

Suppose a significance level of  $\alpha = 0.01$  has been specified and our sample size is 14. If we reject the null hypothesis for large values of the test statistic, we look in the table under the column labeled  $\chi^2_{0.010}$  and find the critical value corresponding to  $14 - 1$ , or 13 degrees of freedom. The corresponding critical value is 27.688, as shown in Figure 16.1.3.

$df$	...	$\chi^2_{0.050}$	$\chi^2_{0.025}$	$\chi^2_{0.010}$
1		3.841	5.024	6.635
2		5.991	7.378	9.210
3		7.815	9.348	11.345
...				
13		22.362	24.736	27.688
14		23.685	26.119	29.141
...				

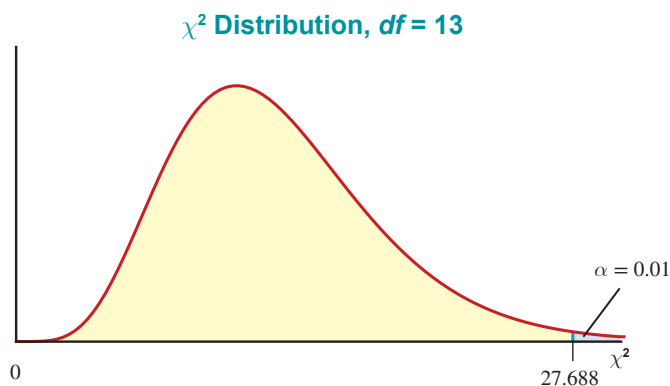


Figure 16.1.3

The analysis in the remainder of the chapter deals with comparing the *actual* number of observations falling into a particular category with the number of observations that is *expected* to fall in that category, based on our hypothesis. In certain circumstances, this type of formulation can be evaluated with a chi-square distribution.

## 16.1 Exercises

### Basic Concepts

- Describe the shape of the chi-square distribution.
- What is the sampling distribution of the sample variance?
- What are the degrees of freedom associated with the chi-square distribution?
- Can a chi-square statistic ever be negative? Explain why or why not.
- Describe how the chi-square distribution changes in shape as  $n$  becomes large.
- Explain the meaning of  $\chi^2_{\alpha}$ .
- Explain the procedure for determining chi-square critical values.

### Exercises

- Find the chi-square critical value for each of the following.
  - $\alpha = 0.01$ ,  $df = 14$
  - $\alpha = 0.01$ ,  $df = 26$
  - $\alpha = 0.05$ ,  $df = 4$
  - $\alpha = 0.05$ ,  $df = 9$
  - $\alpha = 0.005$ ,  $df = 12$

9. Find the chi-square critical value for each of the following.
- $\alpha = 0.005, df = 21$
  - $\alpha = 0.025, df = 16$
  - $\alpha = 0.025, df = 1$
  - $\alpha = 0.10, df = 90$
  - $\alpha = 0.10, df = 17$
10. Find the chi-square critical value for each of the following.
- $\alpha = 0.01, df = 10$
  - $\alpha = 0.01, df = 21$
  - $\alpha = 0.05, df = 6$
  - $\alpha = 0.05, df = 11$
  - $\alpha = 0.005, df = 29$
11. Find the chi-square critical value for each of the following.
- $\alpha = 0.005, df = 40$
  - $\alpha = 0.025, df = 15$
  - $\alpha = 0.025, df = 2$
  - $\alpha = 0.10, df = 24$
  - $\alpha = 0.10, df = 50$
12. Suppose that a marketing manager is studying sales data for products that are not available in stores and only sold on television. She collects the following weekly sales data for 10 products not sold in stores. Assume the population standard deviation for these data is \$5000.

Weekly Sales Figures			
Product	Weekly Sales (\$)	Product	Weekly Sales (\$)
1	26,259	6	22,511
2	18,514	7	29,753
3	21,579	8	20,235
4	18,739	9	16,258
5	27,821	10	15,990

- Compute the sample standard deviation for these data. Round your answer to the nearest dollar.
  - Compute the value of  $\chi^2$ . Round your answer to three decimal places.
  - How many degrees of freedom are associated with this chi-square distribution?
  - What is the value of  $\chi_{0.05}^2$  for these data?
13. Michael is studying 30-year fixed mortgage rates in Myrtle Beach, SC. He got quotes from 8 lenders, and the APR rates that were quoted to him are given in the following table.

30-Year Fixed Mortgage Rates	
Lender	APR (%)
EverBank	3.918
AimLoan	3.925
Great Western	4.062
Greenlight	4.353
Flagstar	4.350
AuroraBank	4.040
Quicken	4.458
Roundpoint	4.125

- Calculate the variance of the sample. Round your answer to six decimal places.
- Assuming the population standard deviation for the rates is 0.1%, calculate the value of  $\chi^2$ .
- Determine the value of  $\chi_{0.025}^2$  for these data.