MT-A403-01                 Exam Three                 Spring 2000

You may keep this list of questions. Turn in all of your work with your answers on the colored paper.

(1) 16 Points. A random sample of size 225 is taken from an infinite population having population mean 23.70 and population variance 16.00. Find the probability that a sample mean from this population will have a value that is between 23.5 and 24.1.

(2) 16 Points. For a certain process for making bearings, a random sample of 9 bearings is selected. The bearings in this sample had a mean diameter of 0.5003 cm with a standard deviation of 0.0105 cm. Assume that the bearing diameters have a normal distribution. Construct a 95% confidence interval for the mean diameter of all bearings made by this process.

(3) 16 Points. A random sample of 12 observations is taken from a normal population having population variance $\sigma^2 = 50.00$. Find the approximate probability of finding a sample standard deviation $s$ that is between 4.165 and 9.457.

(4) 16 Points. Tests performed with a random sample of 20 diesel engines produced by a large manufacturer found that the sample engines had a mean thermal efficiency of 31.75% with a sample standard deviation of 1.5%. At the 0.05 level of significance, test the null hypothesis $\mu = 32.0\%$ against the alternative hypothesis $\mu \neq 32.0\%$. Show your work. What important assumption will you need to make in order to justify this hypothesis test?
(5) 24 Points. A random regression sample of size \( n = 250 \) was collected from a bivariate normal population and the following sums were calculated:

\[
\begin{align*}
\sum x_i &= 600.0 \\
\sum y_i &= 1375.0 \\
\sum x_i^2 &= 1740.0 \\
\sum x_i y_i &= 3382.5 \\
\sum y_i^2 &= 8562.5
\end{align*}
\]

(a) Find the equation for the estimated regression line.

(b) Find the sample correlation coefficient.

(c) We use this sample for the hypothesis test

\[
H_0 : \rho = 0 \quad H_1 : \rho \neq 0
\]

Should we accept or reject the null hypothesis at the 1% level of significance? Show your work!

(6) 12 Points. Write a brief essay in which you answer the following questions. What is a Type I error? What is a Type II error? How can we avoid Type I errors? How can we avoid Type II errors?

Final Exam
Friday, May 12
12:00 – 1:50