AI5002: Assignment 12

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1 PROBLEM

A continuous random variable X has a probability density function $f(x) = e^{-x}, 0 < x < \infty$. Then $P(X > 1)$ is

1) 0.368
2) 0.5
3) 0.632
4) 1.0

2 SOLUTION

$$F_X(x) = P(X \le x) \tag{2.0.1}$$

$$= \int_0^x e^{-t} dt \tag{2.0.2}$$

$$= 1 - e^{-x} \tag{2.0.3}$$

Thus, the CDF of X is:

$$F_X(x) = P(X \le x) \tag{2.0.4}$$

$$= \begin{cases} 0, & \text{if } x \le 0 \\ 1 - e^{-x}, & \text{if } 0 < x < 1 \\ 1 & \text{if } x \ge 1 \end{cases} \tag{2.0.5}$$

$$P(X > 1) = 1 - P(X \le 1) \tag{2.0.6}$$

$$= 1 - \{1 - e^{-1}\} \tag{2.0.7}$$

$$= e^{-1} \tag{2.0.8}$$

$$= 0.3678 \tag{2.0.9}$$

$$= 0.368 \tag{2.0.10}$$

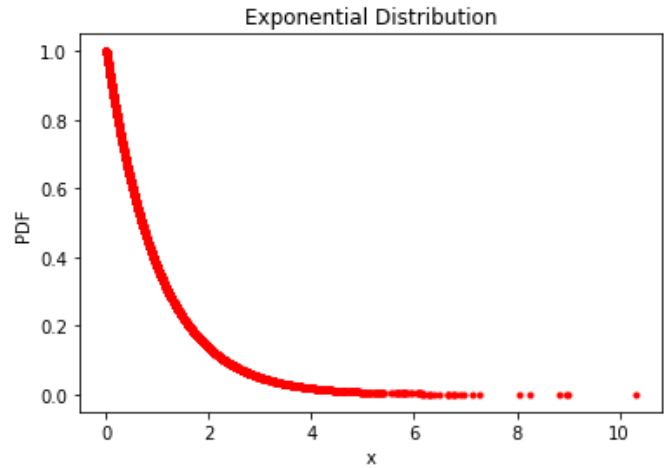Hence, option(1) is the correct answer. The below figure shows the plot of the simulated exponential distribution with mean 1.

Fig. 4: Exponential Distribution Plot