**Exam sample questions**

**Probability and statistics**

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1. In the box there are 10 balls outnumbered from 1-10. Two balls are taken by random. Find the probability of the event that the taken ball is numbered no greater than 10.

2. There are 5 white balls and 10 black balls in the box. 3 balls are taken by random. Find the probability of the event that the taken balls are not white .

3. There are 3 white, 4 black and 5 red balls in the box. Two ball are randomly taken. Find the probability of the event that the taken balls are 1 black and 1 white.

4. There are 3 white, 4 green and 7 red apples in the fruit basket. Find the probability that randomly selected two apples are red.

5. In the shop there work 6 men and 4 women. 2 workers are randomly selected. Find the probability that both selected are men.

6. 16 students out of 30 in the group are master of sports. Find the probability that randomly chosen 3 students are masters of sports.

7.Two fair dice are rolled. Find the probability of the event that the sum of coming numbers are even provided that one of the result is six.

8. 3 shots are made at the target. The probaility of hitting for the first shot is 0.7, for the second one is 0.8 and for the third is 0.9. Find the probability of the event that all three shots hit the target.

9. 10 out of 100 lottery tickets are winning. Two tickets are bought. Find the probability that these two are winning.

10. The student must take three exams. The probability of passing first exam is 0.7, the second 0.9, the third 0.8. Find the probability that the student passes all three.

11. The student knows the answer for 20 questions out of 25. Find the probability that student knows the three questions by professor.

12. Write and prove Bayes’ formula.

13.and  Using Bayes’ formula find .

14. Three shops produce 20%, 30% and 50% of all products respectively. 5%, 4%, 2% of respectively produced products are useless. Find the probability that randomly selected product is useless.

15. Prove the formula of total probability.

16.Letand . Find  using the total probability.

17. Explain the Bernulli problems and write Bernulli formula.

18. In the box where there are 2 balls one white ball is added. After this a ballis randomly selected from the box. Find the probability that the selected ball is white.

19. Two shops produce the same kind of details which total in one place. The productivity of the first shop is twice as much as the productivity of the second one. The first shop produces on average 60% of details of best quality and the second 84%. The randomly selected detail is of the best quality. Find the probability that this detail has been produced by the first shop.

20. Two equal chess players meet. Which is of more probability: winning two parties out of 4 or 3 parties out of 6?

21. Student takes 7 exams in one semester. The probability of student’s passing the exam is 0.8. Find the probability of the event that student passes 4 exams.

22. In UNEC in the first year of Credit faculty there study 1825 students. Find the probability that 4 students were born on the 15th of September.

23. Consider the probability of nonstandart detail produced by the shop is 0.004. Find the probability that 5 details out of 1000 are nonstandarts.

24. In one region in 80 families out of 100 there are refrigerators. Find the probability that in 350 families out of 400 there are refrigerators.

25. The probability of occurance of event A in each trial is 0.25. Find the probability that A occurs 80 times in 243 trials.

26. Write the binomial distribuion and find its mathematical expectation.

27. The binomial distribution of discrete variable X is as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Find the standard deviation

28. Find the standard deviation for

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2 | 3 | 4 |
|  |  |  |  |

29. The distribution of discrete variable X as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2 | 3 | 4 |
|  |  |  |  |

=?

30. The distributions of two independent variables is a follows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 2 |  |  |  |  | 2 |
|  |  |  |  |  |  |  |  |  |

Find .

31. Find the second order centralized moment for exponential (power) distribution.

7. The distribution function of continuous variable X is given as:



Find the probability of X getting the value in the interval  during the trial.

32. The distribution function of continuous variable X is given as:



Find the probability that X gets the value greater or equal to 3

33. The density function of random variable X is as follows:

, 

 . =?

34. Write the regular distribution and find its M(x) and D(x).

35. The density function of random variable X is as follows:

, 

 Find the standard deviation.

36. The density function ,  and ,  Find variance

37. ,  and ,  Find the variance.

38. Explain the meanings of parameters a and  in the density function:



39. Write the  rule for normal distribution.

40. The mathematical expectation of normal distributed random variable X is 2.5 and dispersion is 4. Write the according density function.

41. The mathematical expectation of normal distributed random variable X is 10 and dispersion is 16. Which of the following is the probability that X gets the value in the interval (2, 18)?

a )  ; b)  ; d) ; c) 

42.  Find M(x)+Var(x).

43. Which of the following is the value of in power distribution and prove it.

a)  ; b)  ; d) ; c) 

44. Find the mathematical expectation and variance of 

45. The dispersion of independent random variables  and  are as. Find the standard variance of .

46. The distributions of  and  are as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | 3 |
|  |  |  |  |  |  |  |

=?.

47. Write exponential distribution (power distribution) and find its mathematical expectation.

48. Write three continuous distributions and their mathematical expectations.

49. There are 30 shots at the target. For each shot the probability of hitting the target is . Denoting by X number of hits find variance.

50. Which of the following formulas is used when finding the number with the highest probability in n independent Bernulli trials.

1) ; 2) ;

3)  ; 4) .

a) 3 b) 1 d) 2 c) 4

51. The density function for the two dimesnional independent random variable (X,Y) is as follows:



Write the joint density function of the system.

52. The distribution of X discrete variable is as follows:

|  |  |  |
| --- | --- | --- |
| X | 0,5 | 0,8 |
| P | 0,3 | 0,7 |

0

Using the Chebishev inequality evaluate 

53. Distribution function of 2 dimensional random variables has been given

Find 

|  |  |  |  |
| --- | --- | --- | --- |
| *xi* | 2 | 5 | 7 |
| *ni* | 10 | 15 | 25 |

54. Find the empirical distribution function for

55. From distribution table of 2dimensional random variable, write table of Y component.

|  |  |  |  |
| --- | --- | --- | --- |
| *X/Y* | *3* | *7* | *9* |
| *6* | 0,15 | 0,30 | 0,35 |
| *8* | 0,05 | 0,12 | 0,03 |

56. Set up the histogram for the distribution table:

|  |  |  |
| --- | --- | --- |
| Number of Interval | Interval | Sum of frequencies |
| 1 | 1-5 | 10 |
| 2 | 5-9 | 20 |
| 3 | 9-13 | 50 |
| 4 | 13-17 | 12 |
| 5 | 17-21 | 8 |

57. Set up the histogram for the distribution table:

|  |  |  |
| --- | --- | --- |
| Number of Interval | Interval | Sum of frequencies |
| 1 | 2-7 | 5 |
| 2 | 7-12 | 10 |
| 3 | 12-17 | 25 |
| 4 | 17-22 | 6 |
| 5 | 22-27 | 4 |

58. Sample of  elements is distributed as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *xi* | 3 | 7 | 9 | 12 |
| *ni* | 15 | 10 | 17 | 18 |

Find the unmoved estimator of the general meadnÜmumi ortanın yerini dəyişməyən

59. Sample distribution is given as:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *xi* | 5 | 7 | 7 | 15 |
| *ni* | 8 | 30 | 10 | 2 |

Find

60. Let (X,Y) 2 dimensional random variable with following distribution.

|  |  |  |
| --- | --- | --- |
| *X/Y* | *5* | *9* |
| *4* | *0,15* | *0,05* |
| *10* | *0,3* | *0,12* |
| *18* | *0,35* | *0,3* |

Write conditional distribution for *x* when *y1=4*

|  |  |  |  |
| --- | --- | --- | --- |
| *xi* | 1360 | 1380 | 1400 |
| *ni* | 2 | 5 | 3 |

61. Sample distribution is given:

Find the sample mean with conditional variants.

62. Find the sample mean with conditional variants for the distribution:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *xi* | 2310 | 2300 | 2250 | 2400 | 2800 |
| *ni* | 2 | 3 | 10 | 4 | 1 |

63. For sample with  elements  is the moved estimator for the dispersion. Find the unmoved estimator for dispersion.

64.For the distribution function of*X* find 



65. Which of the following can be the density function for the continuous random variable?

A)  ; B)  ;

C)  ; D) 

66. Given the distribution function  Find D(x).

67. Continous random variable  *x*  is given with this distribution function  on the X-axis. The probability is  for the event that random variable *x*  is greater than x1  in the result of the trial. Find the possible value of x1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 40 | 43 | 44 | 45 | 46 |
|  |  |  | 0,1 | 0,07 | 0,03 |

68. Continuous random variable X is distributed as:

Find the probability of the event X < 44.

69. Random variable *X* is distributed with normal law with parameter *a=35*. If  then find .

70. Distribution of random variable X is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| X | 2 | 3 | 4 |
| P | 0,2 | 0,3 | 0,5 |

Find the seond order central moment.

71. For the random variable (X,Y) with distribution find the conditional distribution when :

|  |  |  |
| --- | --- | --- |
| *X/Y* | 5 | 9 |
| 4 | 0,15 | 0,05 |
| 10 | 0,3 | 0,12 |
| 18 | 0,35 | 0,03 |

72. Find the dispersion of component X for the continuous random variable (X,Y) with density function:



73. Using the Chebishev inequality evaluate the probability  when .

74. Due to distribution table of 2 dimensional random variable. Write table of X component.

|  |  |  |  |
| --- | --- | --- | --- |
| *X/Y* | *x1 =3* | *x2 =7* | *x3=9* |
| *y1 =6* | 0,15 | 0,30 | 0,35 |
| *y2 =8* | 0,05 | 0,12 | 0,03 |

75. The joint density function for random variable (X,Yis as follows:



Find the correlation moment .