

Mat-2.103 Design of experiments

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Final exam 11.5. 2006

Write on each paper:

- Mat-2.103 Final exam 11.5. 2006
- student number and the letter
- IN A CLEAR WAY surname and all forenames
- study program and year
- possible previous names and study programs
- signature

1. Explain the following terms shortly
 - a) Unbiased estimator.
 - b) Residual.
 - c) Interaction of two factors.
 - d) Type I error.
 - e) Latin square.
 - f) regression coefficient.
2.
 - a) Present the model for randomized complete block design. Explain shortly what the components of the model describe.
 - b) All the pairwise comparisons of means of four populations are made. What should be the level of significance per test if we wish that the probability

$$\alpha' = Pr(\text{'At least one incorrect rejection'})$$

has a value $\alpha' \leq 0.05$?

3. Three engineers each solved the same four mathematical problems. The time used for each problem was measured with the following results:

	Engineer 1	Engineer 2	Engineer 3
Problem 1	29s	40s	55s
Problem 2	90s	80s	71s
Problem 3	9s	30s	28s
Problem 4	190s	140s	240s

Are there differences in the solving speeds of the engineers? Do the test with significance level 0.01.

4. The concentration of sugar in soft drinks of four different manufacturers were measured. Three samples from each manufacturer were examined with the following results:

Manufacturer	X		
1	6.9	7.4	7.7
2	5.3	8.0	6.2
3	7.6	7.8	7.9
4	8.3	6.0	5.5

Are the average concentrations same for all manufacturers? Do the test with significance level 0.01.

5. The influence of factors A and B to response variable Y are examined by conducting a 2^2 -factorial experiment with three replications for each combination. The results:

A	B	Y		
-	-	41.0	38.5	43.5
+	-	45.0	55.5	60.0
-	+	48.0	47.0	50.5
+	+	61.0	65.0	58.0

Test the null hypothesis

H_0 : No interaction

H_0^I : No A-effect

H_0^{II} : No B-effect

with significance level 0.05.