1. (a) Consider the experiment of rolling a six-sided die. What is the sample space $S$?

(b) If $A = \{a, b, c, d, e\}$ and $B = \{a, e, i, o, u\}$, then find $A \cap B$.

(c) If $A = \{0, 1, 2\}$ and $B = \{0, 5, 10\}$, then find $A \cup B$.

(d) If $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 3, 5\}$, and $B = \{3, 6\}$, then find $A \cap B'$.

(e) If $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 3, 5\}$, and $B = \{3, 6\}$, then find $A' \cap B'$.

(f) If $S = \{1, 2, 3, 4, 5, 6\}$, $A = \{1, 3, 5\}$, and $B = \{3, 6\}$, then find $(A \cup B)'$. 
Let \( P(A) = 0.5 \), \( P(B) = 0.6 \), and \( P(A \cap B) = 0.3 \). Find the following probabilities.

(a) \( P(A \cup B) \).

(b) \( P(A' \cap B') \).

(c) \( P(A' \cap B') \).

(d) \( P\left( A \cap B' \right) \).

(e) \( P\left( A \cup B' \right) \).

3 Fill in the following blanks.

(a) Probabilities are real numbers between ________ and _______, inclusive.

(b) If an event is certain to occur, its probability is ____, and if an event is certain not to occur, its probability is _____.

(c) If two events are mutually exclusive, the probability that one or the other will occur equals the _____ of their probabilities.

(d) The sum of the probabilities that an event will occur and that it will not occur is equal to _____.
4 The following table gives the exact breakdown of 400 inmates in a prison according to their sentences and the status as first or multiple offenders.

<table>
<thead>
<tr>
<th></th>
<th>$A$</th>
<th>$A'$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B$</td>
<td>120</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>$B'$</td>
<td>80</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Let $A=$\{Sentences less than five years\} and $B=$\{First offenders\}. If an inmate is randomly selected, find the following probabilities.

(a) $P(B)$.

(b) $P(A \cap B)$.

(c) $P(A | B)$.

(d) Explain $P(A' | B)$ in words.

5 Is $f(x)$ given below an appropriate probability distribution function? Explain.

<table>
<thead>
<tr>
<th>$X$</th>
<th>-1</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>0.25</td>
<td>0.50</td>
<td>0.25</td>
</tr>
</tbody>
</table>

(a) Yes  No  (Circle the correct answer)
(b) Explanation.
Let the random variable $X$ have a Binomial distribution with $n = 10$ and $p = 0.4$. Find the following:

(a) $P(X < 3)$.
(b) $P(X \leq 3)$.
(c) $P(X \geq 4)$.
(d) $P(X > 5)$.
(e) $P(3 \leq X < 6)$.

The American Almanac of Jobs and Salaries, reported that 30% of accountants are employed in public accounting. Assume that this percentage applies to a group of 10 college graduates just entering the accounting profession. Find the following:

(a) Find the probability that at least 3 graduates will be employed in public accounting.

(b) Find the probability that at most 3 graduates will be employed in public accounting.

(c) Find the probability that less than 3 graduates will be employed in public accounting.

(d) Find the probability that more than 3 graduates will be employed in public accounting.
Consider the following probability distribution.

<table>
<thead>
<tr>
<th>$X$</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>0.20</td>
<td>0.60</td>
<td>0.20</td>
</tr>
</tbody>
</table>

(a) Find the mean.

(b) Find the variance.

(c) Find the standard deviation.

Find the following. Draw graphs for each part.

(a) $Z_{0.028}$. 

(b) $Z_{0.025}$. 

Let the random variable $Z$ have a standard normal distribution.

(a) What is the mean of the standard normal distribution?
(b) What is the variance of the standard normal distribution?

Let the random variable $Z$ have a standard normal distribution. Find the following probabilities. Draw graphs for each part.

(a) $P(0 < Z < 2.68)$

(b) $P(Z < 2.68)$

(c) $P(Z > 2.68)$

(d) $P(2.35 < Z < 2.68)$

(e) $P(-2.35 < Z < 2.68)$
Drivers who are members of a union earn an average of $20.00 per hour. Assume that available data indicate wages are normally distributed with a standard deviation of $2.25.

(a) What is the probability that wages are between $15.50 and $24.50 per hour?

(b) What is the probability that the wages are less than $15.00 per hour?

(c) Find the wage \( w_0 \) such that only 2.5% of the union drivers earn more than \( w_0 \).