**UNCERTAINTY and DATA ANALYSIS**
**Spring Semester 2009-2010**

## Homework No: 4 – Date Due: 31.05.2010 till 17:00

**1.** Only 24 pile settlements were observed from a very large group of piles and their mean and standard deviation are reported as 7.00 mm and 2.64 mm, respectively.
   *a)* Construct 98% confidence interval for the true mean (population mean) of the pile settlements.
   *b)* Construct 99% confidence interval for the population standard deviation.
   *c)* If you are asked to check whether population mean for the settlement of piles is different from 10mm at 2% significance level, what would your answer be? Explain.

**2.** The weekly maximum flood heights (X) of a river are recorded over a period of 50 weeks with the average maximum weekly height of 672 cm. The true standard deviation (population standard deviation) of the original observations is 15 cm.
   *a)* Construct 95% confidence interval for the true mean of the weekly maximum flood height. What is the length of confidence interval?
   *b)* Referring to part (a), how many weeks should the river be observed such that the true mean height can be estimated in a length not greater than 5 cm from the average maximum weekly height (i.e. $\left| \bar{x} - \mu \right| \le 5$ cm)?

**3.** A manufacturer for the quality control investigates 5 car parts and records the following frequencies for the number of defective car parts:

| Number of Defective Car Parts, x | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **Frequencies** | 2 | 1 | 1 | 1 | 0 | 0 |

   *a)* Can we say that underlying probability distribution of the defected car parts is a binomial distribution with n = 5 and $\theta$ = 0.10 at the 5% significance level of using both goodness of fit test ( $\chi^2$ test ) and Kolmogorov-Smirnov test ( K-S test ) ?
   *b)* Can we say that the underlying probability distribution of the defected car parts is a binomial distribution with n = 5 at the 5% significance level using goodness of fit test ( $\chi^2$-test ) and Kolmogorov-Smirnov test ( K-S test) ?

**4**. The following data are the observed stress (X) at the onset of inelastic strain of a certain material:

| Class Interval (MPa) | 90-95 | 95-100 | 100-105 | 105-110 | 110-115 | 115-120 |
|---|---|---|---|---|---|---|
| Frequency | 4 | 19 | 39 | 23 | 12 | 3 |

a) For the above sample data estimate the population mean and standard deviation.
b) Construct 99 % confidence interval for the population mean (true mean) of the stress at the onset of inelastic strain.
c) Construct 95% confidence interval for the population standard deviation (true standard deviation) of the stress at the onset of inelastic strain.
d) Can we say that the frequency distribution of the stress at the onset of inelastic strain is normally distributed at the 5% significance level using goodness of fit test ($\chi^2$-test ) and Kolmogorov-Smirnov test ( K-S test)?

**5**. The following data for regional precipitation and the augmented reservoir storage are as follows:

| Precipitation, X (cm) | 62.5 | 42.7 | 48.5 | 55.2 | 58.1 |
|---|---|---|---|---|---|
| Reservoir Storage ($m^3$) | 15,100 | 12,250 | 13,000 | 13,750 | 14,220 |

a) Plot the data above on a scatter diagram. If it suggests that there is correlation between the variables X and Y then obtain the linear regression line of Y on X.
b) Find the coefficient of determination and correlation coefficient of X and Y. What information they give about the data?
c) Obtain the confidence interval for the slope of the regression line that you have obtained in part (c) at 1% significance level.
d) Compute the 95% prediction interval for the reservoir storage when precipitation is 50 cm.