

AI1103 - Assignment 2

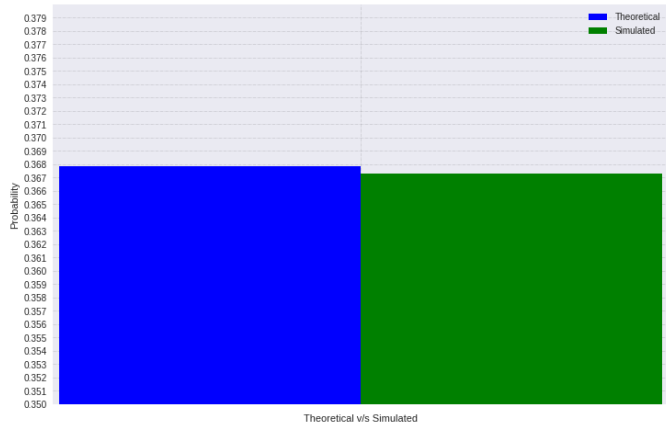
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Download all python codes from

<https://github.com/Anirudh-Srinivasan-CS20/AI1103/tree/main/Assignment-2/Codes>

and latex-tikz codes from

<https://github.com/Anirudh-Srinivasan-CS20/AI1103/blob/main/Assignment-2/Assignment-2.tex>



QUESTION

The lifetime of a component of a certain type is a random variable whose probability density function is exponentially distributed with parameter 2. For a randomly picked component of this type, what is the probability that its lifetime exceeds the expected lifetime (rounded to 2 decimal places) ?

SOLUTION

Given, The lifetime of a component $X \sim \exp(2)$.
The probability density function (PDF) is given by:

$$f_X(x) = \begin{cases} \lambda e^{-\lambda x} & ; 0 < x < \infty \\ 0 & ; -\infty < x \leq 0 \end{cases}$$

where: the parameter $\lambda = 2$

Since, the PDF of the random variable is exponentially distributed,

$$\text{Expected Lifetime} = E(X) = \frac{1}{\lambda} = \frac{1}{2} = 0.5$$

$$\Pr(X > 0.5) = \int_{0.5}^{\infty} 2e^{-2x} dx \quad (0.0.1)$$

$$= -e^{-2x} \Big|_{0.5}^{\infty} \quad (0.0.2)$$

$$= \lim_{x \rightarrow \infty} (-e^{-2x}) - (-e^{-2 \times \frac{1}{2}}) \quad (0.0.3)$$

$$= \frac{1}{e} \quad (0.0.4)$$

$$= 0.36787944117 \quad (0.0.5)$$

Answer: 0.37