Section 5.1

1. \[
\left( \frac{3}{4} \right)^4 \left( \frac{1}{4} \right)^4 = 0.087
\]

2. 
   (a) \(64 \times \frac{1}{2} = 32\)
   (b) \(6 \times \frac{1}{2} + 1 = 4\) (note that we should count the mother of the family as well)

7. Let \(p\) and \(q\) be the probability mass functions of \(X\) and \(Y\), respectively. Then

   \[p(x) = \binom{4}{x} (0.60)^x (0.40)^{4-x}, \quad x = 0, 1, 2, 3, 4;\]

   \[q(y) = p(Y = y) = p(X = \frac{y - 1}{2}) = \binom{4}{\frac{y-1}{2}} (0.60)^{\frac{y-1}{2}} (0.40)^{4-\left(\frac{y-1}{2}\right)}, \quad y = 1, 3, 5, 7, 9.\]
13. 

\[
\left( \frac{6}{3} \right) \left( \frac{1}{3} \right)^3 \left( \frac{2}{3} \right)^3 = 0.219.
\]

16. Call the event of obtaining a full house success. \( X \), the number of full houses is \( n \) independent poker hands is a binomial random variable with parameters \( (n, p) \), where \( p \) the probability that a random poker hand is a full house. To calculate \( p \), note that there are \( \binom{52}{5} \) possible poker hands and 

\[
\frac{\binom{4}{3} \binom{13}{2}}{11!} = 3744 \text{ full houses}. \text{ Thus}
\]

\[
p = \frac{3744}{\binom{52}{5}} \approx 0.0014. \text{ Hence}
\]

\[
E(X) = np \approx 0.0014n
\]

\[
\text{Var}(X) = np(1-p) \approx 0.00144n
\]
Section 5.2

3.
\[ \lambda = 0.025 \times 80 = 2 \]

The answer is \( 1 - \frac{e^{-2} \cdot 0}{0!} - \frac{e^{-2} \cdot 1}{1!} = 0.594 \)

7.
\[ P(X=1) = P(X=3) \text{ implies that} \]
\[ e^{-\lambda} \cdot \lambda = e^{-2} \cdot \frac{\lambda^{3}}{3!} \]
from which we get
\[ \lambda = \sqrt{6} \]

So the answer is \( \frac{e^{-\sqrt{6}} \cdot (\sqrt{6})^{5}}{5!} = 0.063 \)

9.
Let \( X \) be the number of times the randomly selected kid has hit the target. So
\[ P(X=0) = 0.04 \]

\[ e^{-\lambda} \cdot \frac{\lambda^{0}}{0!} = 0.04 \text{ or } e^{-\lambda} = 0.04 \]
So \[ \lambda = -\ln 0.04 = 3.22. \]

\[
P(X \geq 1) = 1 - P(X=0) - P(X=1)
= 1 - 0.04 - \frac{e^{-\lambda} \lambda}{1!}
= 0.83
\]

Section 5.3

3.

(a) \[ \frac{1}{(1/12)} = 12 \]

(b) \[ \left( \frac{11}{12} \right)^2 \left( \frac{1}{12} \right) \approx 0.07 \]

8.

The probability that at least \( n \) light bulbs are required is equal to the probability that the first \( n-1 \) light bulbs are all defective.

So the answer is \( p^{n-1} \).
The transmission of a message takes more than $t$ minutes, if the first $\lfloor t/2 \rfloor + 1$ times it is sent it will be garbled, where $\lfloor t/2 \rfloor$ is the greatest integer less than or equal to $t/2$. The probability of this is $p^{\lfloor t/2 \rfloor + 1}$. 