

University of California, Los Angeles  
Department of Statistics

Statistics 13

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Homework 5

**EXERCISE 1**

Recently there have been discussions about constructing a subway system that would run from Downtown Los Angeles to Santa Monica through Wilshire Boulevard. Suppose a random sample of 900 voters in Hollywood indicates that 600 support such an idea.

- a. Construct a 95% confidence interval for the Hollywood population proportion of residents who would support this idea.
- b. Suppose that the City of Los Angeles wants to estimate with 95% confidence the percentage of residents who would support this idea in Hollywood. The city wants the error of estimation to be  $\pm 2\%$  of the population proportion. What is the minimum sample size required?
- c. Suppose that the City of Los Angeles wants to estimate with 95% confidence the percentage of residents who would support this idea in Westwood. The city wants the error of estimation to be  $\pm 2\%$  of the population proportion. What is the minimum sample size required? Assume that there is no prior information about the population proportion.

**EXERCISE 2**

The following 16 numbers came from a normal random number generator on a computer

5.3299	4.2537	3.1502	3.7032	1.6070	6.3923	3.1181	6.5941
3.5281	4.7433	0.1077	1.5977	5.4920	1.7220	4.1547	2.2799

- a. What would you guess the mean and variance ( $\mu$  and  $\sigma^2$ ) of the generating normal distribution were?
- b. Give 90%, 95%, and 99% confidence intervals for  $\mu$ .
- c. How much larger a sample do you think you would need to halve the length of the interval for  $\mu$ ?

**EXERCISE 3**

A sample of 9 instrument readings on the same object using a precision instrument yielded the measurements:

5.2, 4.4, 4.8, 3.6, 3.1, 6.2, 5.8, 5.1, and 3.2.

- a. Construct a 99% confidence interval for the population mean.
- b. What assumption do you have to make about the population from where the 9 readings were selected.

**EXERCISE 4**

As part of a study of the development of the thymus gland, researchers weighed the glands of five chicks embryos after 14 days of incubation. The thymus weights (*mg*) were as follows: 29.6, 21.5, 28.0, 34.6, 44.9.

For these data,  $\bar{x} = 31.7$ ,  $s = 8.7$ .

- a. Construct a 90% confidence interval for the population mean  $\mu$ .
- b. True or false and why: We are 90% confident that all the thymus weights are included in the interval you constructed in part (a).

**EXERCISE 5**

The output voltage of a certain electric circuit is specified to be 130 volts. The population standard deviation is known to be  $\sigma = 3.0$  volts. A sample of 40 readings on the voltage of this circuit gave a sample mean of 128.6 volts.

- a. Construct a 95% confidence interval for the true voltage mean. Based on your confidence interval do you believe that the mean voltage is 130 volts?
- b. What is the probability that the confidence interval that you constructed in part (a) contains the true voltage mean? Explain.

**EXERCISE 6**

A manufacturer of batteries claims that the lifetime of these batteries is normally distributed. The manufacturer provides us with the standard deviation  $\sigma = 10$  hours. For a random sample of 50 batteries the sample average was found to be  $\bar{x} = 115$  hours.

- a. Construct a 95% confidence interval for the population mean  $\mu$ .
- b. How will you interpret the confidence interval in (a) for a friend of yours who has not taken statistics yet?!

**EXERCISE 7**

The manager of a supermarket would like to know the average time that a person spends at the checkout counter. Using a stopwatch, he observes 100 customers. He computed the sample mean to be  $\bar{x} = 15.35$  minutes and the sample standard deviation to be  $s = 6.1$  minutes.

- a. Construct a 95% confidence interval for the population mean  $\mu$ .
- b. Suppose that the manager wants a smaller error in estimation (smaller than what you found in (a)). He wants his error to be  $\pm 1$  minute with 95% confidence. How many customers will he need? For this question assume  $\sigma = 6.1$  minutes.

**EXERCISE 8**

Use R to access the data from the Maas river. These data contains the concentration of lead and zinc in *ppm* at 155 locations at a flooding area of the Maas river in the Netherlands.

```
a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics13/soil.txt", header=TRUE)
```

- a. Use R to compute the sample mean and sample standard deviation of lead.
- b. Construct a 95% confidence interval for the population mean of lead in this area.
- c. The level of risk for surface soil based on lead concentration in *ppm* is given on the table below:

Mean concentration (ppm)	Level of risk
Below 150	Lead-free
Between 150-400	Lead-safe
Above 400	Significant environmental lead hazard

Based on your confidence interval from (b) in which category does the soil of this area fall in terms of the *ppm* concentration?

- d. Do you see any problem in these calculations (meaning by just using the averages)?