20. Do World War II Bomb Hits Fit a Poisson Distribution? In analyzing hits by V-1 buzz bombs in World War II, South London was subdivided into regions, each with an area of 0.25 km^2. Shown below is a table of actual frequencies of hits and the frequencies expected with the Poisson distribution. (The Poisson distribution is described in Section 5-5.) Use the values listed and a 0.05 significance level to test the claim that the actual frequencies fit a Poisson distribution.

Number of Bomb Hits	0	1	2	3	4 or more
Actual Number of Regions	229	211	93	35	8
Expected Number of Regions (from Poisson Distribution)	227.5	211.4	97.9	30.5	8.7

Benford's Law. According to Benford's law, a variety of different data sets include numbers with leading (first) digits that follow the distribution shown in the table below. In Exercises 21–24, test for goodness-of-fit with Benford's law.

Leading Digit	1	2	3	4	5	6	7	8	9
Benford's Law: Distribution of Leading Digits	30.1%	17.6%	12.5%	9.7%	7.9%	6.7%	5.8%	5.1%	4.6%

21. Detecting Fraud When working for the Brooklyn district attorney, investigator Robert Burton analyzed the leading digits of the amounts from 784 checks issued by seven suspect companies. The frequencies were found to be 0, 15, 0, 76, 479, 183, 8, 23, and 0, and those digits correspond to the leading digits of 1, 2, 3, 4, 5, 6, 7, 8, and 9, respectively. If the observed frequencies are substantially different from the frequencies expected with Benford's law, the check amounts appear to result from fraud. Use a 0.01 significance level to test for goodness-of-fit with Benford's law. Does it appear that the checks are the result of fraud?

22. Author's Check Amounts Exercise 21 lists the observed frequencies of leading digits from amounts on checks from seven suspect companies. Here are the observed frequencies of the leading digits from the amounts on checks written by the author: 68, 40, 18, 19, 8, 20, 6, 9, 12. (Those observed frequencies correspond to the leading digits of 1, 2, 3, 4, 5, 6, 7, 8, and 9, respectively.) Using a 0.05 significance level, test the claim that these leading digits are from a population of leading digits that conform to Benford's law. Do the author's check amounts appear to be legitimate?

23. Tax Cheating? Frequencies of leading digits from IRS tax files are 152, 89, 63, 48, 39, 40, 28, 25, and 27 (corresponding to the leading digits of 1, 2, 3, 4, 5, 6, 7, 8, and 9 respectively, based on data from Mark Nigrini, who sells software for Benford data analysis). Using a 0.05 significance level, test for goodness-of-fit with Benford's law. Does it appear that the tax entries are legitimate?

24. Author's Computer Files The author recorded the leading digits of the sizes of the files stored on his computer, and the leading digits have frequencies of 45, 32, 18, 12, 9, 3, 13, 9, and 9 (corresponding to the leading digits of 1, 2, 3, 4, 5, 6, 7, 8, and 9, respectively). Using a 0.05 significance level, test for goodness-of-fit with Benford's law.

11-2 Beyond the Basics

25. Testing Goodness-of-Fit with a Normal Distribution Refer to Data Set 1 in Appendix B for the 40 heights of females.

Height (cm)	Less than 155.410	155.410–162.005	162.005–168.601	Greater than 168.601
Frequency				