

Assignment 6

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I. CLASS-12-PROBABILITY-EXERCISE-13.4

Question 1: State which of the following are not the probability distributions of a random variable. Give reasons for your answer.

(i) Random variable: X

X	0	1	2
P(X)	0.4	0.4	0.2

(ii) Random variable: X

X	0	1	2	3	4
P(X)	0.1	0.5	0.2	-0.1	0.3

(iii) Random variable: Y

Y	-1	0	1
P(Y)	0.6	0.1	0.2

(iv) Random variable: Z

Z	3	2	1	0	-1
P(Z)	0.3	0.2	0.4	0.1	0.05

Solution: We can verify whether a probability distribution is valid for a given random variable by checking two of its properties. The below are the one to be verified in each case for a random variable X.

Property 1: The value of P(X) should always be positive.

$$p_i > 0, \text{ for } i = \{1, 2, 3, \dots, n\}$$

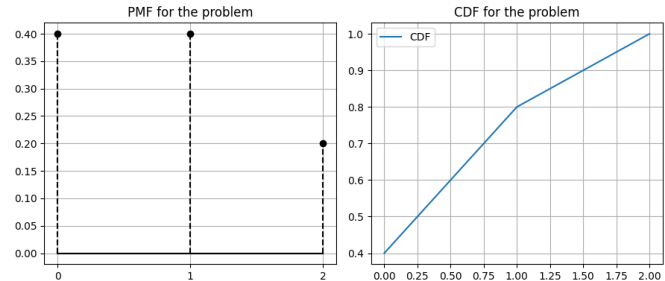
Property 2: The sum of all the values of P(X) should always sum upto one.

$$\sum_{i=1}^n p_i = 1, \text{ for } i = \{1, 2, 3, \dots, n\}$$

(i) For the random variable X, we can observe that all the p_i are positive, and also

$$p_1 + p_2 + p_3 = 0.4 + 0.4 + 0.2 \quad (\text{I.1})$$

$$p_1 + p_2 + p_3 = 1 \quad (\text{I.2})$$

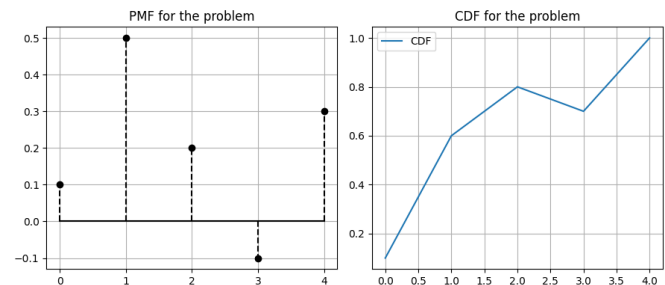


And also from the PMF graph we plotted, it's clear that all values are positive and the CDF also approaches to 1.

\therefore This probability distribution of the random variable X is a valid one.

(ii) For this probability distribution we can observe that the value of p_4 i.e., -0.1 is a negative value, which violates the first property of a probability distribution.

And also from the PMF graph we plotted, it's



clear that the value of the probability at the x-axis point 3 is negative.

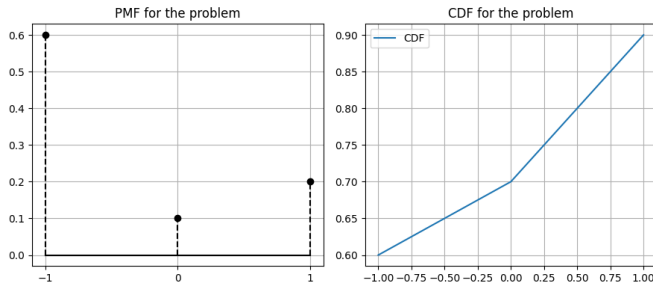
\therefore This probability distribution of the random variable X is **NOT** a valid one.

(iii) For the random variable Y, we can observe that all the p_i are positive, and also

$$p_1 + p_2 + p_3 = 0.6 + 0.1 + 0.2 \quad (\text{I.3})$$

$$p_1 + p_2 + p_3 = 0.9 < 1 \quad (\text{I.4})$$

Though the property 1 is valid here, but the property 2 isn't a valid one. The sum is not coming out to be 1.



And also from the PMF graph we plotted, its clear that all values are positive and the CDF doesn't approach the value 1.

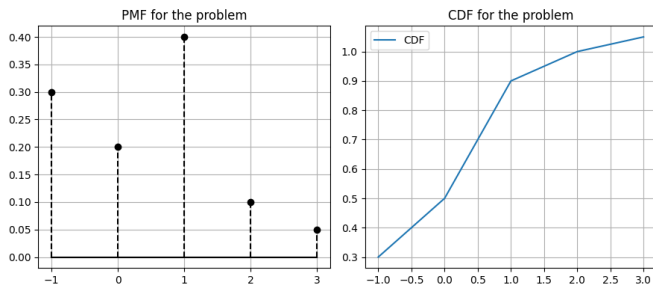
∴ This probability distribution of the random variable Y is **NOT** a valid one.

- (iv) For the random variable Z, we can observe that all the p_i are positive, and also

$$\begin{aligned} p_1 + p_2 + p_3 + p_4 + p_5 &= 0.3 + 0.2 + 0.4 \\ &\quad + 0.1 + 0.05 \end{aligned} \quad (\text{I.5})$$

$$p_1 + p_2 + p_3 + p_4 + p_5 = 1.05 > 1 \quad (\text{I.6})$$

Though the property 1 is valid here, but the



property 2 isn't a valid one. The sum is not coming out to be 1.

And also from the PMF graph we plotted, its clear that all values are positive and the CDF exceeds the value 1.

∴ This probability distribution of the random variable Z is **NOT** a valid one.