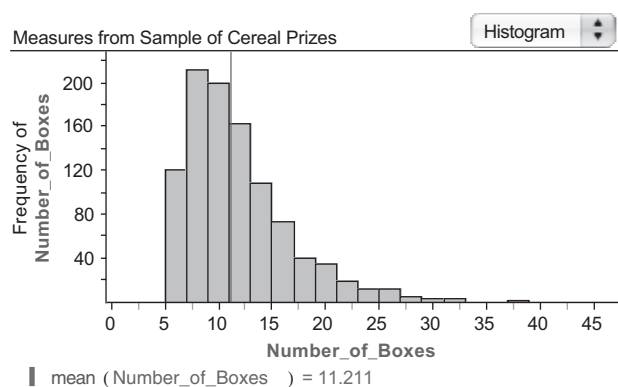


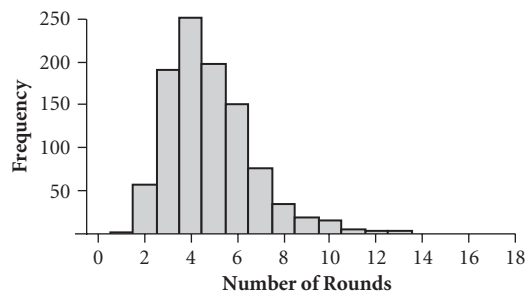
The result of 1000 trials is shown below. The mean of these 1000 trials is about 11.2 boxes.



The Fathom window at the bottom of the page shows how you can set up the simulation.

- E55. a. $\frac{1}{0.5} = 2$ flips
 b. $P(\text{at least one dies}) = 1 - P(\text{none die}) = 1 - 0.5^{10} \approx 0.9990$
 c. $\frac{1}{0.9990} \approx 1.001$ flips, which is fewer flips than are expected for a single copper flipper to die, because there is less chance of all ten living than there is of a single copper flipper living.

d. The result of 1000 trials is shown here. The mean of these 1000 trials is about 4.8 rounds.



AP Sample Test

AP1. B. To have a total of 2 children, either (*first woman has 0 and second has 2*) or (*first woman has 1 and second has 1*) or (*first woman has 2 and second has 0*), so the probability is $0.18 \cdot 0.35 + 0.17 \cdot 0.17 + 0.35 \cdot 0.18 = 0.1549$. [Source: United States Census Bureau, Current Population Survey, 2002, www.census.gov]

AP2. B. The expected winnings are \$0.50. The variance is $(5 - 0.50)^2 \cdot 0.1 + (0 - 0.50)^2 \cdot 0.9$, or 2.25, so the standard deviation is \$1.50.

Lesson 6.2, E54

Sample of Cereal Prizes	Cereal...	<new>
1	3	
2	1	
3	1	
4	3	
5	5	
6	4	
7	1	
8	3	
9	1	
10	5	
11	1	
12	2	

AP3. C. It takes $1/p = 1000$ productions of 2.5 feet each, on average, for the machine to cut the cable. So the expected length is $1000(2.5)$, or 2,500 feet.

AP4. D. First, list all $\binom{5}{2} = 10$ possible pairs of days when Russell could get the apple. In 6 of these pairs, Russell gets an apple on Monday or on Tuesday, but not both. The probability is $6/10$. Alternatively, $P(\text{apple Monday and no apple Tuesday}) + P(\text{no apple Monday and apple Tuesday}) = \frac{2}{5} \cdot \frac{3}{4} + \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{10}$.

Note that the probability of an apple is 0.4 for each day, but the outcomes for Monday and Tuesday are not independent events because the probability of getting an apple on Tuesday depends on what happens on Monday.

AP5. D. There are $\binom{5}{2} = 10$ ways to select which 2 days get yogurt, and then for each pattern (such as *yogurt, not, not, yogurt, not*) the probability is $(\frac{2}{6})^2 \cdot (\frac{4}{6})^3$, so the net result is $10 \cdot (\frac{2}{6})^2 \cdot (\frac{4}{6})^3$, or about 0.329.

AP6. D. Jeanne runs twice as fast, so on average it takes her 1 hour 25 minutes, and since she leaves at 1:30, she arrives at 2:55. Leaving 30 minutes later has no effect on the standard deviation, though, so since her time is always exactly half as long, her standard deviation is half as big.

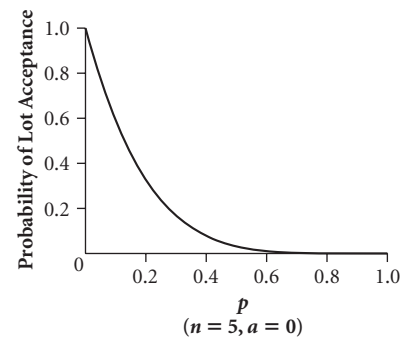
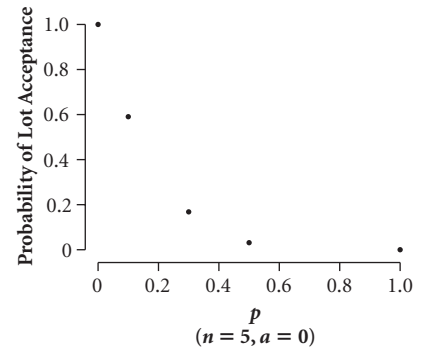
AP7. D. The mean is $np = 100(0.35) = 35$, and the standard deviation is $\sqrt{np(1-p)} = \sqrt{100(0.35)(0.65)}$, or about 4.7697. [Source: EarthTrends, earthtrends.wri.org, with data from Development Data Group, The World Bank, 2006, www.worldbank.org]

AP8. A. She must not win on her first four fill-ups, with probability $(1249/1250)^4$, and then win on the fifth, with probability $(1/1250)$. Multiplying these gives the answer. [Source: Game piece from Shell gasoline station, fall 2006]

AP9. a. The lot is accepted when there are no defective items in a random sample of size 5. On the TI-83 Plus and TI-84 Plus, the command $\text{binompdf}(5,p,0)$ gives the probability that there will be no defective items for each p . Alternatively, you can compute the probability that all five items will be good using $(1-p)^5$. The probabilities are given in this table.

p	$P(\text{no defectives})$
0	1
0.1	0.59049
0.3	0.16807
0.5	0.03125
1	0

b. The operating characteristic curve for the points in the table is shown in the first plot below. The probability of acceptance is high when the proportion of defective items in the lot is low and drops off rapidly as the proportion of defectives increases.



The second plot is the actual operating characteristic curve, which is a smooth continuous curve for all values of p , $0 \leq p \leq 1$. You can graph this curve on a TI-83 Plus or TI-84 Plus calculator by defining $Y_1 = \text{binompdf}(5,X,0)$ in the Y= menu and graphing Y_1 in an appropriate window. Here X stands for the proportion of defective items, p .

c. To compute the probability of 1 or fewer defective items for a sample of size 5, use the calculator command $\text{binomcdf}(5,p,1)$. To compute the probability of 5 or fewer defective items for a sample of size 25, use $\text{binomcdf}(25,p,5)$.

The operating characteristic curves for the two plans are shown in the plots on the next page. Again, these will be smooth continuous curves for all values of p , $0 \leq p \leq 1$, although students may plot discrete points. On a calculator the equation of the graph for $n = 5$ and $a = 1$ is $Y_1 = \text{binomcdf}(5,X,1)$.