Example 1

H_0: The type of music being played has no effect on wine sales.
H_a: The type of music being played has an effect on wine sales.
T.S.

$$\begin{aligned}\chi^2 &= \sum_i \sum_j \frac{O_{ij}^2}{E_{ij}} - n \\ &= \frac{30^2}{34.2} + \frac{39^2}{30.6} + \frac{30^2}{34.2} + \frac{11^2}{10.7} + \frac{1^2}{9.6} + \frac{19^2}{10.7} + \frac{43^2}{39} + \frac{35^2}{34.9} + \frac{35^2}{39} - 243 \\ &= 18.45\end{aligned}$$

$$\nu = (k-1)(r-1) = (3-1)(3-1) = 4$$

R.R.
For $\alpha = 5\%$, reject H_0 if $\chi^2 > \chi^2_{.05}(4) = 9.49$
Conclusion:
Since observed $\chi^2 > 9.49$, we can reject H_0 at 5% level of significance and conclude that wine sales depend on the type of music being played.

Example 2

H_0 : A die is fair. or $p_i = \frac{1}{6}, \quad i = 1, \cdots, 6$
H_a : A die is not fair.
T.S.

$$E_i = np_i = 360 \times \frac{1}{6} = 60 \quad i = 1, \cdots, 6$$

$$\begin{aligned}\chi^2 &= \sum \frac{(O_i - E_i)^2}{E_i} \\ &= \frac{(49-60)^2}{60} + \frac{(52-60)^2}{60} + \frac{(47-60)^2}{60} + \frac{(71-60)^2}{60} + \frac{(73-60)^2}{60} + \frac{(68-60)^2}{60} \\ &= \frac{121+64+169+121+49+64}{60} = \frac{708}{60} \approx 11.8\end{aligned}$$

$$\nu = k - 1 - r = 6 - 1 - 0 = 5$$

R. R.: Reject H_0 if $\chi^2 > \chi^2_{.05}(5) = 11.07$
Conclusion: Since the observed χ^2 is very close to critical value at 5% level of siginficance, we need to be very careful to make a decision.

Example 3 See excel file.