Statistics Question Bank

Second Paper

Abdullah Al Mahmud

Updated on: February 13, 2023

www.statmania.info

Contents

Chapter 1

Probability

1.1 Creative Questions

1. **It is observed that in a college, there are 100 students, of whom 30 play football, 40 play cricket, and 20 play both.**

   (a) What is the range of probability? 1

   (b) What is the relationship between independence and mutual excluvity? 2

   (c) Are the probabilities of playing cricket and that of football independent? Prove. 3

   (d) If a student is selected randomly, and if he does not play cricket, what is the probability that he plays football? 4

2. **A box contains four blue and 6 green balls. 3 balls are drawn randomly.**

   (a) What is the value of ^nC_r? 1

   (b) Illustrate the difference between permutation and combination with an example. 2

   (c) What is the probability that all balls are green? 3

   (d) What is the probabilith that one ball has a different color? 4

3. **Sadman has an urn with 5 red and 4 white balls. He has randomly drawn two balls from the urn.**

   (a) What is the probability of an uncertain event? 1

   (b) Write the third axiom of probability. 2

   (c) What is the probability that both the balls drawn by Sadman are white? 3

   (d) Are the probabilities of both balls being same color and different color equal? Analyze. 4

4. **Two dice are thrown together. The dice are named A and B.**

   (a) What is P(A=7)? 1

   (b) Create the sample space. 2

   (c) What is the probability that the outcomes of A & B are different? 3

   (d) Determine the probability that the summation of outcome of two dice is a prime number. 4

5. **A magician draws two cards from a pack (i) with replacement and then (ii) without replacement. The cards were well-shuffled before drawing.**

   (a) What is the probability of an impossible event? 1

   (b) How to determine the probability of a joint event? 2

   (c) As per (i), what is the probability that the cards have different color? 3

   (d) As per (ii), what is the probability that the cardsare aces of same color? 4

6. $P(A) = \frac{3}{10}, P(B) = \frac{2}{5}, P(B \cup A) = \frac{1}{2}$

    (a) What is an independent event? 1
    (b) What is the relationship between independency and mutual excluvity? 2
    (c) Find $P(A|B)$ and $P(B|A)$ 3
    (d) Verify the equality mathematically & empirically: $P(B) = P(A) \cdot P(B|A) + P(\bar{A}) \cdot P(B|\bar{A})$ 4

7. $P(A|B) = \frac{1}{8}, P(A) = \frac{1}{2}, P(B) = \frac{1}{5}$

    (a) Write down the range of probability. 1
    (b) Find $P(A \cap B)$. 2
    (c) Find $P(A|\bar{B})$. 3
    (d) Are the probabilities $P(A|B)$ and $P(B|A)$ equal? Justify 4

8. **Sakib has recently graduated from the University of Dhaka. he applies to two firms - EduCube & Digic- for a Data Analyst job. The probability of hiring by EduCube is 0.8 and by Digic is 0.4. The probability that none hires is 0.5.**

    (a) What is a sample space? 1
    (b) Explain how to find $P(\bar{A} \cap B)$ using Venn Diagram. 2
    (c) Find the probability of hiirng by by Digic but not by EduCube. 3
    (d) Find the probability that no firm will reject him. 4

9. **Recently there is an increase in the number of electronic medias in Bangladesh. A professor stated in the class room that very few people now resort to print media for news. A research indicates 70% people collect news from electronic media, 60% from print media, and 50% from both.**

    (a) What is an impossible event? 1
    (b) Write the event "None of the two occurs" in two different notations. 2
    (c) What is the probability of getting news from at most one type of media? 3
    (d) Is the professor correct in his/her statement? Analyze. 4

10. **A coin is tossed five times. The number of heads appearing from the tosses is considered a discrete random random variable.**

    (a) What is a discrete random variable? 1
    (b) Are probability distributions and frequency distributions similar? Show with an example. 2
    (c) Find the probability distribution from the stem and show in a table. 3
    (d) Find the probability that a head will appear in more than 3 tosses. 4

11. **A red and a blue dice are thrown once. The dice are absolutely neutral and independent.**

    (a) What is a simple event? 1
    (b) Give an example of a certain event using set theory. 2
    (c) Find the probability that the difference of two digits from two dices is less than 3. 3
    (d) Are the probabilities of getting greater digit from the blue die and that from the red die equal? Justify. 4

1.2 Short Questions

1. Question 1

2. Question 2

3. Question 3

4. Question 4

Chapter 2

Random Variable and Probability Function

2.1 Creative Questions

1. **The joint probability function of two random variables X and Y is given below:**

   $$P(X, Y) = \frac{x + 2y}{16}; x = 0, 1; y = 0, 1, 2, 3$$

   (a) Write down the formula of conditional proibability.   1
   (b) What is the relationship between marginal and joint probability?   2
   (c) Find P(X).   3
   (d) Find $P(X|Y)$ and $P(X|0)$.   4

2. **The probability density function of a continuous random variable is**

   $$f(x) = \begin{cases} k(x+1), & 0 \leq x \leq 1 \\ 0, & otherwise \end{cases}$$

   (a) What is a random variable?   1
   (b) Find the value of k   2
   (c) Find the probability that the values of x would lie between 0 and 0.5.   3
   (d) What is the probability that X is greater than 0.8?   4

3. **The probability distribution of a discrete random variable X is given below:**

x	-2	-1	0	1	3	4
P(x)	0.1	k	2k	3k	4k	0.2

   (a) What is $\Sigma P(x)$?   1
   (b) Find the value of k.   2
   (c) Find $P(X \geq 0) \& P(X < 1)$ 3
   (d) Find the cumulative distribution function, F(X) and F(2) and explain.   4

4. **The joint probability function of two random variables X & Y is given below:**

   $P(x, y) = \frac{1}{21}(x + y); x = 1, 2, 3 \ \& \ y = 1, 2$

   (a) What is a probability density function (pdf)?   1
   (b) What is P(X=a) in a pdf, where a is an aribitrary number?   2

(c) Find the marginal probabilities. 3

(d) Find $P(x|y), P(x|1)$ and $P(y|4)$ 4

5. **The probability density function of a continuous random variable is**

$$f(x) = \begin{cases} kx^2 + kx + \frac{1}{8}, & 0 \leq x \leq 2 \\ 0, & otherwise \end{cases}$$

(a) What is a continuous random variable? 1

(b) Find the value of k 2

(c) Find the probability that the values of x would lie between1 and 3. 3

(d) Find the 40th percentile of the distribution and explain. 4

6. **A professor showed a probability distribution in a class:**

x	1	2	3	4	5
p(x)	0.1	a	0.3	b	0.2

The value of the arithmetic mean of the distribution is 3.

(a) What is the formula of expectation? 1

(b) What is the variance of a constant? Explain logically. 2

(c) What are the values of a & b? 3

(d) Find and explain the variance of the distribution. 4

2.2 Short Questions

1. What is a continuous random variable? 1

2. Question 1

3. Question 1

4. Question 1

Chapter 3

Mathematical Expectation

3.1 Creative Questions

1. **X is a random variable having the below functional form:**
   $P(X) = \frac{6-|7-x|}{k}; x = 1, 2, \cdots, 10$
   Y is another variable having the relationship y = 3x+5

   (a) What is joint probability?   1
   (b) What is the minimum possible value of variance? Why?   2
   (c) Find the value of k.   3
   (d) Find E(X) and E(Y). Why are they different?   4

2. **Various sales and their probabilities of a grocery store is given below**

Sales	200	250	275	310	350
Probability	0.10	0.20	0.40	0.25	0.05

   (a) Can the expectation of a random variable be negative?   1
   (b) Find the expected sales of the store on a given day.   2
   (c) Compute the dispersion of sales f the store.   3
   (d) To make the expected sale 280, what sale does the store need in place of 200?   4

3. **A survey of Television (TV) users at Gulshan in Dhaka was conducted to find how many sets each family use. The following data were obtained:**

No of TV set	0	1	2	3
No of family	10	75	10	5

   (a) What is Expectation equivalent to?   1
   (b) Can Variance be negative? Why or why not?   2
   (c) Find the variance of the number of TV sets.   3
   (d) Find and compoare between arithmetic mean and expectation.   4

3.2 Short Questions

Chapter 4

Binomial Distribution

4.1 Creative Questions

1. **A farmer plans to store rice seeds for future use. It was found that 8 out of 20 seeds are rotten. He then collected a sample of 15 seeds.**

   (a) What is Bernoulli trial?   1

   (b) How are Bernoulli and Binomial distributions related?   2

   (c) What is the probability that at least one seed is rotten out of 15?   3

   (d) What is the probability that the number of rotten seeds is greater than the arithmetic mean?   4

4.2 Short Questions

Chapter 5

Poisson Distribution

5.1   Creative Questions

1. **In winter, the probability that it rains on a particular day is 0.015. An analyst observes 100 winter days.**

   (a) What is an experiment?   1
   (b) When can the Poisson distribution be approximated by the Binomial distribution?   2
   (c) Find, using Binomial distribution, the probability that it would not rain at all on the
       observed days.   3
   (d) Find the probability in 3(c) using Poisson distribution.   4

2. **BTCL receives 2.5 telephone calls on average from 4 pm to 6 pm. The number of calls received is a random variable.**

   (a) When is Poisson variate applicable?   1
   (b) Show conversion criteria and method from Binomial to Poisson distribution.   2
   (c) Find the probability of receiving no more than 3 calls.   3
   (d) Find the pattern of calls and show on graph paper.   4
       Hint: Find probabilities: P(0), P(1), $\cdots$

5.2   Short Questions

Chapter 6

Normal Distribution

Chapter 7

Index Number

Chapter 8

Sampling

8.1 Creative Questions

8.2 Short Questions

Chapter 9

Vital Statistics

9.1 Creative Questions

1. **For projection of population in a future time period, demographers use simple, geometric or exponential growth technique. Each method has its advantages and disadvantages.**

   (a) What is geometric growth? 1

   (b) In geometric growth method, obtain the formula for time required for the population to get doubled [denote rate as r]. 2

   (c) In exponential method, how much unit of time is required for the population to get tripled? 3

   (d) For projecting (predicting future values), is geometric growth method better than the exponential method? Justify. 4

2. **Population of Dhaka and Sylhet by different age groups and areas are given below:**

Division	Age			Area (km^2)
	0-14	15-64	65+	
Dhaka	10,000,00	5,00,000	5,80,000	1,880
Sylhet	7,00,000	2,70,000	4,70,000	2,319

   (a) Write down the formula of dependency ratio. 1

   (b) What is meant by NRR = 0.983? 2

   (c) Find and compare between the dependency ratios of the cities. 3

   (d) Based on data, which city is more comfortable for living? 4

9.2 Short Questions

Conclusion

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Donec odio elit, dictum in, hendrerit sit amet, egestas sed, leo. Praesent feugiat sapien aliquet odio. Integer vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus, consectetuer at, consectetuer sed, eleifend ac, lectus. Nulla facilisi. Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia sit amet, placerat et, mollis vitae, dui. Sed ante tellus, tristique ut, iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing quis, ultrices a, dui.

Contents