Yates' Correction

The $X^2$ test is known to provide unreliable results when $r = 1$. In order to correct for this error, we adjust the contribution formula as follows:

$$\text{Contribution} = \left(10 - E - 0.5\right)^2 \div E$$

The following contingency table shows the results of 100 people in a driving test along with their gender.

<table>
<thead>
<tr>
<th>Result</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>34</td>
<td>24</td>
</tr>
<tr>
<td>Fail</td>
<td>24</td>
<td>18</td>
</tr>
</tbody>
</table>

Test at the 10% significance level if the outcome of the test is independent of the gender.

$H_0$: Result and gender are independent

$H_1$: Result and gender are not independent

Since $r = 1$, we must perform a Yates' correction.

Note: do not use the calculator's test statistic ($X^2_{calc}$) as Yates' correction is not performed by the calculator.

Contribution:

$$\left(\frac{34 - 33.64 - 0.5}{33.64}\right)^2 = \frac{49}{84100}$$

$$\left(\frac{24 - 24.36 - 0.5}{24.36}\right)^2 = \frac{7}{8700} \times 2$$

$$\left(\frac{18 - 17.64 - 0.5}{17.64}\right)^2 = \frac{1}{900}$$
\[
\chi^2_{\text{calc}} = \frac{4.9}{84100} + \frac{7}{3700} + \frac{1}{900} = \frac{25}{7569} \approx 3.303 \times 10^{-3}
\]

Critical values for the \( \chi^2 \) distribution

If \( X \) has a \( \chi^2 \) distribution with \( v \) degrees of freedom, then, for each pair of values of \( p \) and \( v \), the table gives the value of \( x \) such that

\[ P(X \leq x) = p. \]

<table>
<thead>
<tr>
<th>( \nu )</th>
<th>0.01</th>
<th>0.025</th>
<th>0.05</th>
<th>0.90</th>
<th>0.95</th>
<th>0.975</th>
<th>0.99</th>
<th>0.995</th>
<th>0.999</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.01571</td>
<td>0.019821</td>
<td>0.023932</td>
<td>2.706</td>
<td>3.841</td>
<td>5.024</td>
<td>6.635</td>
<td>7.879</td>
<td>10.83</td>
</tr>
<tr>
<td>2</td>
<td>0.02010</td>
<td>0.05064</td>
<td>0.1026</td>
<td>4.605</td>
<td>5.991</td>
<td>7.378</td>
<td>9.210</td>
<td>10.60</td>
<td>13.82</td>
</tr>
</tbody>
</table>

\( 3.303 \times 10^{-3} \leq 2.906 \)

Do not reject \( H_0 \).

Insufficient evidence to suggest gender and results are dependent.