Statistical Analysis

BAS331 – BAS332

Assignment 4

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TA:

Chapter 3

Test of Hypotheses for one parameter

μ, σ^2, σ and p.

1] An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with a mean of 800 and a standard deviation of 40 hours. if a random sample of 30 bulbs has an average life of 780 hours.

(a) Test the hypothesis that $\mu=800$ against the alternative $\mu \neq 800$ hours Use a 5 % level of significance.

(b) Compute and interpret the P-value.

2] A random sample of size 20 from a normal distribution has a mean $\bar{\mathbf{X}} = 32.8$ and a standard deviation s = 4.51.

(a) Does this suggest, at 0.05 level of significance, that the population mean is greater than

(b) Test the hypothesis that $\sigma^2 = 20$ against the alternative $\sigma^2 > 20$. Use $\alpha = 0.05$

3] A sample of eight observations is selected at random from a normal distribution whose variance is 25. Their mean is calculated, and found to be 11.1.

(a) Test the hypothesis that the true value of the population mean is 10. Use $\alpha = 0.05$.

(b) Compute and interpret the P-value.

4] Given that X is normally distributed and given the sample values: $\bar{\mathbf{X}} = 42$, S = 6 and n =20,

(a) Test the hypothesis that $\mu = 44$. (Use $\alpha = 0.05$).

(b) Test the hypothesis that $\sigma^2 = 30$ against the alternative that $\sigma^2 \neq 30$. (Use $\alpha = 0.05$)

5] The volume of containers of a particular lubricant is thought to be normally distributed with mean 10 and variance of 0.03 liter. If the contents of a random sample of 10 containers are as follows:

10.2, 9.7, 10.1, 10.3, 10.1, 9.8, 9.8, 10.4, 10.3, 9.8 ounces.

(a) Test the hypothesis that $\mu =10$ against the alternative $\mu \neq 10$ hours Use a 1 % level of significance.

(b) Test the hypothesis that $\sigma^2 = 0.03$ against the alternative that $\sigma^2 \neq 0.03$ Use 0.01 level of significance.

6] Scientists have labeled benzene, a chemical solvent commonly used to synthesize plastics, as a possible cancer-causing agent. Studies have shown that people who work with benzene more than 5 years have 20 times the incidence of leukemia than the general population. As a result, the federal government has lowered the maximum allowable level of benzene in the workplace from 10 parts per million (ppm) to 1 ppm. Suppose a steel manufacturing plant, which exposes its workers to benzene daily, is under investigation by the Occupational Safety and Health Administration (OSHA). Twenty air samples, collected over a period of 1 month and examined for benzene content, yielded the data in Table (1).

(a) Test the hypothesis that the mean level of benzene at the steel manufacturing plant is greater than 1 ppm. Use a 0.05 level of significance.

(b) Test the hypothesis that the standard deviation of benzene at the steel manufacturing plant is less than 1.7 ppm. Use a 0.05 level of significance.

0.21	1.44	2.54	2.97	0.00	3.91	2.24	2.41	4.50	0.15
5.03	0.00	2.89	4.71	0.85	2.60	1.26	4.50	0.36	0.30

Table (1): Benzene Content for 20 Air Samples

7] A team of doctors claim to have developed a medicine that will with 80% effectiveness stop the growth of a skin cancer on rats. To test the medicine on a wide scale, a random sample of 400 cancer-infected rats is treated. The cancer growth was entirely stopped on 310 rats.

(a) Test against their claim, using $\alpha = 0.05$.

(b) Compute and interpret the P-value.

8] A builder claims that heat pumps are installed in 70% of all homes being constructed today in the city of Richmond. Would you agree with this claim if a random survey of new homes in this city shows that 8 out of 15 had heat pumps installed? Use a 0.01 level of significance.

9] Annual survey of computer crimes. The Computer Security Institute (CSI) conducts an annual survey of computer crime at United States businesses. CSI sends survey questionnaires to computer security personnel at all U.S. corporations and government agencies. A total of 351 organizations responded to the 2010 CSI survey. Of these, 144 admitted unauthorized use of computer systems at their firms during the year. (CSI Computer Crime and Security Survey, 2010/2011.) Let p represent the true proportion of U.S. organizations that experience unauthorized use of computer systems at their firms.

(a) Test the hypothesis that the value of p differs from 0.35. Use $\alpha = 0.05$.

(b) Find the p-value of the test and confirm that the conclusion based on the p-value agrees with the conclusion in part **(a)**

10] A wiki is a web information depository with content that can be updated and edited through a web browser. Engineering faculty at a university in Portugal investigated the degree to which wiki tools are accepted in an academic environment (Computer Applications in Engineering Education, Vol. 20, 2012). An online survey was made available to both professors and students that were involved in engineering courses that make use of a wiki-based tool. A total of 136 students responded to the survey. One of the survey questions asked, “Have you ever edited content in a wiki-based tool?” Of the 136 respondents, 72 answered “yes”.

(a) Do the survey results support the claim that more than half of engineering students edit content in wiki-based tools? Use $\alpha = 0.1$.

(b) Find the p-value of the test and confirm that the conclusion based on the p-value agrees with the conclusion in part **(a)**

11] For safety reasons, calf dehorning has become a routine practice at dairy farms. A 2009 report by Europe’s Standing Committee on the Food Chain and Animal Health (SANKO) stated that 80% of European dairy farms carry out calf dehorning. A later study, published in

the Journal of Dairy Science (Vol. 94, 2011), found that in a sample of 639 Italian dairy farms, 515 dehorn calves. Does the Journal of Dairy Science study support or refute the figure reported by SANKO? Explain.

12] The mean water temperature downstream from a power plant cooling tower discharge pipe should be no more than 100°F. Past experience has indicated that the standard deviation of temperature is 2°F. The water temperature is measured on nine randomly chosen days, and the average temperature is found to be 98°F.

(a) Should the water temperature be judged acceptable with $\alpha = 0.05$?

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

13] The life in hours of a battery is known to be approximately normally distributed, with standard deviation of 1.25 hours. A random sample of 10 batteries has a mean life of 40.5 hours.

(a) Is there evidence to support the claim that battery life exceeds 40 hours? Use $\alpha = 0.05$.

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

14] A 1992 article in the Journal of the American Medical Association ("A Critical Appraisal of 98.6 Degrees F, the Upper Limit of the Normal Body Temperature, and Other Legacies of Carl Reinhold August Wundrlich") reported body temperature, gender, and heart rate for a number of subjects. The body temperatures for 25 female subjects follow:

97.8	97.2	97.4	97.6	97.8	97.9	98.0	98.0	98.0
98.2	98.3	98.3	98.4	98.4	98.4	98.5	98.6	98.6
98.8	98.8	98.9	98.9	99.0	98.1	98.7		

(a) Test the hypothesis that $\mu = 98.6$ against the alternative $\mu \neq 98.6$ hours Use a 5 % level of significance.

(b) Explain how the question in part **(a)** could be answered by constructing a 95% confidence interval on the mean female body temperature.

(c) Test the hypothesis that $\sigma^2 = 0.03$ against the alternative that $\sigma^2 \neq 0.03$ Use 0.01 level of significance.
