Problem 12.13.4.1

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The question given is from class 12th **NCERT**, and is the 1st question of 4th exercise of 13th chapter. The question is given as below:-
State which of the following are not the probability distributions of a random variable. Give reasons for your answer.

1)
X	0	1	2
P(X)	0.4	0.4	0.2

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

3)
Y	-1	0	1
P(Y)	0.6	0.1	0.2

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

Solution of the problem:- The sum of all the probabilities in a probability distribution must be one. Mathematically: If the probability distribution of a random variable X is the system of numbers and is represented as:-

X	x_1	x_2	.	x_n
P(X)	p_1	p_2	.	p_n

where, $p_i > 0, \sum_{i=1}^{n}(p_i) = 1, i = 1, 2, 3...n$
Hence for all cases the sum of P(X) should be equal to one.

1) $\sum_{i=0}^{2}(p_i) = 0.4 + 0.4 + 0.2 = 1,$
   This means it is a probability distribution.
2) $\sum_{i=0}^{4}(p_i) = 0.1 + 0.5 + 0.2 - 0.1 + 0.3 = 1,$
   This means it is a probability distribution.
3) $\sum_{i=-1}^{1}(p_i) = 0.6 + 0.1 + 0.2 = 0.9,$
   This means it is NOT a probability distribution.
4) $\sum_{i=0}^{4}(p_i) = 0.3 + 0.2 + 0.4 + 0.1 + 0.05 = 1.05,$
   This means it is NOT a probability distribution.

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