Math 1324
Section 7.3 Part 1
Variance and Standard Deviation

The videos corresponding to this worksheet can be found at
UH students can also view the videos within the Math 1324 textbook.

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Variance and Standard Deviation

Definition of Variance

Expected value (mean) is an important measure that we can use in studying data, but it doesn't tell the whole story. In this lesson, we will look at two other measures of a set of data which give us additional information, the variance and the standard deviation.

We begin by looking at two histograms, both of which have E(X) = 3.
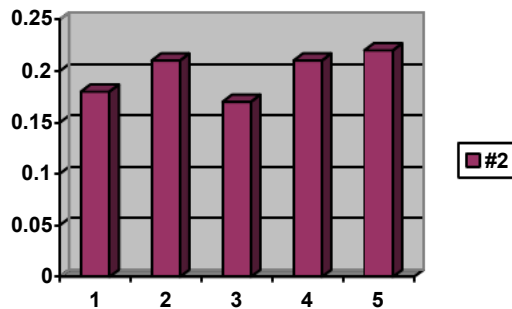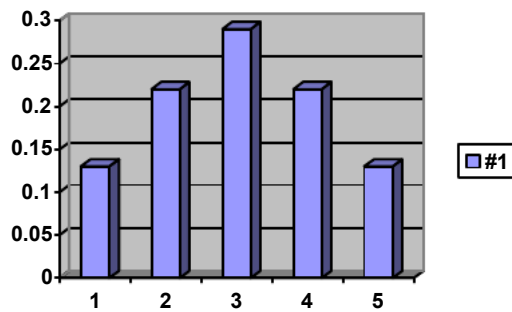
In histogram #1, the data are closely concentrated around the mean. In histogram #2, the data are more widely dispersed.

A measure of the degree of dispersion, or the spread, of a probability distribution, is a number called the variance. A probability distribution with a small spread will have a smaller variance. A probability distribution with a large spread will have a larger variance. So, comparing these two histograms, the first one would have a smaller variance than the second one.

We need a method for systematically computing the variance.

Computing the Variance of a Probability Distribution of a Random Variable:

Suppose X is a random variable with the following probability distribution

x	x_1	x_2	x_3	...	x_n
P(X=x)	p_1	p_2	p_3	...	p_n

and has expected value $E(X) = \mu$.

Then the variance of the random variable is

Var (X) =

Example 1

Example 1: Find the variance of the random variable X with the given probability distribution:

x	2	4	6	8	10
P(X=x)	0.15	0.35	0.25	0.20	0.05

Example 2

Example 2: The birth rates in the US for the years 1991 – 2000 are given in the table.
The birth rate is the number of live births per 1000 population.

Year	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00
Birth Rate	15.3	15.7	15.3	15.9	15.8	15.7	15.9	15.3	16.2	15.8

Suppose the random variable X denotes the annual birth rate.

Find the probability distribution of X.

Find the expected value and variance given this probability distribution.

Definition of Standard Deviation, Examples 3 – 4

Variance is given in terms of the squares of the deviations from the mean. The unit of measure of the variance is the square of the units in the data. We often want to work with a measure given in the same units as the data, so we will frequently want to work with the square root of the variance.   This quantity is called the **standard deviation** of the random variable X.

Notation:

Example 3: Find the standard deviation of the random variable for which the variance is 4.91.

Example 4: Find the standard deviation of the random variable for which the variance is 0.0829.