

Problem Section 3

Mon Oct 16, 2023

Learning Outcomes

The problems are designed to build conceptual understanding and problem-solving skills. The emphasis is on learning to find, evaluate and build confidence. The specific tasks include:

- Identifying the range of discrete and continuous random variables
 - Deriving the PMF and CDF of a discrete random variable
 - Recognizing properties of CDFs
 - Back up and support work with relevant explanations
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Exercises

1. For each situation, give the range of the random variable X . Then state whether the random variable is discrete or continuous.
 - a. Three fair coins are tossed independently until they show the same side. X is the number of tosses needed.
 - b. Using modern aptitude testing and screening procedures, Rote Industries has greatly reduced its employee turnover. Recent records show that 90% of the company's new assembly line workers stay with the company for at least a year. X is the number of employees among 12 recently hired that will still be with the company in another year.
 - c. In a busy 24 hour copy center, minor malfunctions of the copy machine occur randomly. X denotes the time (in hours) until the first minor malfunction occurs.
2. Suppose you toss a fair coin 3 times. The sample space for this experiment is shown below:

$$S = \{HHH, HHT, HTH, HTT, TTT, TTH, THT, THH\}.$$

- a. Write the PMF of X defined as the difference between number of heads and number of tails.
 - b. Give the CDF of X .
 - c. Draw the probability histogram of X in R.
3. Which of the following is a valid CDF? (choose one; also point out what's wrong with the ones you didn't choose)
 - a.

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{4} & 0 \leq x \leq 3 \\ \frac{3}{4} & 3 < x < 5 \\ 1 & 5 \leq x \end{cases}$$

b.

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{4} & 0 \leq x < 3 \\ \frac{3}{4} & 3 \leq x < 5 \\ 1 & 5 \leq x \end{cases}$$

c.

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{3}{4} & 0 \leq x < 3 \\ \frac{1}{4} & 3 \leq x < 5 \\ 1 & 5 \leq x \end{cases}$$

d.

$$F(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{4} & 0 \leq x < 3 \\ \frac{3}{4} & 3 \leq x < 5 \\ \frac{1}{8} & 5 \leq x \end{cases}$$