Experimental Design (Försöksplanering) – Assignment 1

1. A normally distributed random variable has an unknown mean μ and a known variance σ2 = 9. Find the sample size required to construct a 95 percent confidence interval on the mean that has total length of 1.0.

2. An article in *Solid State Technology*, "Orthogonal Design of Process Optimization and Its Application to Plasma Etching" by G.Z. Yin and D.W. Jillie (May, 1987) describes an experiment to determine the effect of C2F6 flow rate on the uniformity of the etch on a silicon wafer used in integrated circuit manufacturing. Data for two flow rates are as follows:

C2F6 Flow	**Uniformity Observation**					
(SCCM)	**1**	**2**	**3**	**4**	**5**	**6**
125	2.7	4.6	2.6	3.0	3.2	3.8
200	4.6	3.4	2.9	3.5	4.1	5.1

(a) Does the C2F6 flow rate affect average etch uniformity? Use α = 0.05.

(b) What is the *P*-value for the test in part (a)?

(c) Does the C2F6 flow rate affect the wafer-to-wafer variability in etch uniformity? Use α = 0.05.

3. An article in the *Journal of Strain Analysis* (vol.18, no. 2, 1983) compares several procedures for predicting the shear strength for steel plate girders. Data for nine girders in the form of the ratio of predicted to observed load for two of these procedures, the Karlsruhe and Lehigh methods, are as follows:

Girder	Karlsruhe Method	Lehigh Method
S1/1	1.186	1.061
S2/1	1.151	0.992
S3/1	1.322	1.063
S4/1	1.339	1.062
S5/1	1.200	1.065
S2/1	1.402	1.178
S2/2	1.365	1.037
S2/3	1.537	1.086
S2/4	1.559	1.052

(a) Is there any evidence to support a claim that there is a difference in mean performance between the two methods? Use α = 0.05.

(b) What is the *P*-value for the test in part (a)?

(c) Construct a 95 percent confidence interval for the difference in mean predicted to observed load.

Note: Further recommended problems from chapter 2 are: 2.19, 2.29.