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Indian Statistical Institute, Bangalore Centre

Documentation Research and Training Centre
M.S. (Library and Information Science)
2nd Semester Final Examination (2022-2024)

Paper 09: Elements of Mathematics and Statistics

Time: 10.00 AM - 1:00 PM

Max. Marks: 80

Date: 15-06-2023

[INSTRUCTION: (i)Read the question before you attempt.

(ii)Section A of 11 marks, Section B of 19 marks, and Section C of 50 marks]

Section A

[1x6 = 6]

- 1) The median for the following frequency distribution is

X	6	7	5	2	10	9	3
F	9	12	8	13	11	14	7

- a) 6 b) 5 c) 4 d) 7

- 2) The unit of correlation coefficient between height in feet and weight in kgs is

- a) kg/feet b) percentage
c) non-existent d)None of the above

- 3) The average income of all employed individuals in a certain community is Rs. 35,500.

A group of citizens suspects this value is incorrect. The alpha critical region, to determine if the average income is not Rs.35,500 would be placed in:

- a) in the upper tail c) in the upper and lower tail
b) in the lower tail d) in the nether tail

- 4) Regression modelling is a statistical tool for building a mathematical equation depicting how

- a) One explanatory and one or above response variables are related
b) There is a link between one response variable and one or many explanatory variables
c) Several explanatory and response variables are related
d) All of the above are correct.

- 5) The variable y is income in 1000's of rupee and x is years of experience. Suppose a relationship between x and y is represented by the function $y = 10 + 18x$. Which statement is correct?
- For each additional year of experience, income is expected to increase by Rs.1800.
 - For every Rs. 18,000 increase in income, experience is expected to rise by one year.
 - For each additional year of experience, income is expected to increase by Rs. 18,000.
 - All the above
- 6) If any regression coefficient's value is one, the two variables are:
- Independent
 - Qualitative
 - Dependent
 - None of the preceding.
- 7) Which measurement scale can measure the following phenomena [5]
- Movie Rating
 - Blood type
 - Number of passengers in a bus
 - Temperature measured on the celsius scale
 - Educational grade

Section B

- 8) The weight of Asian men, X , follows the normal distribution with a mean of 70 kg and a standard deviation of 5 kg. [2+4]
- What is the chance that a randomly selected Asian man weighs at least 76 kg?
 - What is the probability that a randomly selected Asian man weighs between 65 kg and 75 kg?

- 9) A tyre manufacturing company kept a record of the distance covered before a tyre needed to be replaced. The table shows the results of 1000 cases.

Distance [d] (in km)	$d < 2000$	$2000 < d < 7000$	$7000 < d < 12000$	$d > 12000$
Frequency	20	210	325	445

what is the probability that:

- it will need to be replaced before it has covered 2000 km?
 - it will last more than 7000 km?
 - it will need to be replaced after it has covered somewhere between 2000 km and 12000 km?
- [3]

10) Three cards are drawn successively without replacement from a pack of 52 well shuffled cards. What is the probability that the first two cards are queens and the third card drawn is a diamond? [2]

11) Suppose an experiment was performed to compare the reliability of two brands of golf balls (Nike and Callaway). Six golf balls of each brand were struck by a mechanical golf club with exactly the same force. Balls from a perfectly reliable brand would travel the same distance with every strike. Below is the number of feet travelled by the six golf balls from each of the two brands. [2+2+2]

Number of feet travelled by Callaway (in ft)	229	265	220	280	245	250
Number of feet travelled by Nike (in ft)	240	265	215	270	250	249

- Do the numbers above represent a sample or a population? Calculate the mean distance travelled by the two types of balls. Compare the two means you just calculated. What does the comparison imply?
- Calculate the variance and standard deviation of distance travelled by the two types of golf balls. Compare the two standard deviations and indicate which brand is the more reliable golf ball. Defend your answer.
- From the criterion we are using for reliability can you say with 100% certainty that, based on this experiment, one golf ball brand is more reliable than the other

12) A bag contains 7 red and 8 white marbles. Two marbles are drawn from the bag one after the other without replacement. What is the probability that both drawn marbles are red? [2]

Section C

(Attempt any 5 questions from this section)

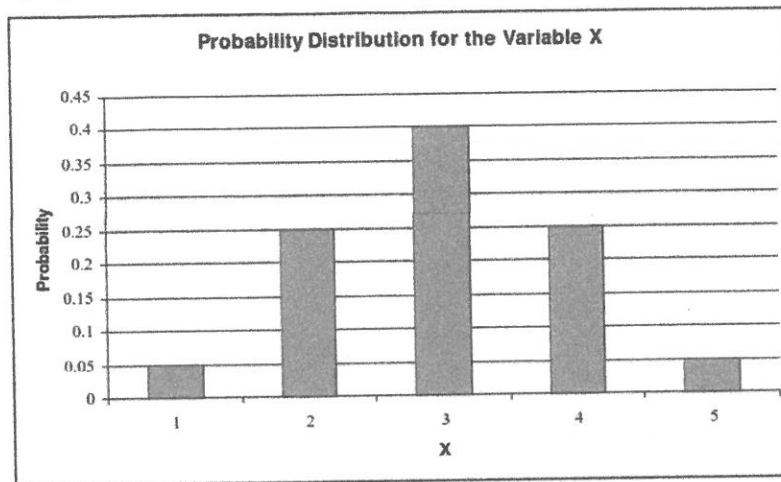
13) Calculate coefficient of correlation between the price and quantity demanded. State the strength of the relationship. [10]

Price (Rs.)	5	10	15	20	25
Demand (kg.)	40	35	30	25	20

14) Consider the experiment of throwing a die, if a multiple of 2 comes up, throw the die again and if any other number comes, toss a coin. Find the conditional probability of the event 'the coin shows a head', given that 'at least one die shows a 2'. [10]

15) Refer the following figure to answer the following questions:

[10]



- Is this a symmetric probability distribution? Explain?
- What is the median value of X?
- What is the mean value of X?
- What is $P(2 \leq X \leq 4)$?
- What is $P(X > 4)$?
- Calculate the variance and standard deviation of X

16) An instructor has a question bank consisting of 300 easy True / False questions, 200 difficult True / False questions, 500 easy multiple choice questions and 400 difficult multiple choice questions. If a question is selected at random from the question bank, what is the probability that it will be a difficult question given that it is a True/ False question?

[10]

17) A clothing manufacturer claims that the average length of their shirts is 28 inches. To test this claim, a random sample of 50 shirts is selected, and the lengths are measured. The sample mean length is found to be 27.5 inches, with a sample standard deviation of 1.2 inches. Test the manufacturer's claim at a 1% level of significance using a two-tailed test. solution (Test the hypothesis at 5% level of significance. The value of t for 49 degrees of freedom is either ± 2.679952 (two tailed) or 2.404892 (one tailed).)

[10]

18) Short answers questions: (attempt any 5)

[5x2=10]

- Level of significance
- Confidence Interval
- Difference between null hypothesis and alternative hypothesis
- Difference between z-test vs t-test
- Regression
- Conditional Probability