DO NOT OPEN YOUR EXAM UNTIL TOLD TO DO SO.

You may use your class textbook and a calculator, but no other materials or resources (such as class notes or old homework). There is no sharing of textbooks or calculator with a neighbor.
1. Two dice are rolled. We are interested in the sum of the two dice. The sums of the 36 possible rolls are given. In answering each of the following questions, leave your answers as fractions, but simplify the fractions where appropriate.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

/3 What is the probability that the sum is even?

/3 What is the probability that the sum is \( \geq 9 \)?

/4 What is the probability that the sum is even and \( \geq 9 \)?

/4 What is the probability that the sum is even or \( \geq 9 \)?

/4 If we know that the sum is \( \geq 9 \), what is the probability the sum is even?

/4 If we know that the sum is even, what is the probability that the sum is \( \geq 9 \)?

/3 Given that event \( E \) is that the sum of the dice is even and/or \( > 6 \) or that we rolled doubles (i.e. 1 and 1, 2 and 2, etc.), find \( \Pr(E \cup E') \) and find \( \Pr(E \cap E') \).
2. A coin is tossed 6 times. Simplify each of these answers to be a simple fraction.

What is the probability of having exactly five heads?

What is the probability of having five or fewer heads?

Given that there are five or fewer heads, what is the probability of having exactly five heads?

Given that there are exactly five heads, what is the probability of having five or fewer heads?
3. Suppose that E and F are events where Pr(E) = \( \frac{4}{8} \), Pr(F) = \( \frac{5}{8} \), and Pr(E \cap F) = \( \frac{2}{8} \).

Note/hint: use the diagram and/or some of the probabilities you find to find subsequent probabilities. Simplify your answers (the fractions) for this problem.

Draw a Venn Diagram representing the given information:

Find Pr(E \cup F).

Find Pr(E').

Find Pr(F').

Find Pr(E' \cap F').

Find Pr(E|F).

Find Pr(F|E).

Find Pr(E'|F).

Find Pr(F|E').

Are E and F independent events? Why or why not?
4. A certain test can determine whether or not a person has the flu. Ideally, the test would test positive (meaning you do have the flu) 100% of the time for those who do have the flu, and negative (meaning you do not have the flu) 100% of the time for those who do not have the flu. Suppose in reality that of those who do have the flu, the test is positive only 94% of the time, and that of those who do not have the flu, only 98% test negative. Finally, assume that 5% of the population actually does have the flu.

Suppose a randomly selected person is tested, and that the test is positive. What is the probability that this person does have the flu? Simplify your answer.

What is the probability that a person who tests positive does not have the flu (a so-called false positive)?

Now suppose that a person is randomly selected and tested, and that the test is negative. What is the probability that this person actually does not have the flu? Simplify your answer.

What is the probability that a person who tests negative does have the flu (a so-called false negative)?