

Assignment-2

Sushma - CS20BTECH11051

Download all python codes from

https://github.com/Sushma-AI1103/AI1103-Assingment-2/blob/main/assingment_2.py

1 PROBLEM

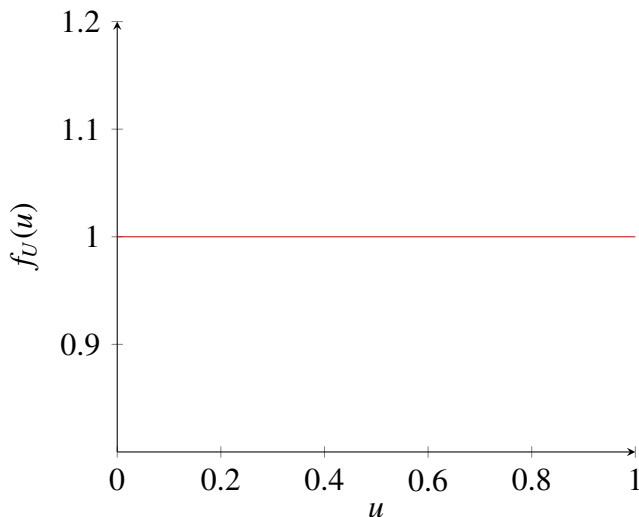
79-Suppose the random variable U has uniform distribution on $[0,1]$ and $X = -2\ln(U)$. Find the density of X .

2 SOLUTIONS:

Given U is uniformly distributed random variable on $\in [0,1]$.

X is also random variable which is function of U

Probability density function of U is:



Random variable X is given by :

$$X = -2\ln(U) \quad (2.0.1)$$

Therefore, $0 \leq X \leq \infty$

Cummulative distribution function of random variable X is defined as

$$F_X(x) = \Pr(X \leq x) \quad (2.0.2)$$

$$= \Pr(-2\ln(U) \leq x) \quad (2.0.3)$$

$$= \Pr(\ln(U) \geq (-x)/2) \quad (2.0.4)$$

$$= \Pr(U \geq \exp(-x/2)) \quad (2.0.5)$$

$$= 1 - \Pr(U \leq \exp(-x/2)) \quad (2.0.6)$$

$$= 1 - \exp(-x/2) \quad (2.0.7)$$

Therefore, CDF of X is $\therefore F_X(x) = 1 - \exp(-x/2)$

PDF of X is the differentiation of CDF $F_X(x)$ with respect to x .

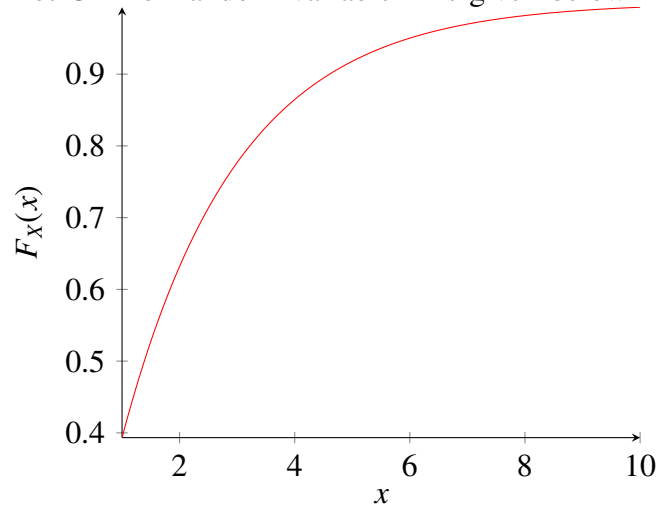
$$f_X(x) = \frac{d(F_X(x))}{dx} \quad (2.0.8)$$

$$= \frac{1}{2} \exp((-x)/2) \quad (2.0.9)$$

Therefore, PDF of X will be

$$f_X(x) = \begin{cases} \frac{1}{2} \exp((-x)/2) & x > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2.0.10)$$

Plot CDF of random Variable X is given below



Probability density function of random variable X is given by-

