HomeWork 6: Inference (Chapters 7, 8 & 10)

Part I (Estimation)

Q1.

A random sample of 12 shearing pins is taken in a study of the Rockwell hardness of the head on the pin. Measurements on the Rockwell hardness were made for each of the 12, yielding an average value of 48.50 with a sample standard deviation of 1.5. Assuming the measurements to be normally distributed, construct a 90% confidence interval for the mean Rockwell hardness.

Q2.

An efficiency expert wishes to determine the average time that it takes to drill three holes in a certain metal clamp. How large a sample will he need to be 95% confident that his sample mean will be within 15 seconds of the true mean? Assume that it is known from previous studies that σ = 40 seconds.

Q3.

A random sample of size n_1 = 25 taken from a normal population with a standard deviation σ_1 = 5 has a mean $\bar{x}_1$ = 80. A second random sample of size n_2 = 36, taken from a different normal population with a standard deviation σ_2 = 3, has a mean $\bar{x}_2$ = 75. Find a *94%* confidence interval for $\mu_1 - \mu_2$.

Q4.

An experiment reported in *Popular Science* compared fuel economics for two types of similarly equipped diesel mini-trucks. Let us suppose that 12 Volkswagen and 10 Toyota trucks are: used in 90- kilometer per hour steady-spaced tests. If the 12 Volkswagen trucks average 16 kilometers per liter with a standard deviation of 1.0 kilometer per liter and the 10 Toyota trucks average 11 kilometers per liter with a standard deviation of 0.8 kilometer per liter, construct a 90% confidence interval for the difference between the average kilometers per liter of these two mini-trucks. Assume that the distances per liter for each truck model are approximately normally distributed with equal variances.

Q5.

(a). Compute a 98% confidence interval for the proportion of defective items in a process when it is found that a sample of size 100 yields 8 defectives.

(b). With reference to part (a), how large a sample is needed if we wish to be 98% confident that our sample proportion will be within 0.05 of the true proportion defective?

Part II (Testing)

Q1.

Recently many companies have been experimenting with telecommuting, allowing employees to work at home on their computers. Among other things, telecommuting is supposed to reduce the number of sick days taken. Suppose that at one firm, it is known that over the past few years employees have taken a mean of 5.4 sick days. This year, the firm introduces telecommuting. Management chooses a simple random sample of 80 employees to follow in detail, and, at the end of the year, these employees average 4.5 sick days with a standard deviation of 2.7 days. Let μ represent the mean number of sick days for all employees of the firm.

(a). Find the *P*-value for testing $H0 : \mu \geq 5.4$ versus $H1 : \mu < 5.4$.

(b). Do you believe it is plausible that the mean number of sick days is at least 5.4, or are you convinced that it is less than 5.4? Explain your reasoning.

Q2.

Using a 0.01 level of significance, test the hypothesis that the average content of containers of a particular lubricant is 10 liters if the contents of a random sample of 10 containers are 10.2, 9.7, 10.1, 10.3, 10.1, 9.8, 9.9, 10.4, 10.3, and 9.8 liters. Assume that the distribution of contents is normal.

Q3

A random sample of 300 electronic components manufactured by a certain process are tested, and 25 are found to be defective. Let p represent the proportion of components manufactured by this process that are defective. The process engineer claims that $p \leq 0.05$. Does the sample provide enough evidence to reject the claim? Use p-value approach to decide.

Q4.

An experiment was performed to compare the abrasive wear of two different laminated materials. Twelve pieces of material 1 were tested by exposing each piece to a machine measuring wear. Ten pieces of material 2 were similarly tested. In each case, the depth of wear was observed. The samples of material 1 gave an average (coded) wear of 85 units with a sample standard deviation of 4, while the samples of material 2 gave an average of 81 and a sample standard deviation of 5. Assume the populations to be approximately normal with equal variances.

a) Can we conclude at the 0.05 level of significance that the abrasive wear of material 1 exceeds that of material 2 by more than 2 units?
b) Repeat part (a) if $n1=n2=60$.

Q5.

In a sample of 150 households in a certain city, 110 had high-speed internet access. Can you conclude that more than 70% of the households in this city have high-speed internet access? Use Rejection region approach to conclude.