

# ASSIGNMENT 3

MANIKANTA VALLEPU - AI20BTECH11014

Download all python codes from

[https://github.com/manik2255/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT\\_3/assign\\_3.py](https://github.com/manik2255/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT_3/assign_3.py)

and latex-tikz codes from

[https://github.com/manik2255/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT\\_3/ASSIGNMENT\\_3.tex](https://github.com/manik2255/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT_3/ASSIGNMENT_3.tex)

using (2.0.1) and (2.0.2) in (2.0.5),

$$= \sum_{y=1}^{\infty} \left(1 - \sum_{i=1}^{2y-1} 2^{-i}\right) (2^{-y}) \quad (2.0.6)$$

$$= \sum_{y=1}^{\infty} (1 - (1 - 2^{-(2y-1)})) (2^{-y}) \quad (2.0.7)$$

$$= \sum_{y=1}^{\infty} 2^{-(3y-1)} \quad (2.0.8)$$

$$= \frac{2}{7} \quad (2.0.9)$$

## 1 GATE 2017 MA PROBLEM.47

Let  $X$  and  $Y$  be independent and identically distributed random variables with probability mass function  $p(n) = 2^{-n}, n = 1, 2, \dots$

Then  $pr(X \geq 2Y)$  equals

## 2 SOLUTION

given,

$$pr(X = x) = 2^{-x}, x = 1, 2, \dots \quad (2.0.1)$$

$$pr(Y = y) = 2^{-y}, y = 1, 2, \dots \quad (2.0.2)$$

We need to find  $pr(X \geq 2Y)$ , which is also can be written as

$$pr(X \geq 2Y) = \sum_{y=1}^{\infty} pr(X \geq 2y | Y = y) \quad (2.0.3)$$

as,  $X$  and  $Y$  are independent random variables

$$\begin{aligned} pr(X \geq 2Y) &= \sum_{y=1}^{\infty} pr(X \geq 2y) pr(Y = y) \quad (2.0.4) \\ &= \sum_{y=1}^{\infty} (1 - pr(X < 2y)) pr(Y = y) \quad (2.0.5) \end{aligned}$$

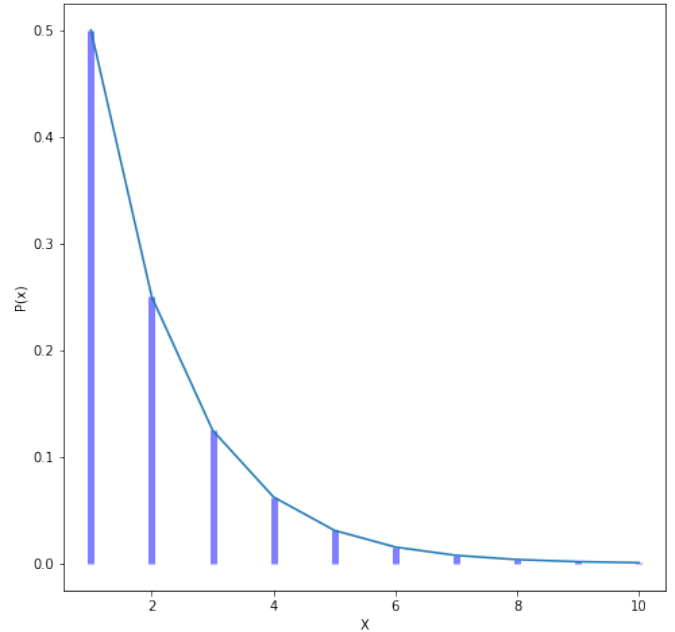


Fig. 0: Pmf of random variable X

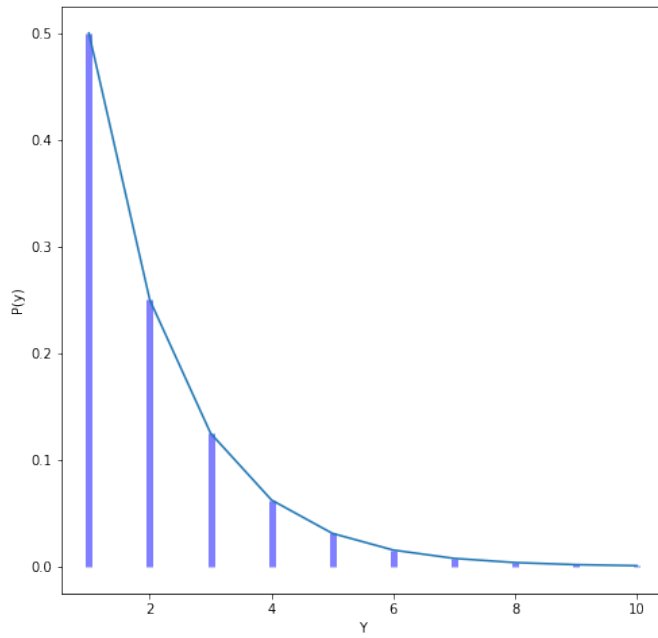


Fig. 0: Pmf of random variable  $Y$