Math 247: Probability Distributions (Section 6.1)

Random Variable (R.V.) A random variable is a **numerical** outcome of a probability experiment. It is usually denoted with the uppercase letter, X.

Discrete R.V.: Values can be listed (usually counting numbers but not always).
Continuous R.V.: Values can divided up, theoretically, an infinite number of times.

Example: Write a few possible values for X. Then state whether the variable is Discrete or Continuous.

(a) X = the number of heads you get when flipping a coin 10 times.

(b) X = the weight of bags of chips labeled "20 ounces"

(c) X = the number of units a student is taking in a semester

(d) X = the amount of time a student takes to get to Cuesta

(e) X = the number of times per month a student takes the bus to Cuesta

(Discrete) Probability Distributions: A probability distribution (that later becomes a "probability density function" or "pdf") is a table or a graph or a formula that relates of all the values of X and their probabilities, P(X).

Properties: Each probability must be between 0 and 1: Notation: _____

The probabilities must add to 1 (100%): Notation: _____

Example Suppose you roll a six-sided die. Let X = the number of spots showing.

Make a table and a graph for the probability distribution of X.

What is the name of this type of distribution? _____

Example: Someone says that the following table shows the probability distribution for the number of boys in a family of 4 children. Is this possible? Explain why or why not.

X = number of boys	0	1	2	3	4
P(x)	0.12	0.25	0.45	0.25	0.18

Important Discrete Probability Distributions: The Binomial Probability Model

Probability Model Binomial: *Required conditions*

1. There are a fixed number of trials.
2. There are two possible outcomes for each trial.
   The outcomes are labeled "success" and "failure".
3. The probability of success is the same on each trial.
4. The trials are independent (the outcome of one trial doesn't affect the others).

Example: Buzz and Doris. Remember the gist of the experiment: Doris saw a light go on (blinking or steady), communicated that information to Buzz, then Buzz chose a door (left or right) where the fish treat was located. They did this 16 times, and Buzz got it right 15 times.

What is a trial?

What is a success?

What is the random variable?

Is the R.V. discrete or continuous?

The graph shows the results of 1000 simulations of Buzz and Doris going through the 16 trials of their "blinking light-communicate-choose food door" experiment.

Describe the shape of the distribution.

Coming up! Even though the Random Variable is discrete, since the probability distribution is roughly symmetric we can apply the techniques for "Normal Distributions" (Section 6.2) to analyze the probabilities.

This isn't always the case, as the next example will show.

(We'll discuss this in detail in Chapter 7.)

Example: A recent survey by the magazine "Prepared Foods" (a food industry magazine which looks at all types of commercial foods) found 6% of respondents (U.S.) identified as vegan.

Suppose two random people meet and start talking about their diet. Let V = the event of a person being vegan.

Let X = the number of people (in the pair) who are vegan.

(a) What is the probability that both will be vegan?

(b) What is the probability that neither will be vegan?

(c) What is the probability that one or the other will be vegan?

(d) Make a probability distribution table and a graph for X. Describe the shape of the distribution.

Table: **Graph:**