3.

Mid Term due Mar 4, 2020 05:29 IST *Completed*

Expectation 1

1/1 point (graded)

Compute $\mathbf{E}(X)$ for the following random variable X:

$$X = \text{ Number of tosses until getting 4 (including the last toss) by tossing a fair 10-sided die.}$$

$\mathbf{E}(X) =$ 10 ✔ **Answer:** 10

Solution:

This is just the mean of a geometric random variable with parameter $1/10$. Hence, $\mathbf{E}(X) = 10$.

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

Expectation 2

0.0/2.0 points (graded)

Compute $\mathbf{E}(X)$ for the following random variable X:

$$X = \text{ Number of tosses until all 10 numbers are seen (including the last toss) by tossing a fair 10-sided die.}$$

To answer this, we will use induction and follow the steps below:

Let $\mathbf{E}(i)$ be the expected number of additional tosses until all 10 numbers are seen (including the last toss) **given i distinct numbers have already been seen**.

1. Find $\mathbf{E}(10)$.

   $\mathbf{E}(10) =$ 10 ✖ **Answer:** 0

2. Write down a relation between $\mathbf{E}(i)$ and $\mathbf{E}(i+1)$. Answer by finding the function $f(i)$ in the formula below.

   For $i = 0, 1, \ldots, 9$:

$$\mathbf{E}(i) = \mathbf{E}(i+1) + f(i)$$

where $f(i) =$ -1

✖ **Answer:** 10/(10-i)

-1

3. Finally, using the results above, find $\mathbf{E}[X]$.

(Enter an answer accurate to at least 1 decimal place.)

$\mathbf{E}[X] =$ 5.5

✖ **Answer:** 29.28968

Solution:

Recall $\mathbf{E}(i)$ is the expected number of additional tosses until all 10 numbers are seen (including the last toss) given i distinct numbers have already been seen.

1. $\mathbf{E}(10) = 0$

2. The induction step is as follows. For $i = 1, \ldots 9$:

$$\begin{aligned} \mathbf{E}(i) &= (\mathbf{E}(i)+1) \times \frac{i}{10} + (\mathbf{E}(i+1)+1) \times \left(1 - \frac{i}{10}\right) \\ \iff \mathbf{E}(i) &= \mathbf{E}(i+1) + \frac{10}{10-i}. \end{aligned}$$

Using $\mathbf{E}(10) = 0$ and the induction step, we have

$$\mathbf{E}(0) = \frac{10}{10} + \frac{10}{9} + \ldots + \frac{10}{2} + \frac{10}{1} + 0 \approx 29.28968.$$

Submit You have used 1 of 3 attempts

Answers are displayed within the problem

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Hi, I'm a little thrown off by the 'Number of Attempts' shown at the bottom of each question. We only have 1 attempt for each question, correct? ...

for STAFF, URGENT — 2
I just wanted to be sure to have **completed** the exam ;If it isn't against the exam rules can you please clearly ensure how many web pages ar...

2.3 Required notation — 2
The question states "Enter an answer accurate to at least 1 decimal place.". Does this mean that the exact fraction will not be accepted and theref...

E[10] — 5
In one post it stated that it is not an expectation in a "mathematical" sense. What does that mean? E[i=10]? We've already had 10 throws? We've a...

2.2