# Chapter 10.6: Construct and Interpret Binomial Distributions

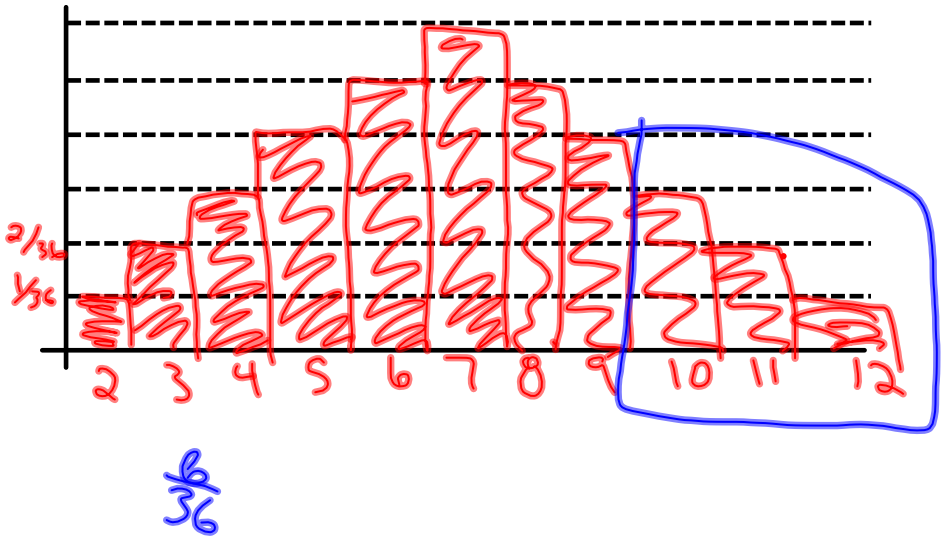
A random variable is a variable whose value is determined by the outcomes of a random event.

A probability distribution is a function that gives the probability of each possible value of a random variable.

rolling a number on a die

| X | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| P(X) | 1/6 | 1/6 | 1/6 | 1/6 | 1/6 | 1/6 |

**Let $X$ be a random variable that represents the sum when two six-sided dice are rolled. Make a table and a histogram showing the probability distribution for $X$.**



**Use the probability distribution in Example 1 to answer each question.**

**What is the most likely sum when rolling two six-sided dice?**

**What is the probability that the sum of the two dice is at least 10?**

One type of probability distribution is a binomial distribution. A binomial distribution shows the probabilities of the outcomes of a binomial experiment.

- A binomial experiment has the following:

1. there are n independent trials
2. two possible outcomes per trial
3. the probability of success(p) is the same for each trial. Failures is 1-p.

the probability of k successes in n trials

$$P(k) = {}_nC_k p^k (1-p)^{n-k}$$

**According to a survey, about $41\%$ of U.S. households have a soccer ball. Suppose you ask $6$ randomly chosen U.S. households whether they have a soccer ball. Draw a histogram of the binomial distribution for your survey.**

$k=0 = {}_6C_0(.41)^0(.59)^6 = .042$

$k=1 = {}_6C_1(.41)^1(.59)^5 = .176$

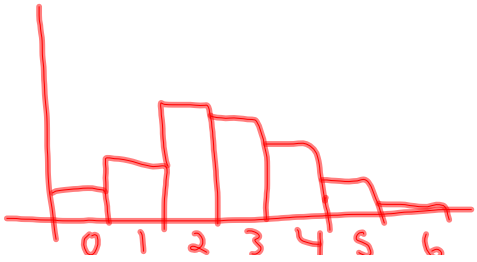
$k=2 = {}_6C_2(.41)^2(.59)^4 = .306$

$k=3 = {}_6C_3(.41)^3(.59)^3 = .283$

$k=4 = {}_6C_4(.41)^4(.59)^2 = .148$

$k=5 = {}_6C_5(.41)^5(.59)^1 = .041$

$k=6 = {}_6C_6(.41)^6(.59)^0 = .005$



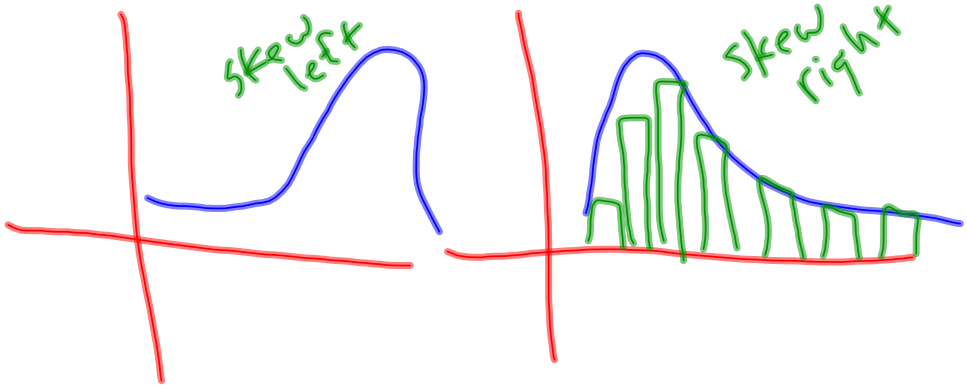

# Use the binomial distribution in Example $3$ to answer each question.

**What is the most likely outcome of the survey?**

**What is the probability that at most $2$ households have a soccer ball?**

Symmetry and Skewness

- The distribution is symmetric if a vertical line can be drawn that divides the histogram into mirror images. A distribution that is not symmetric is skewed(left or right depending on the tail)




**Describe the shape of the binomial distribution that shows the probability of exactly $k$ successes in $8$ trials if $(a)\ p = 0.5$ and $(b)\ p = 0.9$.**

# Work: Chapter 10.6 pg.727 #'s 4-10e,16,18,24,28,34,44