

## 15: Chi Squared- Goodness of Fit and Contingency Tables

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Recall that the  $\chi^2$  is essentially the distribution of sample variances  $s^2$  from a normal population. It has three important applications (there are others) :

1. Hypothesis test of population variance (covered in [Section 9.5](#)).
2. Model fitting through  $\chi^2 = SS_{\text{error}}$  (not covered in this course).
3. Hypothesis test of frequencies :
  - a) Goodness of fit
  - b) contingency tables.

Here we focus on the last application. We will use the  $\chi^2$  statistic to compare the measured (or observed) statistic with expected ( $H_0$ ) frequencies. The difference of observed and expected frequencies squared represents a variance. If the difference between observed and expected frequencies is due to noise, which will have some sort of binomial distribution, then we expect the  $\chi^2$  statistic to be low. If the difference between observed and expected frequencies is large then there must be an effect other than noise that is causing that difference.

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