Binomial Distribution

- **Bernoulli Trial:** A *Bernoulli Trial* is a trial that has only two (2) possible outcomes – a success "S" or a failure "F".
- **Bernoulli Distribution:** Let the random variable $X = 1$ when a success is observed from a Bernoulli trial and $X = 0$ when a failure is observed. If the probability of getting a success is denoted by p, then the probability distribution of X is given below

x	1	0
$\Pr(X = x)$	p	$1 - p$

- **Binomial Distribution:** Suppose a *Bernoulli* trial is repeated n times. The random variable X, that counts the number of successes out of n, follows the *Binomial* probability distribution. The probability for each possible value of X is given by the following formula

$$P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}, \qquad \text{for } x = 0, 1, \ldots, n$$

- A couple plans to have exactly 5 children. Let the random variable X be the number of girls that they will have. Assume that the probability of a male birth is 2/5 and the probability of a female birth is 3/5 and that gender of any successive child is unaffected by previous brothers or sisters.

  1. Find the probability distribution of X.

  2. Find the mean and standard deviation of X.

- Suppose that 20% of all copies of a particular textbook fail a certain binding strength test. If 15 of these textbooks are randomly selected, what is the probability that at least 4 but not more than 7 fail this binding strength test?

- **Homework problems:**
  Section 4.4: pp. 215-218; # 49, 50, 52, 53, 59, 60.

- **Practice problems.**

1. Suppose that each time you take a free throw shot, you have a 30% chance of making it. If you take 15 shots,

a. What is the probability of making exactly 5 of them?

b. What is the probability of making fewer than 3 shots?

c. What is the probability of making at least 2 of them?

2. In a 20-question multiple choice exam (5 choices per item), what is the probability that a student who purely guesses his answers will get

a. exactly 10 questions right?

b. between 3 to 6 (inclusive) questions right?

c. at least half of the questions right?

3. The probability that a student will catch a cold from another student in the classroom is 0.20. A student with a cold is sitting in the classroom with 7 fellow students. What is the probability that

a. exactly 2 of the fellow students will catch the cold?

b. at least 2 of the fellow students will catch the cold?

4. If 80 percent of the mortgage loan applications received by a savings and loan association are approved, what is the probability that among 25 loan applications

a. less than 18 will be approved?

b. at least 18 will be approved?

c. at least 20 will be approved?

d. between 20 and 23 (inclusive) will be approved?