

Assignment 4: Random variables

Your name here

PSTAT 194TR

Contents

Instructions	1
Exercise 1:	1
Exercise 2:	1
Exercise 3:	2
Exercise 4:	2
Exercise 5:	2

Instructions

This assignment does not require any code to be written. You can complete these theory problems by hand or you may type these up in latex, Rmd as per your choice.

You only need to upload a .PDF of a photo or scan of your handwritten work or typed up work.

Exercise 1:

Let X be a random variable that represents the result of a single die roll

- What is the sample space of X
- What type of random variable is X ?
- What is the probability mass function of X
- What is the expected value of X

Exercise 2:

Consider 3 flips of a single coin and counting the number of heads.

- Define the random variable X for this experiment and it's probability mass function.

- b. What is the probability that you get 2 heads in 3 flips of a single coin? Answer this question using the random variable X and the appropriate probability in mathematical notation using the p.m.f from (a)
- c. If we repeat this random process of 3 coin flips many times, how many number of heads would we expect to see on average? Again use the random variable X and mathematical notation.
- d. Calculate the variance of X , $Var(X)$.

Exercise 3:

Determine the constant c such that $P(x)$ is a valid p.m.f. of a discrete random variable X :

$$P(x) = c(1/3)^x, \quad \text{for } x = 1, 2, 3, \dots$$

Hint: Use the fact that $\sum_{x=1}^{\infty} P(x) = 1$

Exercise 4:

Suppose a discrete random variable X has the following probability distribution:

$$P(X = 0) = P(0) = 2 - \sqrt{e}; P(X = k) = P(k) = \frac{1}{2^k \cdot k!}, \quad k = 1, 2, 3, \dots$$

Show that this is a valid probability mass function. ie Show that $\sum_{x=1}^{\infty} P(x) = 1$

Exercise 5:

Let X be a continuous random variable with density function

$$f(x) = \begin{cases} 3e^{-3x} & \text{if } x > 0 \\ 0 & \text{otherwise} \end{cases}$$

- a. Calculate $E(X)$
- b. Calculate $Var(X)$