TAMS38
Computer exercise 1

Preparations: *Read about One-Way ANOVA, F–test and construction of pairwise comparisons in the literature. Read about Bartlett's and Levene's test for the equality of variances page 84-86 in Design and Analysis of Experiments – D . C. Montgomery.*

Bring collection of formulas.

Go to the Windows, open Minitab, click in the session window, go to **Editor** and choose **Enable Commands**. Check that **Output editable** in **Editor** also is activated.

1 – Liver enzyme changes – One-Way ANOVA

To study the genetic variation in liver enzyme changes, induced by application of a particular drugs, one made measurements of liver enzymes in mice belonging to four different inbred strains with six animals in each strain. Results

Strain nr 1	274	276	277	281	275	268
Strain nr 2	268	272	269	280	257	261
Strain nr 3	282	279	285	278	276	274
Strain nr 4	268	273	267	283	255	267

Model: We have four samples from $N(\mu_i, \sigma)$.

Type in samples to columns C1-C4 (directly in the data window). Note that you must use the point as decimal separator. Then put together samples in a single column C5 and factor levels (no. strain) in column C6 with help of the command

```
STACK C1-C4 C5;
SUBSCRIPTS C6.
```

The semicolon on line 1 means that you will go to subcommand level. Remember to put the final point on line 2 to finish command. Call C5 as Y and C6 as Strain (you put names direclty in data window).

Firstly, investigate if the assumption about the constant variance was reasonably by going under **Stat/ANOVA/Test for equal variances** and choosing **Response:** c5 and **Factors:** c6.

Print plots through **File/PrintGraph** if desired. Select the printer in the room where you sit. Check P-values and put conclusions.

Generally, the test statistic for the Bartletts test is approx. χ^2-distributed with $a-1$ (=3 here) degrees of freedom, when the test statistic for the Levenes test is approx. $F(a-1, N-a)$. In both tests we reject H_0 about the equal variances for large values of the test statistics.

a) Is it reasonable to assume the same variance?

A variance analysis you through the menu **Stat/ANOVA/Oneway**. Choose **Response:** c5 and **Factor:** c6.

Choose **Store residuals** and **Store fits**. In **Graph** choose **Four in one** and **Residuals versus c6.**

b) Does it seem that residuals fit with a straight line in normal probability plot? Is there any abnormal observation?

c) Determine using an appropriate F-test on the level 0.05 if there is difference in expected values. In **Comparison** choose Tukey with $\alpha = 0.10$. Set up the formula for Tukey intervals. Are there any significant differences between the strains?

test statistic:..... critical region from $F(\ldots,\ldots)$-table: .....

$P = \ldots\ldots$..

Tukey-interval:.....

Conclusions:

2 – Different catalysts – A one-factor model

Four catalysts that may affect the concentration of one component in a three-component liquid mixture are being investigated. The following concentrations are obtained from a completely randomized experiment:

Catalyst			
1	2	3	4
58.2	56.3	50.1	52.9
57.2	54.5	54.2	49.9
58.4	57.0	55.4	50.0
55.8	55.3		51.7
55.8	55.3		
55.2			

Model: Four samples from $N(\mu_i, \sigma)$.

a) Do all four catalysts have the same effect on the concentration?

b) Analyze the residuals from this experiment.

b) Construct pairwise comparisons between the different catalysts with a simultaneous confidence level at least 94%.

(This is almost the same problem as Problem 3.26 in *Design and Analysis of Experiements* - D. C. Montgomery.)

3 – Breastfeeding infants – A one-factor model

"Recommendations regarding how long infants in developing countries should be breast-fed are controversial. If the nutritional quality of the breast milk is inadequate because the mothers are malnourished, then there is risk of inadequate nutrition for the infant. On the other hand, the introduction of other foods carries the risk of infection from contamination. Further complicating the situation is the fact that companies that produce infant formulas and other foods benefit when these foods are consumed by large numbers of customers. One question related to this controversy concerns the amount of energy intake for infants who have other foods introduced into the diet at different ages. Part of one study compared the energy intakes, measured in kilocalories per day (kcal/day), for infants who were breast-fed exclusively for 4, 5 or 6 months. Here are the data:"

Breast-fed for:	Energy intake (kcal/d)									
4 months	499	620	469	485	660	588	675	517	649	209
	404	738	628	609	617	704	558	653	548	
5 months	490	395	402	177	475	617	616	587	528	518
	370	431	518	639	368	538	519	506		
6 months	585	647	477	445	485	703	528	465		

Based on a study by J.E. Stuff and B.L. Nichols reported in Chelsea Lutter, "Recommended length of exclusive breast-feeding, age of introduction of complementary foods and the weaning dilemma" World Health Organisation, 1992.

Model: We have three samples from $N(\mu_i, \sigma)$.

Clean windows. Put the samples in the columns c1-c3. Go to **Data/Stack** and put together c1-c3 in **Column of current worksheet** c4 with **"subscripts"** (= nr of sample) in c5, remember not to use the variable name in c5. Choose c4 as Y and c5 as Time.

Perform an analysis of variance. Is it reasonable to assume normal distribution?