**Exam sample questions**

**Probability and statistics**

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1. A doctor’s office staff studied the waiting times for patients who arrive at the office with a request for emergency service. The following data with waiting times in minutes were collected over a one-month period**.**

4 5 17 11 8 9 8 12 21 6 8 7 2 5 10 12 4 13 18 3

Use classes of 0–4, 5–9, and so on in the following:

a. Show the frequency distribution.

b. Show the relative frequency distribution.

c. Show the cumulative frequency distribution

2. According to an annual consumer spending survey, the average monthly Bank of America Visa credit card charge was $1838 (*U.S. Airways Attaché Magazine,* December 2003). A sample of monthly credit card charges provides the following data.

4135 1333 1584 236 1710

316 387 1351 825 7450

991 3396 170 1428 1688

a. Compute the mean and median.

3. A panel of economists provided forecasts of the U.S. economy for the first six months of 2007 (*The Wall Street Journal,* January 2, 2007). The percent changes in the gross domestic product (GDP) forecasted by 30 economists are as follows.

0.4 2.5 2.2 1.9 1.8 1.1 2.0 2.1 2.5 0.5

2.7 2.7 2.7 2.9 3.1 2.8 1.7 2.3 2.8 3.5

2.6 3.1 2.3 2.7 3.4 0.9 2.6 2.8 2.0 2.4

a. What is the minimum forecast for the percent change in the GDP? What is the

maximum?

b. Compute the mean, median, and mode.

c. Compute the first and third quartiles.

4. In San Francisco, 40% of workers take public transportation daily.

a. In a sample of 9 workers, what is the probability that exactly three workers take

public transportation daily?

5. An average of 20 aircraft accidents occur each year

a. Compute the mean number of aircraft accidents per month.

b. Compute the probability of no accidents during a month

c. Compute the probability of exactly one accident during a month.

d. Compute the probability of more than one accident during a month

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. NRF/BIG research provided results of a consumer holiday spending survey (USA Today, December 20, 2005). The following data provide the dollar amount of holiday spending for a sample of 25 consumers.

450 890 260 610  350

1200 850 740 590  340

800 1090 510 520  220

1780 180 850 2050 770

1450 280 1120 200 350

a. What is the lowest holiday spending? The highest?

b. Use a class width of $250 to prepare a frequency distribution and a percent frequency distribution for the data.

 c. Prepare a histogram and comment on the shape of the distribution.

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 .