Chapter 5
Random Variables for Success/Failure Experiments

5.1 $\mu = \pi = 1/13 = 0.0769$,

$\sigma = \sqrt{\pi(1-\pi)} = \sqrt{(1/13)(12/13)} = 0.2665$

5.3 $\mu = \pi = 6022/8023 = 0.7506$,

$\sigma = \sqrt{\pi(1-\pi)} = \sqrt{(6022/8023)(2001/8023)} = 0.4327$

5.9 In general $\mu = n\pi$ and $\sigma = \sqrt{n\pi(1-\pi)}$

a. For n = 100 and π = 1/3, $\mu = n\pi = 100/3 = 33.3333$ and
$\sigma = \sqrt{n\pi(1-\pi)} = \sqrt{100(1/3)(2/3)} = \sqrt{200}/3 = 10\sqrt{2}/3 = 4.7140$

b. For n = 900 and π = 1/3, $\mu = n\pi = 900/3 = 300$ and
$\sigma = \sqrt{n\pi(1-\pi)} = \sqrt{900(1/3)(2/3)} = \sqrt{1800}/3 = 30\sqrt{2}/3 = 14.1421$

c. For n = 100 and π = 2/3, $\mu = n\pi = 200/3 = 66.6667$ and
$\sigma = \sqrt{n\pi(1-\pi)} = \sqrt{100(1/3)(2/3)} = \sqrt{200}/3 = 10\sqrt{2}/3 = 4.7140$

d. For n = 900 and π = 2/3, $\mu = n\pi = 1800/3 = 600$ and
$\sigma = \sqrt{n\pi(1-\pi)} = \sqrt{900(1/3)(2/3)} = \sqrt{1800}/3 = 30\sqrt{2}/3 = 14.1421$

5.11 $\Pr(K = k) = {}_{10}C_k(.10)^k(.90)^{(10-k)}$

a. $\Pr(K = 0) = {}_{10}C_0(.10)^0(.90)^{10} = (1)(1)\ (.90)^{10} = 0.3487$

b. $\Pr(K = 1) = {}_{10}C_1(.10)^1(.90)^9 = (10)(.1)\ (.90)^9 = 0.3874$

c. $\Pr(K = 2) = {}_{10}C_2(.10)^2(.90)^8 = (45)(.1)^2\ (.90)^8 = 0.1937$

d. $\Pr(K < 2) = \Pr(K = 0) + \Pr(K = 1) = .3487+.3874 = 0.7361$

e. $\Pr(K \geq 2) = 1 - \Pr(K < 2) = 1 - 0.7361 = 0.2639$

f. $\Pr(K > 2) = 1 - \Pr(K \leq 2) = 1 - \{\Pr(K=0) + \Pr(K = 1) + \Pr(K = 2)\} = 1 - 0.9298 = 0.0702$

5.13 **a.** $Pr(K = 1) = {}_{100}C_1(.01)^1(.99)^{99} = .3697$

b. $Pr(K = 0) = {}_{100}C_0(.01)^0(.99)^{100} = .3660$

c. $Pr(K \geq 1) = 1 - Pr(K= 0) = 1 - .3660 = .6340$

d. Here n = 1600, E(K) = 16.
$Pr(K = 16) = {}_{1600}C_{16}(.01)^{16}(.99)^{1584} = .0997$

5.15 Here $\pi = 1/2$, n = 4, K = number of boys.
$Pr(K > 2) = Pr(K = 3) + Pr(K = 4) = 4/16 + 1/16 = 5/16$

5.17 **a.** $\mu = n\pi = (25)(.50) = 12.5$,
$\sigma = \sqrt{\pi(1-\pi)} = \sqrt{25(.5)(1-.5)} = 2.5$

b. $\mu = n\pi = (25)(.50) = 12.5$,
$\sigma = \sqrt{(500-25)/(499)}\ \sqrt{25(.5)(1-.5)} = 2.4391$

5.19 **a.** Here N = 52, $N_1 = 13$, $N_0 = 39$, n = 13, and k = 7.
$$f(7) = \frac{{}_{13}C_7 \cdot {}_{39}C_6}{{}_{52}C_{13}} = 0.0088$$

b. $\mu = n\pi = 13(1/4) = 13/4$
$$\sigma = \sqrt{\frac{N-n}{N-1}}\ \sqrt{n \cdot \pi(1-\pi)} = \sqrt{39/51}\sqrt{13(1/4)(3/4)} = 1.3653$$

c. Pr(7 spades or 7 clubs or 7 diamonds or 7 hearts) = 4(0.0088) = 0.0353

5.21 Let K be the number that recover. Here $\pi = 1 - 63/877 = .9282$, n = 10.

a. $Pr(K = 10) = (.9282)^{10} = 0.4745$

b. $Pr(K = 8) = 0.1279$

c. $Pr(K \geq 8) = 0.9697$

5.23 **a.**

x	f(x)
0	0.1296
1	0.3456
2	0.3456
3	0.1536
4	0.0256

b. See histogram in Answers section of book.

5.25 Let K be the number of girls.
Pr(3–2 split) = Pr(K=2) + Pr(K = 3) = 5/16 + 5/16 = 10/16 = 0.6250

5.27 Hypergeometric. Here N = 20, $N_1 = 4$, $N_0 = 16$, n = 5;

$f(k) = \frac{{}_4C_k \cdot {}_{16}C_{5-k}}{{}_{20}C_5}$.

a. $f(0) = \frac{{}_4C_0 \cdot {}_{16}C_5}{{}_{20}C_5} = 0.2817$

b. $f(4) = \frac{{}_4C_4 \cdot {}_{16}C_1}{{}_{20}C_5} = 0.0010$

c. $f(1) = \frac{{}_4C_1 \cdot {}_{16}C_4}{{}_{20}C_5} = 0.4696$

d. 1 – f(0) =1 – 0.2817 = 0.7183

e. $\mu = n\pi = 5(4/20) = 1$

f. $\sigma = \sqrt{\frac{20-5}{20-1}}\sqrt{5\cdot(4/20)(16/20)} = 0.7947$

5.29 Hypergeometric. Here N = 16, $N_1 = 5$, $N_0 = 11$, n = 3.

$f(k) = \Pr(k \text{ have worn tires}) = \frac{{}_5C_k \cdot {}_{11}C_{3-k}}{{}_{16}C_3}$.

$\Pr(0 \text{ have worn tires}) = \frac{{}_5C_0 \cdot {}_{11}C_3}{{}_{16}C_3} = .2946$

Pr(At least one has worn tires) = 1 – .2946 = .7054

5.31 π= 1/48; Pr(K $\geq$ 1) = 1 – Pr(K = 0) = 1 – $(47/48)^{12}$ = 0.2232

5.33 **a.** Using hypergeometric. Here N = 120, N_1 = 80, N_0 = 40, n = 5.

$$f(k) = \text{Pr(k have access)} = \frac{{}_{80}C_k \cdot {}_{40}C_{5-k}}{{}_{120}C_5}.$$

$$f(2) = \text{Pr(2 have access)} = \frac{{}_{80}C_2 \cdot {}_{40}C_3}{{}_{120}C_5} = 0.1638$$

b. Using binomial. Here n = 5, π = 80/120 = 2/3, k = 2

$$f(k) = {}_5C_k (2/3)^k (1/3)^{5-k}$$

$$f(2) = {}_5C_2 (2/3)^2 (1/3)^3 = 0.1648$$

c. No. The sample size n = 5 is less than 5% of population size N = 120. A population is considered small only if the sample is more than 5% of the population.