Discrete Random variable

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1 Random Variable

A random variable is a quantity "X " resulting from an experiment, by chance, that can assume different values.

A random variable is a variable "X" that has a single numerical value determined by chance, for each outcome of a procedure.

If a sample space S is discrete, then every R.V. defined on S is also discrete, i.e., its range is countable (think of random counts for examples).

2 Discrete Random Variable

A Discrete Random Variable is a variable that can assume only certain clearly separated values.

A Discrete Random Variable has either a finite or countable number of values, where "countable" refers to the fact that there might be infinitely many values, but they can be associated with a counting process.

2.1 Examples of Discrete Random Variables

- The outcome of rolling a single die.
- The number of boys in a family with three children.
- The number of heads that appear when a coin is flipped nine times.
- The sum of the numbers on the dice, when k dice are rolled.
- The number of bits received in error when n bits are received.
- The number of bits received until the r-th error.

3 Discrete Probability Distributions

A discrete probability distribution is a listing of all possible values of a random variable along with their probabilities.

$$\frac{X}{P(X)}\frac{|x_1|}{|p_1|}\frac{|x_2|}{|p_2|}\frac{|x_2|}{|p_2|}\frac{|\dots|}{|\dots|}\frac{|x_k|}{|p_k|}; \quad \sum_{k\geq 1} p_k = 1. \tag{1}$$

1. The sum of all probabilities must be 1in any probability distribution
2. All probability values must be in [0,1]

Example 3.1. x $\Rightarrow$ The number of heads appearing when a coin is flipped three times.

X	0	1	2	3
P(X)	1/8	3/8	3/8	1/8