Statistics 4.1—Probability Distributions

**Objective 1: I can distinguish between discrete random variables and continuous random variables.**

The outcome of a probability experiment is often a \_\_\_\_\_\_\_\_\_\_\_ or a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When this occurs, the outcome is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *x*, represents a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ associated with each \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a probability experiment.

The word \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ indicates that *x* is determined by chance. There are two types of random variables: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ random variable has a \_\_\_\_\_\_\_\_\_\_\_\_\_ or countable number of \_\_\_\_\_\_\_\_\_\_\_\_ that can be listed. Generally the outcomes consist of \_\_\_\_\_\_\_\_\_\_\_ numbers.

Examples:

**\*Discrete variables can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ random variable has an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These outcomes cannot be listed as they represent \_\_\_\_\_\_\_\_\_\_\_\_\_\_ on a number line.

Examples:

**\*Continuous variables can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

\*Read bottom half of pg 194

\*Read Example 1, pg 195

**TIY 1:** Decide whether the random variable *x* is discrete or continuous.

A) *x* represents the number of questions on a test.

B) *x* represents the length of time it takes to complete a test.

C) *x* represents the number of songs played by a band at a concert.

D) *x* represents the time, in minutes, that the band plays.

**\*The rest of this chapter focuses on discrete random variables.**

**Objective 2: I can construct a discrete probability distribution and its graph.**

Each value of a discrete random variable can be assigned a probability. By listing each value of the random variable and its corresponding probability, we form a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Let’s create a probability distribution for rolling a 6-sided die.

There are two properties that will always be true of a discrete probability distributions.

In Words In Symbols

1)

2)

Because probabilities represent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a discrete probability distribution can be graphed with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Steps to constructing a discrete probability distribution**

Let x be a discrete random variable with possible outcomes 

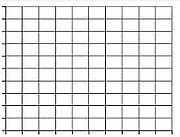
1)

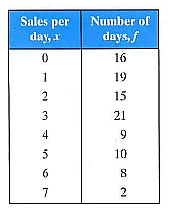
2)

3)

4)

\*Read Example 2, pg 196

TIY 2: A company tracks the number of sales new employees make each day during a 100-day probationary period. The results for one new employee are shown below. Construct and graph a probability distribution.



\*Read Ex 3 & 4, pg 197 to see how to verify that a distribution **IS** a probability distribution.

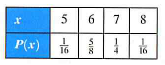
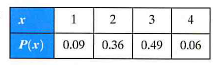
TIY 3 and 4: Are the distributions below probability distributions? Explain why or why not.

A) B)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 | 4 |
| y | 0.38 | 0.12 | 0.25 | 0.07 | 0.15 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 | 4 |
| y | 0.22 | 0.31 | 0.19 | 0.12 | 0.16 |

C) D)

**Objective 3: I can find the mean, variance, and standard deviation of a discrete probability distribution.**

You can measure the center of a probability distribution with its \_\_\_\_\_\_ and measure the variability with its \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (SD).

The formulas to find the mean, variance, and SD are below.

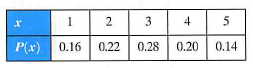
The \_\_\_\_\_\_\_\_\_ of a discrete random variable is given by

\*Basically, each value of \_\_\_\_ is multiplied to its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the products are \_\_\_\_\_\_\_\_.

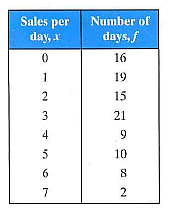
The \_\_\_\_\_\_\_\_\_\_\_\_ of a discrete random variable is given by

The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a discrete random variable is given by

Ex 6: Let’s find the mean, variance, and SD of the probability distribution that showed the test scores for passive-aggressive traits.



TIY 6: Find the mean, variance, and SD of the probability distribution in Ex 2 (below).



**Objective 4: I can find the expected value of a discrete probability experiment.**

The mean of a random variable represents what you would expect to happen for thousands of trials. It is also called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The expected value of a discrete random variable is equal to the \_\_\_\_\_\_\_\_\_\_ of the random variable.

Expected Value =

Ex 7: At a raffle, 1500 tickets are sold for $2 each for four prizes of $500, $250, $150, and $75. You buy one ticket. What is the expected value of your gain?

\*Although individual probabilities cannot be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, expected value can (and usually is).

Ex 8: EFHS is holding a raffle to raise money for the senior party. Tickets are $5 each and only 500 tickets will be sold. The prizes are $500, $250, and five people will win $75. You buy one ticket. Find the expected value of your gain.