AI5002 - Assignment 8

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Download code and LaTeX from below hyperlinks
1. Codes/MiscDist_5_15.py
2. LaTeX

***Problem* 5.15**

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

i)

X	0	1	2
P(X)	0.4	0.4	0.2

ii)

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

iii)

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

iv)

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

Solution

Consider an experiment whose sample space is S. For each event E of the sample space S, we assume that a number P(E) is defined and satisfies the following three axioms -
We refer to P(E) as the probability of the event E.

Axiom 1:

$$0 \leq P(E) \leq 1 \tag{0.0.1}$$

It states that the probability that the outcome of the experiment is an outcome in E is some number between 0 and 1.

Axiom 2:

$$P(S) = 1 \tag{0.0.2}$$

It states that, with probability 1, the outcome will be a point in the sample space S.

Axiom 3:

$$P\left(\bigcup_{i=1}^{\infty} E_i\right) = \sum_{i=1}^{\infty} P(E_i) \tag{0.0.3}$$

It states that, for any sequence of mutually exclusive events, the probability of at least one of these events occurring is just the sum of their respective probabilities.

From figure i) we see that, the sum of probabilities is = 0.4 + 0.4 + 0.2 = 1.
Thus X is a valid probability distribution.

From figure ii) we see that, a negative probability -0.1 is given which is impossible.
Thus X is NOT a valid probability distribution.

From figure iii) we see that, the sum of probabilities is = 0.6 + 0.1 + 0.2 = 0.9 $\neq$ 1 .
Thus X is NOT a valid probability distribution.

From figure iv) we see that, the sum of probabilities is = 0.3 + 0.2 + 0.4 + 0.1 + 0.05 = 1.05 $\neq$ 1.
Thus X is NOT a valid probability distribution.