Ex: A simple random sample of 200 Utah schoolchildren were asked whether or not they like math. 102 kids were boys, 41 of whom said they liked math. The other 98 were girls, 29 of whom said they like math. Is liking math independent of gender for Utah schoolchildren?

<table>
<thead>
<tr>
<th>Obs</th>
<th>Exp</th>
<th>Like Math</th>
<th>Don't Like Math</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>41</td>
<td>36</td>
<td>61</td>
<td>102</td>
</tr>
<tr>
<td>Girls</td>
<td>29</td>
<td>34</td>
<td>69</td>
<td>98</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>130</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{Expected: } \frac{70 \cdot 102}{200} = 36 \quad \frac{130 \cdot 102}{200} = 66 \\
\frac{70 \cdot 98}{200} = 34 \quad \frac{130 \cdot 98}{200} = 64
\]

① Null: Gender and liking math are independent, i.e., boxes are the same
Alternative: Gender and liking math are not independent, i.e., boxes are different

② \[
\chi^2 = \frac{(41-36)^2}{36} + \frac{(61-66)^2}{66} + \frac{(29-34)^2}{34} + \frac{(69-64)^2}{64}
\]

\[
= 2.2
\]

③ \[
\# \text{ df} = (2-1) \cdot (2-1) = 1
\]

④ \[
\chi^2 = 2.2 \text{ is between } 1.07 \text{ and } 2.71
\]

\[
\sqrt{\frac{1}{0.10}} \quad \sqrt{\frac{1}{0.01}}
\]

\[
\rightarrow \text{p-value is somewhere between 10% and 30%}
\]

⑤ P-value is greater than 5% \n→ do not reject null hypothesis
→ Gender and liking math are independent