) = P(X=2) \Rightarrow parameter\ \lambda = 2$

$P(X=0) = e^{-2}$

22. $P(X=3) = \frac{2}{3}P(X=4)$

$\lambda = \frac{4}{\frac{2}{3}} = 6$

28. $P(X=0) = 0.1,$

$P(X=2) = 0.2 \Rightarrow P(X=2) = 2P(X=0)$

$\frac{\lambda^2 e^{-\lambda}}{2!} = \frac{2\lambda^0 e^{-\lambda}}{0!} = \lambda^2 = 4 \Rightarrow \lambda = 2$

44. 200 pages, 220 misprints, average number of misprints per page = $\frac{220}{200} = 1.1$

$P(X=0) = e^{-1.1}$

62. $\lambda = 25, P(X=10) = \frac{25^{10}.e^{-25}}{10!}$

## LEVEL-2

1. Cycle tyres are supplied in lots of 10 and there is a chance of 1 in 500 to be defective. Using poisson distribution, the approximate number of lots containing no defectives in a consignment of 10,000 lots if $e^{-0.02} = 0.9802$ is

1. 9980 2. 9998 3. 9802 4. 9982

2. There are 500 boxes each containing 1000 ballot papers for election. The chance that a ballot paper is defective is 0.002. Assuming that the number of defective ballot papers follow P.D., the number of boxes containing atleast one defective ballot paper given that $e^{-2} = 0.1353$ is

1. 216 2. 432 3. 648 4. 234

3. A manufacturer who produces medicine bottles finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Using poisson distribution, the number of boxes with no defective bottle is

1. $100 \times e^{-0.1}$ 2. $100 \times e^{-0.5}$

3. $100 \times e^{-0.05}$ 4. $100 \times e^{-0.01}$

4. A manufacturer who produces medicine bottles finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the producer of bottles. Using poisson distribution, the number of boxes with at least one defective bottle is

1. $100\left(1 - e^{-0.1}\right)$ 2. $100\left(1 - e^{-0.5}\right)$

3. $100\left(1 - e^{-0.05}\right)$ 4. $100\left(1 - e^{-0.01}\right)$

5. The number of accidents in an year attributed to a taxi driver in a city follows poisson distribution with mean 3. Out of 1000 taxi drivers, the approximate number of drivers with no accident in an year given that $e^{-3} = 0.0498$ is

1. 4.98 2. 49.8 3. 498 4. 4.8

6. The chance of a traffic accident in a day attributed to a taxi driver is 0.001. Out of a total of 1000 days the number of days with no accident is

1. $1000 \times e^{-1}$ 2. $1000 \times e^{-01}$

3. $1000 \times e^{-0.001}$ 4. $1000 \times e^{-0.0001}$

7. A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, the approximate probability that a box will fail to meet the guaranteed quality is

1. $\frac{e^{-5}5^{10}}{\angle 10}$ 2. $1 - \sum_{x=0}^{10} \frac{e^{-5}5^x}{\angle x}$

3. $1 - \sum_{x=10}^{\infty} \frac{e^{-5}5^x}{\angle x}$ 4. $\sum_{x=10}^{\infty} \frac{e^{-5}5^x}{\angle x}$

8. The probability that atmost 5 defective fuses will be found in a box of 200 fuses if experience shows that 2% of such fuses are defective is

1. $\frac{e^{-4}4^5}{\angle 5}$ 2. $\sum_{x=0}^{5} \frac{e^{-4}4^x}{\angle x}$

3. $\sum_{x=6}^{\infty} \frac{e^{-4}4^x}{\angle x}$ 4. $1 - \sum_{x=6}^{\infty} \frac{e^{-4}4^x}{\angle x}$

9. Six unbiased coins are tossed 6400 times. Using

P.D. The approximate probability of getting six heads 2 times is

1. $\frac{e^{-64}64^2}{\angle 2}$ 2. $\frac{e^{-100}100^2}{\angle 2}$

3. $1-\frac{e^{-100}100^x}{\angle x}$ 4. $\frac{e^{-100}100^x}{\angle x}$

10. Assume that the number of cars passing through a particular junction obeys P.D. If the probability of no cards in 1 minute is 0.20. The probability of at least one car in two minutes is

1. $e^{-\log_e 5}$ 2. $1-e^{-2\log_e 5}$

3. $\log_5 e$ 4. $\log_e 5$

11. Patients arrive randomly and independently at a Doctor's room from 8 AM at an average rate of one in 5 minutes. The waiting room can accommodate 12 persons. The probability that the room will be full when the doctor arrives at 9 AM is

1. $\frac{e^{-12}12^{12}}{\angle 12}$ 2. $\sum_{x=0}^{11}\frac{e^{-12}12^x}{\angle x}$

3. $1-\sum_{x=0}^{11}\frac{e^{-12}12^x}{\angle x}$ 4. $1-\sum_{x=0}^{\infty}\frac{e^{-12}12^x}{\angle x}$

12. A distributor of bean seeds determines from extensive tests that 5% of seeds will not germinate. He sells the seeds in packets of 200 and guarantees 90% germination. The probability that a particular packet will violate the guarantee is

1. $\frac{e^{-10}10^{10}}{\angle 10}$ 2. $\frac{e^{-10}10^{20}}{\angle 20}$

3. $1-\sum_{x=0}^{20}\frac{e^{-10}10^x}{\angle x}$ 4. $1-\sum_{x=0}^{\infty}\frac{e^{-10}10^x}{\angle x}$

13. On the average a submarine on patrol sights 6 enemy ships per hour. Assuming the number of ships sighted in a given length of time is a poisson variate, the probability of sighting 6 ships in the next half an hour is

1. $\frac{e^{-6}6^6}{\angle 6}$ 2. $\frac{e^{-3}3^3}{\angle 3}$ 3. $\frac{e^{-3}3^6}{\angle 6}$ 4. $\frac{e^{-6}3^3}{\angle 6}$

14. On the average a submarine on patrol sights 6 enemy ships per hour. Assuming the number of ships sighted in a given length of time is a poisson variate, the probability of sighting 4 ships in the next two hours is

1. $\frac{e^{-12}12^4}{\angle 4}$ 2. $\frac{e^{-4}4^{12}}{\angle 3}$ 3. $\frac{e^{-6}6^4}{\angle 4}$ 4. $\frac{e^{-3}6^2}{\angle 4}$

15. On the average a submarine on patrol sights 6 enemy ships per hour. Assuming the number of ships sighted in a given length of time is a poisson variate, the probability of sighting atleast one ship in the next 15 minutes is

1. $e^{-1.5}$ 2. $1-e^{-6}$ 3. $1-e^{-1.5}$ 4. $e^{-6}$

16. On the average a submarine on patrol sights 6 enemy ships per hour. Assuming the number of ships sighted in a given length of time is a poisson variate, the probability of sighting atleast two ships in the next 20 minutes is

1. $1-e^{-2}$ 2. $1-2.e^{-2}$ 3. $1-3.e^{-2}$ 4. $1-4.e^{-2}$

17. If m is the variance of P.D., then sum of the terms in odd places is

1. $e^{-m}$ 2. $e^{-m}\cosh m$

3. $e^{-m}\sinh m$ 4. $e^{-m}\coth m$

18. If m is the variance of P.D., then sum of the terms in even places is

1. $e^{-m}$ 2. $e^{-m}\cosh m$

3. $e^{-m}\sinh m$ 4. $e^{-m}\coth m$

19. If m is the variance of P.D., then the ratio of sum of the terms in odd places to the sum of the terms in even places is

1. $e^{-m}\cosh m$ 2. $e^{-m}\sinh m$

3. $\coth m$ 4. $\tanh m$

20. If m is the variance of P.D., then the ratio of sum of the terms in even places to the sum of the terms in odd places is

1. $e^{-m}\cosh m$ 2. $e^{-m}\sinh m$

3. $\coth m$ 4. $\tanh m$

21. In a poisson distribution, the probability of 0 success is 10%. The mean of the distribution is equal to

1. $\log_{10} e$ 2. $\log_e 10$ 3. 0 4. $\frac{1}{10}$

## KEY

| | | | | |
|---|---|---|---|---|
| 1. 3 | 2. 2 | 3. 2 | 4. 2 | 5. 2 |
| 6. 3 | 7. 2 | 8. 2 | 9. 2 | 10. 2 |
| 11. 3 | 12. 3 | 13. 3 | 14. 1 | 15. 3 |
| 16. 3 | 17. 2 | 18. 3 | 19. 3 | 20. 4 |
| 21. 2 | | | | |

## HINTS

3. $p=\frac{0.1}{100}, n=500 \Rightarrow \lambda=500\times\frac{1}{1000}=\frac{1}{2}, N=100$

$N.P(X=0)=100\left(e^{-0.5}\right)$

4. $N.P(X\ge 1)=100\left(1-e^{-0.5}\right)$

5. $\lambda=3, N=1000$

$P(X=0)=e^{-3}=0.0498$

$NP(X=0)=1000\times 0.0498=49.8\approx=50$

8. $\lambda=200\times\frac{2}{100}=4;\ \ P(X\le 5)=\sum_{x=0}^{5}\frac{4^x e^{-4}}{\angle x}$

11. $\lambda=12$ patients/hr, the room will be full, if number of patients $\ge 12$

$P(X\ge 12)=\sum_{x=0}^{11}\frac{12^x e^{-12}}{\angle x}=1-\sum_{x=0}^{x=11}\frac{12^x e^{-12}}{x!}$

12. $p = \frac{5}{100}, \lambda = 200 \times \frac{5}{100} = 10$

n = 200, x > 20

Germination = 90%

Non germination = 10%

21. If $\lambda$ is a parameter, $e^{-\lambda} = 10^{-1} \Rightarrow \lambda = \log_e 10$

## LEVEL - 4

1. In a binomial n = 200, p = 0.04. Taking Poisson distribution as an approximation to the binomial distribution,
Assertion (A) :- Mean of the Poisson distribution = 8
Reason (R) : In a Poisson distribution,
$P(X = 4) = \frac{512}{3e^8}$
1. both A and R are true and R is the correct explanation of A
2. both A and R are true and R is not correct explanation of A
3. A is true but R is false
4. A is false but R is true

## KEY

1.2

## LEVEL - 5
## COMPREHENSIVE QUESTIONS

I. A car hire firm has 3 cars which it hires out day by day. if the number of demands for a car on each day follows a poisson distribution with parameter '2'. From the given data

1. The probability that neither car is
1) $e^{-2}$ 2) $2e^{-2}$ 3) $3e^{-2}$ 4) $4e^{-2}$

2. The probability that only one car is used is
1) $\frac{2}{3e^2}$ 2) $\frac{3}{e^2}$ 3) $\frac{2}{e^2}$ 4) $\frac{3}{2e^2}$

3. The probability that all the cars are used is
1) $\sum_{k=0}^{2} \frac{e^{-2}.2^k}{k!}$ 2) $\sum_{k=0}^{3} \frac{e^{-2}.2^k}{k!}$
3) $1 - \sum_{k=0}^{2} \frac{e^{-2}.2^k}{k!}$ 4) $1 - \sum_{k=0}^{3} \frac{e^{-2}.2^k}{k!}$

4. The probability that same demand is refused is
1) $1 - \frac{23}{3e^2}$ 2) $1 - \frac{22}{3e^2}$ 3) $1 - \frac{20}{3e^2}$ 4) $1 - \frac{19}{3e^2}$

## KEY

1. 1 2. 3 3. 3 4. 4

## PREVIOUS EAMCET QUESTIONS
### 2004

1. If X is a poisson variate with $P(X = 0) = 0.8$, then the variance of X is
1. $\log_e 20$ 2. $\log_{10} 20$
3. $\log_e (5/4)$ 4. 0

### 2003

2. For a Poisson variate X if $P(X = 2) = 3P(X = 3)$, then the mean of X is
1. 1 2. 1/2 3. 1/3 4. 1/4

### 2002

3. If the mean of poisson distributiion is $\frac{1}{2}$, then the ratio of P(X=3) to P(X=2) is
1. 1:2 2. 1:4 3. 1:6 4. 1:8

### 2001

4. For a poisson variate X, if P(X=0)=0.2, then its variance is
1. $\log_e 5$ 2. $\log_e 4$ 3. $\log_e 2$ 4. $0.2$

### 2000

5. If X is a poisson variate with P(X=0)=P(X=1), then P(X=2) is
1. $\frac{e}{2}$ 2. $\frac{e}{6}$ 3. $\frac{1}{6e}$ 4. $\frac{1}{2e}$

### 1999

6. In a poisson distribution P(X=0)=P(X=1)=k, then the value of k is
1. 1. 2. $\frac{1}{e}$ 3. e 4. $\sqrt{2}$

### 1997

7. The incidence of an occupational disease to the workers of a factory is found to be $\frac{1}{5000}$. If there are 10000 workers in a factory then the probability that none of them will get the desease is
1. $e^{-1}$ 2. $e^{-2}$ 3. $e^{3}$ 4. $e^{4}$

### 1996

8. If in a poisson distribution P(X=1)=P(X=2); the mean of the distribution $f(x) = e^{-x} \frac{\lambda^x}{\angle x}$ is
1. 1 2. 2 3. $\frac{1}{2}$ 4. $\frac{3}{2}$

### 1996 (RE-EXAMINATION)

9. If the mean is $\lambda$ and the variance is $\sigma^2$ in a poisson distribution, then
1. $\lambda = \frac{1}{2}\sigma^2$ 2. $\sigma^2 = \frac{1}{2}\lambda$ 3. $\lambda = \sigma^2$ 4. $\sigma^2 = \lambda^2$

## 1995

10. In a poisson distribution the variance is m. The sum of the terms in odd places in the distribution is

1. $e^{-m}$ 2. $e^{-m}\cosh m$
3. $e^{-m}\sinh m$ 4. $e^{-m}\coth m$

11. If a random variable X has a poisson distribution such that P(X=1)=P(X=2), its mean and variance are

1. 1,1 2. 2, 2 3. $2,\sqrt{3}$ 4. 2,4

## 1994

12. If X is a random poisson variate such that $\alpha = P(X=1) = P(X=2)$, then P(X=4) =

1. $2\alpha$ 2. $\frac{\alpha}{3}$ 3. $\alpha e^{-2}$ 4. $\alpha e^{2}$

## 1993

13. X is a poisson variate and P(X=1)=P(X=2). Then P(X=0) is

1. $\frac{1}{e}$ 2. $\frac{1}{e^2}$ 3. $e^{-4}$ 4. $e^{4}$

## 1990

14. For a poisson distribution X, if p(1)=p(2), then p(0)=

1. $e^{-1}$ 2. $e^{2}$ 3. $e^{-2}$ 4. $e^{4}$

15. If 3% of electric bulbs manufactured by a company are defective the probability that a sample of 100 bulbs has no defective is

1. 0 2. $e^{-3}$ 3. $1-e^{-3}$ 4. $3e^{-3}$

## 1989

16. Cycle tyres are supplied in lots of 10 and there is a chance of 1 in 500 tyres to be defective. Using poisson's distribution the approximate number of lots containing no defective tyres in a consignment of 10,000 lots is

1. 9980 2. 9998 3. 9802 4. 9982

## 1988

17. In a poisson variate X, P(X=0)=0.2, then the variance of the distribution is

1. 5 2. $\log_e \frac{1}{5}$ 3. $\log_e 5$ 4. -5

## 1987

18. In a poisson distribution, the probability P(X=0) is twice the probability P(X=1). The mean of the distribution is

1. $\frac{1}{4}$ 2. $\frac{1}{3}$ 3. $\frac{1}{2}$ 4. $\frac{3}{4}$

## AIEEE - 2005

19. A random variable X has Poisson distribution with mean 2. Then $P(X > 1.5)$ equals

1. $2/e^2$ 2. 0
3. $1-\frac{3}{e^2}$ 4. $\frac{3}{e^2}$

**Eamcet-2007**

20. Four numbers are chosen at random from $\{1,2,3,.........40\}$. The probability that they are not consecutive is **(E-2007)**

1) $\frac{1}{2470}$ 2) $\frac{4}{7969}$ 3) $\frac{2469}{2470}$ 4) $\frac{7965}{7969}$

21. If A and B are mutually exclusive events with $P(B) \neq 1$, then $P(A/\overline{B}) =$ (Here $\overline{B}$ is the complement of the event B) **(E-2007)**

1) $\frac{1}{P(B)}$ 2) $\frac{1}{1-P(B)}$ 3) $\frac{P(A)}{P(B)}$ 4) $\frac{P(A)}{1-P(B)}$

22. A bag contains 6 white and 4 blacks. Two balls are drawn at random. The probability that they are of the same colour is **(E-2007)**

1) $\frac{1}{15}$ 2) $\frac{2}{5}$ 3) $\frac{4}{15}$ 4) $\frac{7}{15}$

23. The mean and standard deviation of a binomial variate X are 4 and $\sqrt{3}$ respectively. Then $P(X \geq 1) =$ **(E-2007)**

1) $1-\left(\frac{1}{4}\right)^{16}$ 2) $1-\left(\frac{3}{4}\right)^{16}$ 3) $1-\left(\frac{2}{3}\right)^{16}$ 4) $1-\left(\frac{1}{3}\right)^{16}$

24. The Probability distribution of a random variable X is given by

| X = x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| P(X = x) | 0.4 | 0.3 | 0.1 | 0.1 | 0.1 |

The variance of X is **(E-2007)**

1) 1. 76 2) 2.45 3) 3.2 4) 4.8

## KEY

| | | | | |
|---|---|---|---|---|
| 1. 3 | 2. 1 | 3. 3 | 4. 1 | 5. 4 |
| 6. 2 | 7. 2 | 8. 2 | 9. 3 | 10. 2 |
| 11. 2 | 12. 2 | 13. 2 | 14. 3 | 15. 2 |
| 16. 3 | 17. 3 | 18. 3 | 19.3 | 20. 3 |
| 21. 4 | 22. 4 | 23. 2 | 24.1 | |