EXERCISES FOR SECTION 4-4

4-39. The yield of a chemical process is being studied. From previous experience with this process the standard deviation of yield is known to be ~~3~~. The past 5 days of plant operation have resulted in the following yields: 91.6, 88.75, 90.8, 89.95, and 91.3%. Use $\alpha = 0.05$.

(a) Is there evidence that the mean yield is not 90%? Use the *P*-value approach.

(b) What ~~sample size~~ would be required to detect a true mean yield of 85% with probability ~~0.95~~?

(c) What is the type II error probability if the true mean yield is 92%?

(d) Find a 95% two-sided CI on the true mean yield.

(e) Use the CI found in part (d) to test the hypothesis.

EXERCISES FOR SECTION 4-4

4-42. The life in hours of a thermocouple used in a furnace is known to be approximately normally distributed, with standard deviation $\sigma = 20$ hours. A random sample of 15 thermocouples resulted in the following data: 553, 552, 567, 579, 550, 541, 537, 553, 552, 546, 538, 553, 581, 539, 529.

(a) Is there evidence to support the claim that mean life exceeds 540 hours? Use a fixed-level test with $\alpha = 0.05$.

(b) What is the P-value for this test?

(c) What is the β-value for this test if the true mean life is 560 hours?

(d) What ~~sample size~~ would be required to ensure that β does not exceed 0.10 if the true mean life is 560 hours?

(e) Construct a 95% one-sided lower CI on the mean life.

(f) Use the CI found in part (e) to test the hypothesis.

EXERCISES FOR SECTION 4-4

4-44. Suppose that in Exercise 4-42 we wanted to be ~~95%~~ confident that the ~~error~~ in estimating the mean life is less than 5 hours. What ~~sample size~~ should we use?

EXERCISES FOR SECTION 4-5

4-58. A particular brand of diet margarine was analyzed to determine the level of polyunsaturated fatty acid (in percent). A sample of six packages resulted in the following data: 16.8, 17.2, 17.4, 16.9, 16.5, and 17.1.

(a) It is important to determine if the mean is not 17.0. Test an appropriate hypothesis, using the P-value approach. What are your conclusions? Use a normal probability plot to test the normality assumption.

(b) Suppose that if the mean polyunsaturated fatty acid content is $\mu = 17.5$, it is important to detect this with probability at least 0.90. Is the sample size $n = 6$ adequate? Use the sample standard deviation to estimate the population standard deviation σ. Use $\alpha = 0.01$.

(c) Find a 99% two-sided CI on the mean μ. Provide a practical interpretation of this interval.

EXERCISES FOR SECTION 4-5

4-59. In building electronic circuitry, the breakdown voltage of diodes is an important quality characteristic. The breakdown voltage of 12 diodes was recorded as follows: 9.099, 9.174, 9.327, 9.377, 8.471, 9.575, 9.514, 8.928, 8.800, 8.920, 9.913, and 8.306.

(a) Check the normality assumption for the data.

(b) Test the claim that the mean breakdown voltage is less than 9 volts with a significance level of 0.05.

(c) Construct a 95% one-sided upper confidence bound on the mean breakdown voltage.

(d) Use the bound found in part (c) to test the hypothesis.

(e) Suppose that the true breakdown voltage is 8.8 volts; it is important to detect this with a probability of at least 0.95. Using the sample standard deviation to estimate the population standard deviation and a significance level of 0.05, determine ~~the necessary sample size~~.

EXERCISES FOR SECTION 4-6

4-71. The percentage of titanium in an alloy used in aerospace castings is measured in 51 randomly selected parts. The sample standard deviation is $s = 0.37$.

(a) Test the hypothesis $H_0\colon \sigma = 0.35$ versus $H_1\colon \sigma \neq 0.35$ using $\alpha = 0.05$. State any necessary assumptions about the underlying distribution of the data.

(b) Find the P-value for this test.

(c) Construct a 95% two-sided CI for σ.

(d) Use the CI in part (c) to test the hypothesis.

EXERCISES FOR SECTION 4-7

4-75. Large passenger vans are thought to have a high propensity of rollover accidents when fully loaded. Thirty accidents of these vans were examined, and 11 vans had rolled over.

(a) Test the claim that the proportion of rollovers exceeds 0.25 with $\alpha = 0.10$.

(b) Suppose that the true $p = 0.35$ and $\alpha = 0.10$. What is ~~the~~ β-error for this test?

(c) Suppose that the true $p = 0.35$ and $\alpha = 0.10$. How large ~~a sample~~ would be required if we want $\beta = 0.10$?

(d) Find ~~a~~ 90% traditional lower confidence bound on the rollover rate of these vans.

(e) Use the confidence bound found in part (d) to test the hypothesis.

(f) How large ~~a sample~~ would be required to be at least 95% confident that the ~~error~~ on p is less than 0.02? Use an initial estimate of p from this problem.

EXERCISES FOR SECTION 4-7

4-76. A random sample of 50 suspension helmets used by motorcycle riders and automobile race-car drivers was subjected to an impact test, and on 18 of these helmets some damage was observed.

(a) Test the hypotheses H_0: $p = 0.3$ versus H_1: $p \neq 0.3$ with $\alpha = 0.05$.

(b) Find ~~the~~ P-value for this test.

(c) Find ~~a~~ 95% two-sided traditional CI on the true proportion of helmets of this type that would show damage from this test. Explain how this confidence interval can be used to test the hypothesis in part (a).

(d) Using the point estimate of p obtained from the preliminary sample of 50 helmets, how ~~many helmets~~ must be tested to be ~~95%~~ confident that the ~~error~~ in estimating the true value of p is less than 0.02?

(e) How large must ~~the sample~~ be if we wish to be at least 95% confident that the ~~error~~ in estimating p is less than 0.02, regardless of the true value of p?

4-89. Consider the helmet data given in Exercise 4-76. Calculate ~~the~~ 95% Agresti-Coull two-sided CI from equation 4-76 and compare it to ~~the~~ traditional ~~CI~~ in the original exercise.

4-94. Consider the fatty acid content of margarine described in Exercise 4-58.

(a) Construct a 95% ~~PI~~ for the fatty acid content of a single package of margarine.

(b) Find ~~a~~ tolerance interval for the fatty acid content that includes ~~95%~~ of the margarine packages with 99% confidence.