

Chapter 4	Probability Distributions
Section 2	Random Variables

Random Variables

A random variable is a quantitative variable that can take on any value. The value of the random variable is whatever we observe in the process of an experiment.

A random variable comes in two types:

Discrete – a value that is a whole number, generally anything that is counted.

Continuous – a value that is decimal, generally anything that can be measured.

Identifying Unusual Results (Outliers)

Range Rule of Thumb – If a value is more than two standard deviations from the mean, it is considered an unusual result.

Probabilities – If the probability of an event is extremely small, yet it happens anyway, then the original assumption is wrong.

Examples from the book:

Assumption 1: The Lottery is Fair

The odds of you winning the lottery just once are extremely small, but the odds of someone winning the lottery are pretty good. What are the odds of the same person winning the lottery five times in a row? Extremely small. Yet, if someone did, we would have to re-evaluate our assumption about the lottery being fair.

Assumption 2: Birth of a Boy or a Girl is Equally Likely

There has been a lot of discussion as to conditions that might influence the sex of the baby, but let's not go there.

What are the odds that 13 out of 14 babies are girls? Extremely small. However, if it did happen, we would have to re-evaluate our assumption.

Formulas

$$\mu = \sum [xP(x)]$$

$$\sigma = \sqrt{\sum [x^2P(x)] - \mu^2}$$

Expected Value

An expected value is the value that you expect based on the probability of each of the elements in the sample space. It also works out to be the average value.

From the sample space, create a probability space. Multiply each element by its probability, and then add that column.

Expected value when rolling a die:

x	P(x)	xP(x)
1	$\frac{1}{6}$	$\frac{1}{6}$
2	$\frac{1}{6}$	$\frac{2}{6}$
3	$\frac{1}{6}$	$\frac{3}{6}$
4	$\frac{1}{6}$	$\frac{4}{6}$
5	$\frac{1}{6}$	$\frac{5}{6}$
6	$\frac{1}{6}$	$\frac{6}{6}$
		$\frac{21}{6}$
		3.5