13.9 Appendix: Example of the Use of R

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Here we briefly indicate how R can be used to perform the chi-squared analysis for the test for independence using Mendel's data on garden peas. The data, as discussed in Section **??**, should be entered as a matrix.

```
> mendel = matrix(c(38, 60, 28, 65, 138, 68, 35, 67, 30), 3, 3)
```

Then we can use the `chisq.test` command to calculate the expected values and the $\mathcal{X}^2$ value.

```
> mendel.chisq = chisq.test(mendel)
> mendel.chisq

        Pearson's Chi-squared test

data:  mendel
X-squared = 1.8571, df = 4, p-value = 0.762
```

We can examine the object `mendel.chisq` that we just created to find the expected values and contributions to the chi-squared:

```
> mendel.chisq$expect

         [,1]      [,2]     [,3]
[1,] 32.86957  70.69565 34.43478
[2,] 63.11909 135.75614 66.12476
[3,] 30.01134  64.54820 31.44045

> mendel.chisq$resid^2

          [,1]       [,2]        [,3]
[1,] 0.8007821 0.45887481 0.009277558
[2,] 0.1541331 0.03708776 0.011584746
[3,] 0.1347989 0.18458909 0.065994812
```

The expected values listed above are all greater than 5, and so the approximation is appropriate. The p-value is not significant, and all of the contributions to chi-squared are below 1.

The above illustrates the use of R for testing independence. As we have stressed throughout this chapter, the chi-squared *test* for homogeneity is identical, although the *inference* is somewhat different. Thus, the R `chisq.test` command can be used to test both independence and homogeneity.