Statistics Question Bank

Second Paper

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Updated on: December 4, 2022

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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. **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

3. **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

4. **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

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

   (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

6. **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

7. **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

8. **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

9. **Two dices– one red and one blue– are flung together. The dice are absolutely neutral and independent.**

   (a) What is a simple event? 1

   (b) Question 2

   (c) Question 3

   (d) Question 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 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

2. **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

3. **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

4. **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. **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

6.1 Creative Questions

6.2 Short Questions

Chapter 7

Index Number

7.1 Creative Questions

7.2 Short Questions

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

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