Tutorial 8

7.3 An industrial engineer collected data on the labor time required to produce an order of automobile mufflers using a heavy stamping machine. The data on times (hours) for $n = 52$ orders of different parts

2.15	2.27	0.99	0.63	2.45	1.30	2.63	2.20	0.99	1.00	1.05
3.44	0.49	0.93	2.52	1.05	1.39	1.22	3.17	0.85	1.18	2.27
1.52	0.48	1.33	4.20	1.37	2.70	0.63	1.13	3.81	0.20	1.08
2.92	2.87	2.62	1.03	2.76	0.97	0.78	4.68	5.20	1.90	0.55
1.00	2.95	0.45	0.70	2.43	3.65	4.55	0.33			

has $\bar{x} = 1.865$ hours and $s^2 = 1.5623$ so $s = 1.250$ hours. What can one assert with 95% confidence about the maximum error if $\bar{x} = 1.865$ hours is used as a point estimate of the true population mean labor time required to run the heavy stamping machine?

7.4 With reference to the previous exercise, construct a 95% confidence interval for the true population mean labor time.

7.10 If we want to determine the average mechanical aptitude of a large group of workers, how large a random sample will we need to be able to assert with probability 0.95 that the sample mean will not differ from the true mean by more than 3.0 points? Assume that it is known from past experience that $\sigma = 20.0$.

7.11 The dean of a college wants to use the mean of a random sample to estimate the average amount of time students take to get from one class to the next, and she wants to be able to assert with 99% confidence that the error is at most 0.25 minute. If it can be presumed from experience that $\sigma = 1.40$ minutes, how large a sample will she have to take?

Tutorial 8

7.12 One novel process of making green gasoline takes biomass in the form of sucrose and converts it into gasoline using catalytic reactions. At one step in a pilot plant process, a chemical engineer measures the output of carbon chains of length three. Nine runs with same catalyst produced the yields (gal)

0.63 2.64 1.85 1.68 1.09 1.67 0.73 1.04 0.68

What can the chemical engineer assert with 95% confidence about the maximum error if she uses the sample mean to estimate true mean yield?

7.13 With reference to the previous exercise, assume that yield has a normal distribution and obtain a 95% confidence interval for the true mean yield of the pilot plant process.

7.14 To monitor complex chemical processes, chemical engineers will consider key process indicators, which may be just yield but most often depend on several quantities. Before trying to improve a process, $n = 9$ measurements were made on a key performance indicator.

123 106 114 128 113 109 120 102 111

What can the engineer assert with 95% confidence about the maximum error if he uses the sample mean to estimate true mean value of the performance indicator?

7.15 With reference to the previous exercise, assume that the key performance indicator has a normal distribution and obtain a 95% confidence interval for the true value of the indicator.

Tutorial 8

7.20 Ten bearings made by a certain process have a mean diameter of 0.5060 cm and a standard deviation of 0.0040 cm. Assuming that the data may be looked upon as a random sample from a normal population, construct a 95% confidence interval for the actual average diameter of bearings made by this process.

7.21 The freshness of produce at a mega-store is rated a scale of 1 to 5, with 5 being very fresh. From a random sample of 36 customers, the average score was 3.5 with a standard deviation of 0.8.

(a) Obtain a 90% confidence interval for the population mean, μ, or the mean score for all customers.

(b) Does μ lie in your interval obtained in part (a)? Explain.

(c) In long series of repeated experiments, with new random samples collected for each experiment, what proportion of the resulting confidence intervals will contain the true population mean? Explain your reasoning.

7.23 A sample of maximum pressure from 12 trials with a stamping machine yielded a mean of 7.2 thousand psi and a standard deviation of 1.2 thousand psi.

(a) Obtain a 95% confidence interval for the population mean of maximum pressure μ.

(b) Is the population mean contained in your interval in part (a)? Explain.

(c) What did you assume about the population in your answer to part (a)?

(d) Why are you 95% confident about the interval in part (a)?

Tutorial 8

7.24 In an air-pollution study performed at an experiment station, the following amount of suspended benzene-soluble organic matter (in micrograms per cubic meter) was obtained for eight different samples of air:

2.2 1.8 3.1 2.0 2.4 2.0 2.1 1.2

Assuming that the population sampled is normal, construct a 95% confidence interval for the corresponding true mean.

7.27 Suppose that we observe a random variable having the binomial distribution. Let X be the number of successes in n trials.

(a) Show that $\frac{X}{n}$ is an unbiased estimate of the binomial parameter p.

(b) Show that $\frac{X+1}{n+2}$ is not an unbiased estimate of the binomial parameter p.