4.6 The Multiplication Rule; Independence

Ex. A joint frequency dist’n for the number of injuries in the US by circumstance and sex is as shown in the following contingency table. Frequencies are in millions.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Circumst.</th>
<th>Work C₁</th>
<th>Home C₂</th>
<th>Other C₃</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>S₁</td>
<td>8.0</td>
<td>17.8</td>
<td>35.6</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>S₂</td>
<td>11.6</td>
<td>12.9</td>
<td>25.8</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>9.3</td>
<td>21.4</td>
<td>30.7</td>
<td>61.4</td>
</tr>
</tbody>
</table>

a. Fill in the two empty cells

Missing frequencies in cells

b. How many cells does the contingency table have?

c. Find the probability that an injured person was hurt at work.

\[ P( ) = ? \]

\[ P( ) = 0.1515 \]

d. Find the probability that the injured person is female.

\[ P( ) = ? \]

\[ P( ) = 0.4202 \]
e. Find the probability that the injured person is female and was hurt at work.

\[ P( \quad ) = ? \]
\[ P( \quad ) = \quad = 0.0212 \]

f. Given that an individual was hurt at work, what is the probability that it is a female. Obtain this probability directly from the table.

\[ P( \quad ) = ? \]
\[ P( \quad ) = \quad = 0.1398 \]

g. Obtain \( P(S_2*C_1) \) using the conditional probability rule and your answers from part (c) and (e).

\[ P(S_2*C_1) = \]
\[ = \quad = 0.1398 \]

h. Are \( S_2 \) and \( C_1 \) independent? Explain.

\[ \frac{\text{?}}{\text{?}} = \frac{1.3}{9.3} = \frac{25.8}{61.4} \]

\[ 0.1398 \quad 0.4202 \]

Hence, \( C_1 \) and \( S_2 \) are

i. Obtain \( P(S_2 \mid C_1) \) using the multiplication rule and your answers from parts (c) and (e).

\[ P(S_2 \mid C_1) = \]
\[ = \quad \times \quad = 0.0212 \]