1. The _sample space_____ of an experiment is the set of all possible outcomes of that experiment.

2. If $A$ and $B$ are disjoint (mutually exclusive) events, then the probability of both events occurring simultaneously is equal to _zero___________.

3. If $P(A) = .50$, $P(B) = .70$, and $P(A \cap B) = .40$ then $P(A \cup B) = .80$.

4. If $P(A) = .35$, $P(B) = .50$ and $P(A \cap B) = .20$, then $P(A|B)$ is _2/5=.40_.

5. If $P(A \cap B) = .123$ and $P(A|B) = .60$, then $P(B)$ is _.123/.60=.205_.

6. If $P(A) = .25$, $P(B) = .40$, and events $A$ and $B$ are independent, then $P(A \cap B) = _{.25 \times .40} = .10$___________.

7. If $P(A) = .60$, $P(B) = .40$, and events $A$ and $B$ are independent, then $P(A|B)$ is ___.60__________.

8. The probability mass function $p(x)$ of a discrete random variable $X$ is $p(0) = .15$, $p(1) = .30$, $p(2) = .20$, $p(3) = .10$, and $p(4) = .25$. The value of the cumulative distribution function $F(x)$ at $x = 2$ is _____.65 ________.

9. If the expected value of a discrete random variable $X$ is $E(X) = 5$, then $E(2X + 3)$ is ___13__________.

10. Let $X$ be a discrete random variable with $E(X) = 4.5$ and $E(X^2) = 26.25$, then the variance of $X$ is $V(X) = _6_________$. 
Part II Score: _______/60 points

11. (10 points) Standard automobile license plates in Ohio contain three letters and four numbers.

a. How many different such plates are possible?

\[26^3 \times 10^4 = 175,760,000\]

b. If all such plates are equally likely, what is the probability that a randomly selected plate will contain no duplicate letters or numbers?

\[\frac{26 \times 25 \times 24 \times 10 \times 9 \times 8 \times 7}{175,760,000} = .447\]

12. (15 points) Possible contamination of a water supply near a chemical plant is of concern, so the water is monitored. Experts believe that a contamination event can occur as a result of an accident with probability 0.20 and as a result of terrorism with probability 0.65. It is also believed that the probability of an accident is 0.75 and the probability of terrorism is 0.25. A contamination event has been detected. Find the probability that terrorism is the cause.

\[P(\text{terrorism} \mid \text{contam}) = \frac{P(\text{contam} \mid \text{terror}) P(\text{terror})}{P(\text{contam})}\]

where

\[P(\text{contam}) = P(\text{contam} \mid \text{terror}) P(\text{terror}) + P(\text{contam} \mid \text{accident}) P(\text{accident})\]

so

\[P(\text{terrorism} \mid \text{contam}) = \frac{.65(.25)}{.65(.25) + .20(.75)} = .52\]
13. (10 points) Suppose that the probability of living to at least 70 years old is 0.60 and the probability of living to at least 80 years old is 0.20. If a person reaches her 70\textsuperscript{th} birthday, what is the probability that she will reach her 80\textsuperscript{th} birthday?

\[ P(\text{to 80} \mid \text{to 70}) = \frac{P(\text{both})}{P(\text{to 70})} = \frac{0.20}{0.60} = 0.333 \]

14. (15 points) An insurance company offers its policyholders a number of different payment options. For a randomly selected policyholder, let \( X \) = the number of months between successive payments. The cdf of \( X \) is as follows:

\[
F(x) = \begin{cases} 
0 & x < 1 \\
0.30 & 1 \leq x < 3 \\
0.40 & 3 \leq x < 4 \\
0.45 & 4 \leq x < 6 \\
0.60 & 6 \leq x < 12 \\
1 & 12 \leq x 
\end{cases}
\]

a. What is the pmf of \( X \)?

<table>
<thead>
<tr>
<th>( x )</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>p(x)</td>
<td>.30</td>
<td>.10</td>
<td>.05</td>
<td>.15</td>
<td>.40</td>
</tr>
</tbody>
</table>

b. Compute \( P(3 \leq X < 6) \).

\[ = P(X = 3 \text{ or } 4) = 0.15 \]

c. Compute \( P(X > 4) \).

\[ = 1 - P(X \leq 4) = 1 - F(4) = 0.55 \]