Home Assignment 3
TAMS38

Introduction

- Assignments should be solved **individually or in pairs**.
- You can use software, e.g., Minitab to solve the problems.
- Present your conclusions clearly and always attach computer printouts to support the conclusions.
- Hand in Assignment 2 **must** be submitted **by 5 PM on Friday, January 18, 2019** through e-mail to **martin.singull@liu.se**
- You should name the pdf-files as **TAMS38-HA-3-your_last_names.pdf**.
- Address your **name(s), person number(s)** at the beginning of each assignment.
- The feedbacks of the assignments will be back to you ASAP after the deadline.

1 – Regression analysis with dummy variables

Two types of tomatoes, cherry tomatoes (6 plants) and yellow oval (9 plants) has been sown in pots indoors and then planted at three different times. The number of harvested tomatoes on each plant has been calculated. Results:

	Planting time		
Types of tomatoes	Early	Medium early	Late
Cherry tomatoes	$47, 36$	$19, 20, 27, 50$	–
Yellow, oval tomatoes	$39, 50$	–	$4, 8, 8, 10, 12, 14, 19$

It has been suspected that planting early would give greater harvest.

Perform a regression analysis with appropriate dummy variables corresponding to an additive two-factor model and make appropriate residual plots. Think carefully which dummy variables should be used to answer in the **easiest** way the questions below.

a) Give the model and specify used dummy variables.

b) Is it possible to detect the difference in yield between the two tomato types? Is early planting dates better than the two later? Compare early and late planting time and early and medium early planting time. Justify your answer using the appropriate confidence intervals with simultaneous confidence level at least 85%. Here it can be wise to set up your dummy variables in a smart way.

2 – Determination of sample size under normal distribution

A team of researchers want to study whether regular exercise can increase in bone mineral content in young women.

One thinks to select n young women, measure their bone mineral content, allowing them to practice according to a certain program for six months and then re-measuring the mineral content in the bones. Let x_i and y_i stands for their mineral content (unit:%) before and after the training. Then $z_i = y_i - x_i$ stands for the change. Previous measurements have shown that it is reasonable to assume that $Z_i \sim N(\mu, 4)$. We want to test

$$H_0 : \ \mu = 0 \qquad \text{versus} \qquad H_1 : \ \mu \neq 0$$

on level 5%, such that the power of the test is at least 90% if $\mu = 2$.

a) How should you choose n for this two sided hypothesis?

b) Repeat procedure as for the one sided test. How many observations should you get?

c) Determine power of the two-sided test for $n = 25$.

d) Assume that the variance in a) is unknown. Redo part a) using **1-sample t**.

3 – Sample size under binomial distribution

In the treatment of a chronic disease with an old proven drug 20% of patients experience a clear relief. One has developed a new drug and it is hoped that along with the traditional treatment will help more patients.

By allowing n patients to try the new combination therapy and find out how many people feel an improvement we would test the following hypothesis

$$H_0: \quad p = 0.2 \quad \text{against} \quad H_1 : p > 0.2$$

on level 1%. Moreover we want to have power of the test 99% if $p = 0.4$. What n should you choose?

4 – Logistic regression

Finley (1947) reported on an experiment on the effect of Rotenone in different concentrations, when sprayed on the insect *Macrosiphoniella sanborni*, in batches of fifty. The result were:

Conc	Log(Conc)	No. of insects	No. affected
10.2	1.01	50	44
7.7	0.89	49	42
5.1	0.71	46	24
3.8	0.58	48	16
2.6	0.41	50	6

a) Plot the relation between the proportion of affected insects and Log(Conc).

b) Analyze the data using a binary logistic regression model. Write up the model and estimate all parameters. Seems the concentration effect the number of affected insects?

c) What concentration should be used to affect 50% of the insects?