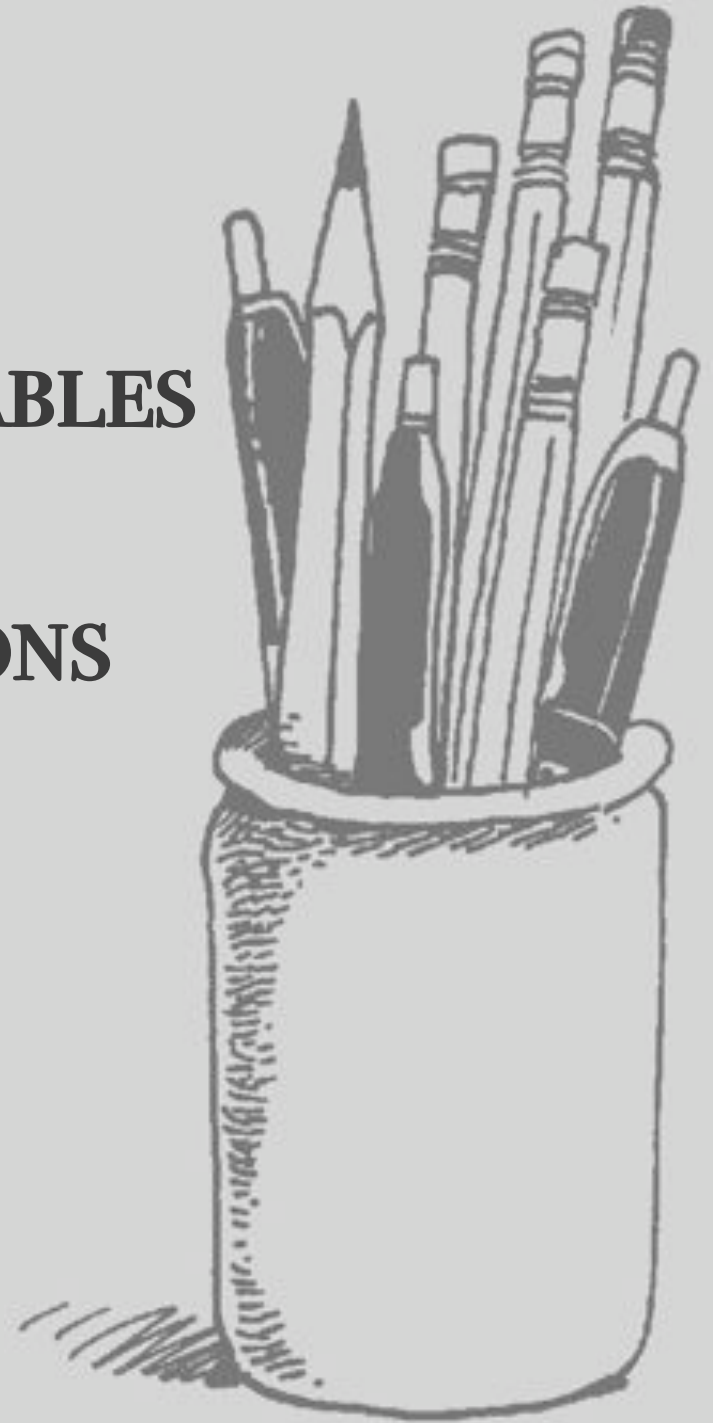


DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS

Section 5.1

Statistics, MATH 181

Mr. Keltner





Random Variables

✓ A **random variable** is a quantitative variable whose value depends on chance.

✓ Examples

- ✓ Number of male puppies in a litter
- ✓ Life span of graphing calculator batteries
- ✓ Number of children a family has
- ✓ Amount of interest earned in Best Buy stock over a 1 year period

Discrete Random Variables

- ✓ **Discrete random variables** are random variables whose values can be listed.
 - ✓ Usually involves a count, or tally, of something
 - ✓ Examples
 - ✓ Sum of dice when rolling a pair
 - ✓ Number of puppies in a litter
 - ✓ Number of students in a class session at JCCC

Probability Distributions

✓ A **probability distribution** is a listing of the possible values of a discrete random variable and their corresponding probabilities.

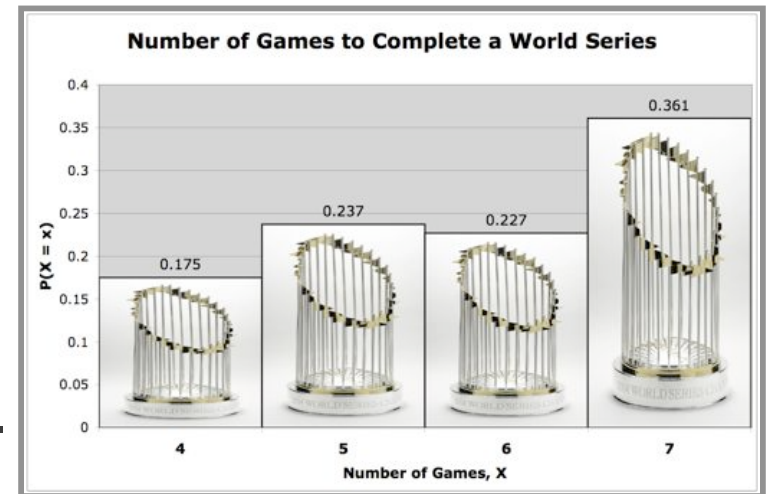
- ✓ Sometimes a formula for the probabilities will be used instead.
- ✓ Conveniently shows the likelihood of each value of the discrete random variable.
- ✓ The table at the right shows the data from Exercise 5.12.



Games	Relative Frequency
4	.175
5	.237
6	.227
7	.361

Probability Histograms

- ✓ A **probability histogram** is a graph of the probability histogram that displays
 - ✓ The possible values of a discrete random variable on the horizontal axis, and
 - ✓ The probabilities of those values on the vertical axis.
 - ✓ The probability of each value is represented by a vertical bar whose height represents the probability.



Probability Histogram for Ex. 5.12

Example 1

- ✓ Consider an example where 3 coins are flipped simultaneously. The possible results on the coins are listed in the table below.
- ✓ Our random variable X will measure the number of heads that occur.
- ✓ $\{X = 2\}$ is notation to indicate the event that 2 heads occur.
- ✓ $P(X = 2)$ is the probability of having 2 heads occur.

TTT	TTH	THT	THH
HHH	HHT	HTH	HTT

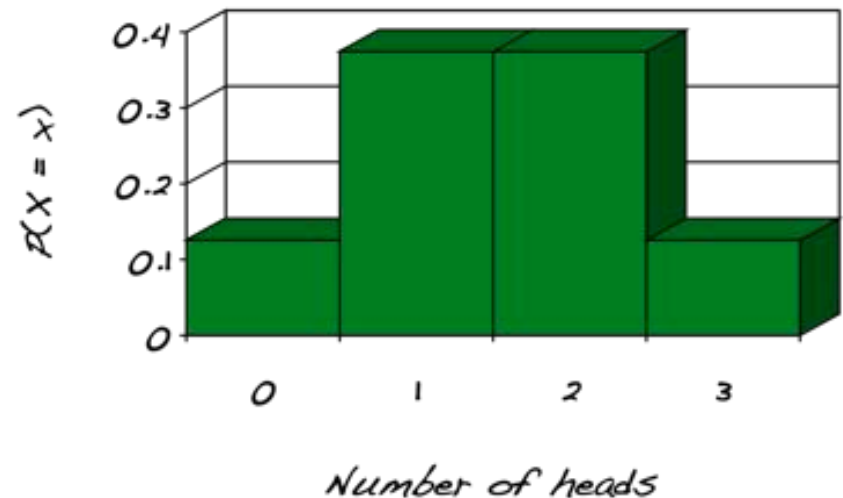
Example 1, Cont.

✓ Use the list from the previous slide to complete a probability distribution for X and also sketch a probability histogram.

✓ What distribution shape occurs in the probability distribution?

x	$P(X = x)$
0	$\frac{1}{8} = .125$
1	$\frac{3}{8} = .375$
2	$\frac{3}{8} = .375$
3	$\frac{1}{8} = .125$

Probability Histogram



Some Other Key Points

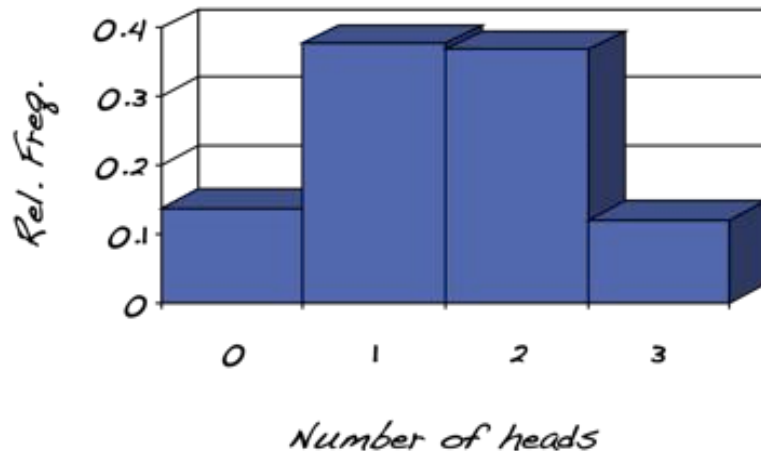
- ✓ Notice that, whether we used fractions or decimals, the sum of all the probabilities was 1.
- ✓ This is one of the properties of a probability distribution, and illustrates the fact a probability must be between 0 and 1.
 - ✓ In some instances, rounding error may cause the sum of the probabilities to be something else, like 0.998 or 1.01, but this is negligible error.

One Last Thing...

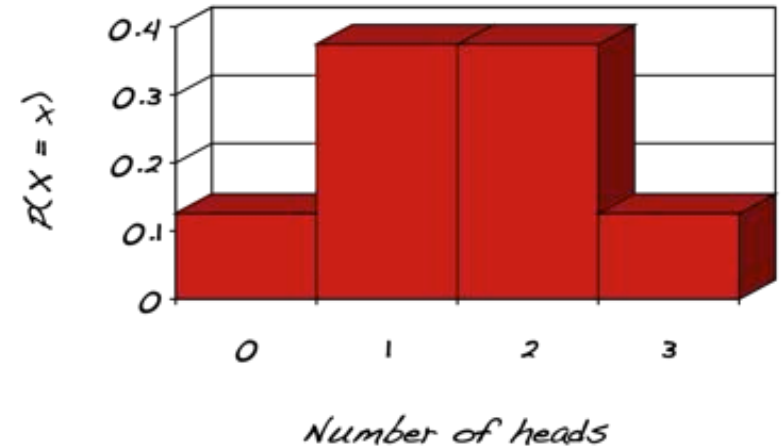
- ✓ The probability histogram shows the likelihood that each value of X occurs.
 - ✓ If we repeat the same experiment a significant amount of times, we will see that the frequency distribution from these trials will closely approximate the probability distribution of X .
 - ✓ This uses the *frequentist interpretation of probability*, mentioned in section 4.1.
 - ✓ More specifically, the frequency histogram from the trials will approximate the probability histogram for X .

Comparing Views

Frequency Histogram



Probability Histogram



- ✓ The two charts above compare the frequency histogram for 1000 independent trials with 3 coins (on the left) and the probability histogram for X (on the right).
- ✓ In general, for a large number of independent observations, these displays will closely mimic one another.

ASSESSMENT

Pgs. 240-241:

#'s 5.4, .5, .7 - .10, .12

