1. If $P(A) = 0.48$ and $P(B) = 0.67$ and $P(A \cap B) = 0.22$, find the following:
   a. $P(A \cup B) = 0.93$
   b. $P(A \cup B^C) = 0.55$
   c. $P(A^C \cap B) = 0.45$
   d. $P(B|A) = \frac{0.22}{0.48} = 0.4583$
   e. $P(A^C|B^C) = \frac{0.07}{0.33} = 0.2121$
   f. Are A and B disjoint events? Why or why not?
      Not disjoint. $P(A \cap B) = 0.22 \neq 0$
   g. Are A and B independent events? Why or why not?
      Not independent. $P(B|A) = 0.4583 \neq P(B) = 0.67$

2. If $P(G) = 0.18$, $P(M) = 0.24$ and G and M are independent, what’s the probability of G and M?
   $P(G \cap M) = 0.18 \times 0.24 = 0.0432$

3. If $P(W) = 0.61$ and $P(J) = 0.45$ and $P(J|W) = 0.2$, find the following:
   a. $P(W \text{ and } J) = 0.61 \times 0.2 = 0.122$
   b. $P(W \text{ or } J) = 0.61 + 0.45 - 0.122 = 0.938$

4. If $P(Y) = 0.54$ and $P(L) = 0.30$ and $P(Y \cap L) = 0.162$, find the following:
   a. $P(Y \cup L) = 0.678$
   b. $P(Y^C \cup L^C) = 0.622$
   c. $P(Y \cap L^C) = 0.378$
   d. $P(L|Y) = \frac{0.162}{0.54} = 0.30$
   e. $P(L^C|Y^C) = \frac{0.322}{0.46} = 0.70$
   f. Are Y and L disjoint events? Why or why not?
      Not disjoint. $P(Y \cap L) = 0.162 \neq 0$
   g. Are Y and L independent events? Why or why not?
      Yes they are independent. $P(L|Y) = 0.30 = P(L)$

5. If $P(D) = 0.48$, $P(R) = 0.25$ and D and R are disjoint, what is the probability of D or R?
   $P(D \cup R) = 0.73$

6. If $P(T) = 0.47$ and $P(B) = 0.74$ and $P(B|T) = 0.7447$, find the following:
   a. $P(T \text{ and } B) = 0.47 \times 0.7447 = 0.35$
   b. $P(T \text{ or } B) = 0.47 + 0.74 - 0.35 = 0.86$

7. Suppose in a library 23% of the books are children’s books, 42% of the books are adult fiction, and the rest are non-fiction.
   a. What is the probability that a randomly selected book is:
      i. Non-fiction
         $P(NF) = 0.35$
      ii. Not a children’s book
         $P(C^C) = 0.77$
      iii. A children’s book or an adult fiction
         $P(C \cup AF) = 0.65$
b. If the type of book is independent of the next what is the probability that:
   i. 2 randomly selected books are both children's books?
      \[ P(C \cap C) = 0.23 \times 0.23 = 0.0529 \]
   ii. 2 randomly selected books are adult fiction then non-fiction?
      \[ P(AF \cap NF) = 0.42 \times 0.35 = 0.147 \]
   iii. 2 randomly selected books are children's and adult fiction?
      \[ P(C \cap AF) = 2(0.23)(0.42) = 0.1932 \]
   iv. 2 randomly selected books are not adult fiction?
      \[ P(AF^C \cap AF^C) = (0.58)(0.58) = 0.3364 \]
   v. At least 1 out of 4 randomly selected books is a children's book?
      \[ P(\text{at least 1 C}) = 1 - P(C^C \cap C^C \cap C^C \cap C^C) = 1 - (0.77)^4 = 0.6485 \]
   vi. The first non-fiction book is the 5th one selected?
      \[ P(NF^C \cap NF^C \cap NF^C \cap NF^C \cap NF) = (0.65)^4(0.35) = 0.0625 \]

8. In a large university 13.5% of the students take economics, 24.7% of the students take statistics, and 11.7% take economics and statistics.
   a. Draw a Venn Diagram
   b. What is the probability that a randomly selected student:
      i. Took economics or statistics?
         \[ P(E \cup S) = 0.265 \]
      ii. Didn't take economics but did take statistics?
         \[ P(E^C \cap S) = 0.130 \]
      iii. Didn't take economics or didn't take statistics?
         \[ P(E^C \cup S^C) = 0.883 \]
      iv. That took statistics didn't take economics?
         \[ P(E^C|S) = \frac{0.130}{0.247} = 0.5263 \]
      v. Didn't take statistics given they took economics?
         \[ P(S^C|E) = \frac{0.018}{0.135} = 0.1333 \]
   c. Is taking statistics and economics mutually exclusive? independent?
      \[ P(E \cap S) = 0.117 \neq 0 \text{ Not mutually exclusive.} \]
      \[ P(E^C|S) = 0.5263 \neq P(E^C) = 0.865; \text{ Not independent} \]

9. The following table shows the results of survey that asked people whether they were involved in any type of charity work.

<table>
<thead>
<tr>
<th></th>
<th>Frequently</th>
<th>Occasionally</th>
<th>Not at all</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>221</td>
<td>456</td>
<td>795</td>
<td>1472</td>
</tr>
<tr>
<td>Female</td>
<td>207</td>
<td>430</td>
<td>741</td>
<td>1378</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>428</strong></td>
<td><strong>886</strong></td>
<td><strong>1536</strong></td>
<td><strong>2850</strong></td>
</tr>
</tbody>
</table>

What is the probability that
   a. a randomly selected person is male and frequently involved in charity work?
      \[ P(M \cap Fr) = \frac{221}{2850} = 0.0775 \]
   b. a randomly selected person is male or occasionally involved in charity work?
      \[ P(M \cup O) = \frac{1472 + 456}{2850} - \frac{456}{2850} = \frac{1902}{2850} = 0.6674 \]
   c. a randomly selected person is female or not involved in charity work?
      \[ P(F \cup N) = \frac{1378 + 1536}{2850} - \frac{741}{2850} = \frac{2173}{2850} = 0.7625 \]
   d. a randomly selected person is male given they frequently involved in charity work?
e. a randomly selected female is occasionally involved in charity work?
\[ P(O|F) = \frac{430}{1378} = 0.3120 \]
f. a person not involved in charity is female?
\[ P(F|N) = \frac{741}{1536} = 0.4824 \]
g. Is sex and involvement in charity independent? Disjoint?
   - They are independent. \( P(F|N) = 0.4824 = P(F) = 0.4835 \)
   - They are not disjoint. \( P(M \cap Fr) = 0.0775 \neq 0 \)