Department of Industrial Engineering & Operations Research

IEOR 165 (Spring 2016)

Homework 5

Due: Friday, Apr 22

Question 1. The PCB concentration of a fish caught in Lake Michigan was measured by a technique that is known to result in an error of measurement that is normally distributed with a standard deviation of .08 ppm (parts per million). Suppose the results of 10 independent measurements of this fish are:

$$11.2,\ 12.4,\ 10.8,\ 11.6,\ 12.5,\ 10.1,\ 11.0,\ 12.2,\ 12.4,\ 10.6$$

(a) Give a 95 percent confidence interval for the PCB level of this fish.
(b) Give a 95 percent lower confidence bound.
(c) Give a 95 percent upper confidence bound.

Question 2. Let $X_1, \ldots, X_n, X_{n+1}$ be a sample from a normal population having an unknown mean μ and variance 1. Let $\bar{X}_n = \sum_{i=1}^{n} X_i/n$ be the average of the first n of them.
(a) What is the distribution of $X_{n+1} - \bar{X}_n$?
(b) If $\bar{X}_n = 4$, give an interval that, within 90 percent confidence, will contain the value of X_{n+1}.

Question 3. A sample of 10 fish were caught at lake A and their PCB concentrations were measured using a certain technique. The resulting data in parts per million were

$$\text{Lake A}: 11.5,\ 10.8,\ 11.6,\ 9.4,\ 12.4,\ 11.4,\ 12.2,\ 11,\ 10.6,\ 10.8$$

In addition, a sample of 8 fish were caught at lake B and their levels of PCB were measured by a different technique than that used at lake A. The resultant data were

$$\text{Lake B}: 11.8,\ 12.6,\ 12.2,\ 12.5,\ 11.7,\ 12.1,\ 10.4,\ 12.6$$

If it is known that the measuring technique used at lake A has a variance of .09 whereas the one used at lake B has a variance of .16, could you reject (at the 5 percent level of significance) a claim that the two lakes are equally contaminated? (assume the population distribution is uniform)

Question 4. A professor claims that the average starting salary of industrial engineering graduating seniors is greater than that of civil engineering graduates. To study this claim, samples of 16 industrial engineers and 16 civil engineers, all of whom graduated in 1993, were chosen and sample members were queried about their starting salaries. If the industrial engineers had a sample mean salary of \$47,700 and a sample standard deviation of \$2,400, and the civil engineers had a sample mean salary of \$46,400 and a sample standard deviation of\$2,200, has the professors claim been verified (at the 5 percent level of significance)? Find the appropriate p-value. (assume the population distribution is uniform)

Question 5. A question of medical importance is whether jogging leads to a reduction in ones pulse rate. To test this hypothesis, 8 nonjogging volunteers agreed to begin a 1-month jogging program. After the month their pulse rates were determined and compared with their earlier values. If the data are as follows, can we conclude that jogging has had an effect on the pulse rates with the 5 percent level of significance (assume the population distribution is uniform)?

Subject	1	2	3	4	5	6	7	8
Pulse Rate Before	74	86	98	102	78	84	79	70
Pulse Rate After	70	85	90	110	71	80	69	74