

Assignment 1

AI1110: Probability and Random Variables

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

TABLE 1
PART1

1)

X	0	1	2
P(X)	0.4	0.4	0.2

TABLE 2
PART2

2)

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

TABLE 3
PART3

3)

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

TABLE 4
PART4

4)

X	0	1	2	3	4
P(Z)	0.3	0.2	0.4	0.1	0.05

Solution: The probability distribution of a random variable X follows this condition:-

$$\Pr(X = i) > 0, \sum_{i=1}^n \Pr(X = i) = 1, i = 1, 2, 3 \dots n. \quad (1)$$

Hence for all cases the sum of $\Pr(X)$ should be equal to one. The second is that probabilities of all events must be between 0 and 1, both inclusive. i.e.,

$$0 < \Pr(X = i) < 1, i = 1, 2, 3 \dots n. \quad (2)$$

1)

$$\sum_{i=0}^2 \Pr(X = i) = 0.4 + 0.4 + 0.2 = 1 \quad (3)$$

Satisfies both(1) and(2), it is a probability distribution.

2)

$$\sum_{i=0}^4 \Pr(X = i) = 0.1 + 0.5 + 0.2 - 0.1 + 0.3 = 1 \quad (4)$$

Satisfies(1) but does not satisfy(2) as $P(3) < 0$. Hence NOT a probability distribution.

3)

$$\sum_{i=-1}^1 \Pr(X = i) = 0.6 + 0.1 + 0.2 = 0.9 \quad (5)$$

(1) not satisfied, it is NOT a probability distribution.

4)

$$\sum_{i=0}^4 \Pr(X = i) = 0.3 + 0.2 + 0.4 + 0.1 + 0.05 = 1.05 \quad (6)$$

(1) not satisfied, it is NOT a probability distribution.