# STAT 113 – Practice Midterm 3

1) An interlaboratory study was conducted to determine the variation in the measured level of polychlorinated biphenyls (PCBs) in environmentally contaminated sediments. Samples of sediment from New Bedford Harbor (MA) known to be contaminated with PCBs were collected and aliquot solutions prepared. For one part of the study, the PCB concentration in each of a random sampe of five aliquots was determined by a single laboratory using the Webb-Mccall prcudre. The analysis yielded a mean PCB concentration of 56 mg/kg and a sample standard deviation of .45 mg/kg.

a) Find a 90% confindence interval for the variance in the PCB levels of contaminated seidment, determined using the Webb-McCall procedure.

b) The laboratory claims that the variance is less than 1.0 mg/kg. Propose and evaluate a statistical test to verify the claim.

2) Suppose $\bar{X}$ is the mean of a normal random sample of size 25, where $\sigma = 10$. Test $H_0 : \mu = 75$ versus $H_1 : \mu < 75$ by rejecting the null hypothesis when $\bar{X} \leq 71.08$.

(a) Find $\alpha$.

(b) Find $\beta$ for $\mu = 73$.

3) Test $H_0 : \mu = 15$ versus $H_1 : \mu \neq 15$ if a normal random sample of size 20 gives $\bar{X} = 9.6$ and $s = 4.7$. Let $\alpha = 0.05$.

4)* Problem 9.56 from the book.

5) **Take-home problem**

In forestry, the diameter of a tree at breast height (which is fairly easy to measure) is used to predict the height of a tree (a difficult measurement ot obtain). Silviculturists working in British Columbia's boreal forest conducted a series of spacing trials to predict the heights of several species of trees. The data in the accompanyhing table are the breast height diameters (in cm, $x$) and heights (in m, $y$) for a sample of 36 white spruce trees.

| x | y | x | y | x | y | x | y | x | y | x | y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18.9 | 20.0 | 20.3 | 17.8 | 18.5 | 19.0 | 20.0 | 20.0 | 23.6 | 18.9 | 17.7 | 19.9 |
| 16.6 | 18.8 | 14.1 | 18.5 | 14.4 | 16.6 | 27.5 | 21.4 | 20.7 | 17.4 | 20.7 | 19.4 |
| 15.5 | 16.8 | 20.0 | 19.2 | 21.5 | 19.2 | 29.8 | 20.2 | 14.8 | 13.3 | 21.0 | 20.4 |
| 15.5 | 16.9 | 10.1 | 12.1 | 13.4 | 12.9 | 20.3 | 19.2 | 17.8 | 18.4 | 13.3 | 15.5 |
| 19.4 | 20.2 | 22.0 | 22.3 | 14.8 | 16.1 | 19.8 | 18.0 | 22.7 | 20.6 | 15.9 | 17.6 |
| 13.7 | 16.3 | 5.8 | 8.0 | 17.8 | 17.5 | 22.9 | 19.8 | 11.4 | 17.3 | 22.9 | 19.2 |

The data are available on the STA 113 homepage (click "exams"). Or copy the data set by typing from your acpub account:

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cp /afs/acpub/project/sta215/trees.data trees.data
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a) Construct a scattergram for the data.

b) Assuming the relatinship between the variabels is best described by a straight line, use the method of least squares to estimate the intercept and the slope of the line.

c) Plot the least squares lline on your scattergram.

d) Do the data provide sufficient evidence to indicate that the breast height diamter $x$ contributes information for the prediction of tree height? Test using $\alpha = 0.05$.

e) Use your least squares line to find a 90% confidence interval for the *average* height of white spruce trees with a breast diameter of 20cm. Interpret the result.