AI 1103 - Assignment 5

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Question

A continuous random variable X has a probability density function

$$f(x) = e^{-x}, \text{where}, 0 < x < \infty. \tag{0.0.1}$$

Then $\Pr(X > 1)$ is ?

Solution

x is uniform with

$$0 < x < \infty. \tag{0.0.2}$$

$f(x) = e^{-x}$ is uniform, with $0 < f(x) < 1$. (0.0.3)

Let,

$F_X(x)$ be the cumulative distribution function of X. (0.0.4)

$$\text{As, } 0 < x < \infty, F_X(x) = 0 \text{ for } x < 0 \tag{0.0.5}$$
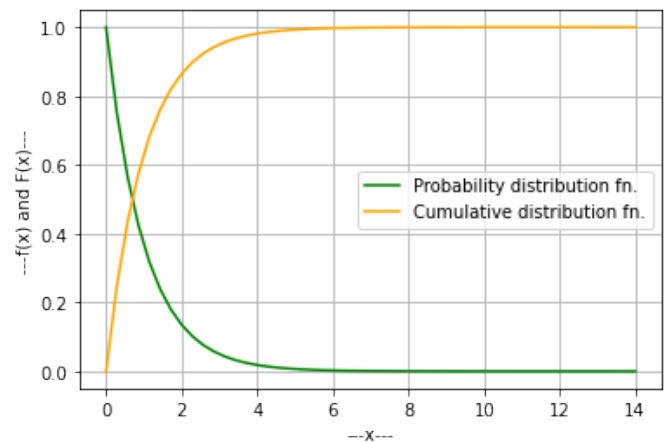
Fig. 0: Plotting probability distribution and cumulative distribution functions.

$$F_X(x) = \Pr(X \le x) = \int_0^x f(x)\,dx = \int_0^x e^{-x}dx \tag{0.0.6}$$

$$= \left[-e^{-x}\right]_0^x = (-e^{-x}) - \left(-e^0\right) = 1 - e^{-x} \tag{0.0.7}$$

$$\Pr(X > 1) = 1 - F_X(1) \tag{0.0.8}$$

$$= 1 - \left(1 - e^{-1}\right) = 0.368 \tag{0.0.9}$$