## Experimental Design (Försöksplanering) – Assignment 2

You may use R (programming language) whenever it is necessary.

1. An article in the *ACI Materials Journal* (Vol. 84, 1987. pp. 213-216) describes several experiments investigating the rodding of concrete to remove entrapped air. A 3" x 6" cylinder was used, and the number of times this rod was used is the design variable. The resulting compressive strength of the concrete specimen is the response. The data are shown in the following table:

Rodding Level	Compressive Strength				
10	1530	1530	1440		
15	1610	1650	1500		
20	1560	1730	1530		
25	1500	1490	1510		

- (a) Is there any difference in compressive strength due to the rodding level? Use  $\alpha = 0.05$ .
- (b) Find the *P*-value for the *F* statistic in part (a).

**2.** An article in *Environment International* (Vol. 18, No. 4, 1992) describes an experiment in which the amount of radon released in showers was investigated. Radon enriched water was used in the experiment and six different orifice diameters were tested in shower heads. The data from the experiment are shown in the following table.

Orifice Dia.		Radon Released (%)			
0.37	80	83	83	85	
0.51	75	75	79	79	
0.71	74	73	76	77	
1.02	67	72	74	74	
1.40	62	62	67	69	
1.99	60	61	64	66	

- (a) Does the size of the orifice affect the mean percentage of radon released? Use  $\alpha = 0.05$ .
- (b) Find the P-value for the F statistic in part (a).
- (c) Analyze the residuals from this experiment.

**3.** The effective life of insulating fluids at an accelerated load of 35 kV is being studied. Test data have been obtained for four types of fluids. The results were as follows:

Fluid 7	Type	Life (in	<u>h) at 35 kV</u>	Load		
1	17.6	18.9	16.3	17.4	20.1	21.6
2	16.9	15.3	18.6	17.1	19.5	20.3
3	21.4	23.6	19.4	18.5	20.5	22.3
4	19.3	21.1	16.9	17.5	18.3	19.8_

(a) Is there any indication that the fluids differ? Use  $\alpha = 0.05$ .

(b) Which fluid would you select, given that the objective is long life?

**4.** Use the Kruskal-Wallis test for the experiment in Problem 3. Are the results comparable to those found by the usual analysis of variance?

Note: Further recommended problems from your text book are: 3.15, 3.18, 3.27, 3.34.