Home Assignment 2
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, December 7, 2018** through e-mail to **martin.singull@liu.se**
- You should name the pdf-files as **TAMS38-HA-2-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 – Tukey-Duckworths quick test

Table below contains data on the total energy consumption per day for the group of lean and obese women.

Perform Tukey-Duckworths quick test on the significance level 0.001 for the given data material and present your conclusions.

Table. 24 hour total energy expenditure (MJ/day) in groups of lean and obese women (Prentice et al. (1968))

Lean (n=13)	Obese (n=9)
6.13	8.79
7.05	9.19
7.48	9.21
7.48	9.68
7.53	9.69
7.58	9.97
7.90	11.51
8.08	11.85
8.09	12.79
8.11	
8.40	
10.15	
10.88	
Mean 8.066	10.298
StDev 1.238	1.398

2 – Comparison of treatments II

Let us consider an experimental study of drugs to relieve itching (Beecher 1959). Five drugs were compared to a placebo and no drug with 10 volunteer male subjects aged 20-30. (Note that this set of subjects limits the scope of inference; from a statistical point of view, one cannot extrapolate the results of the experiment to older women, for example. Any such extrapolation could only be justified on grounds of medical judgment.)

Each volunteer underwent one treatment per day, and the timeorder was randomized. Thus, individuals were **"blocks"**. The subject were given a drug (or placebo) intravenously, and then itching was induced on their forearms with cowage, an effective itch stimulus. The subjects recorded the duration of the itching. More details are in Beecher (1959). The following table gives the duration of the itching (in seconds):

Subject	No drug	Placebo	Papa-verine	Morphine	Amino-phylline	Pento-barbital	Tripelen-namine
BG	174	263	105	199	141	108	141
JF	224	213	103	143	168	341	184
BS	260	231	145	113	78	159	125
SI	255	291	103	225	164	135	227
BW	165	168	144	176	127	239	194
TS	237	121	94	144	114	136	155
GM	191	137	35	87	96	140	121
SS	100	102	133	120	222	134	129
MU	115	89	83	100	165	185	79
OS	189	433	237	173	168	188	317
Average	191.0	204.8	118.2	148.0	144.3	176.5	167.2

a) Examine with an appropriate parametric tests on the level 0.05 if there exists differences between treatments. Write null hypothesis and alternative hypothesis. Is normal distribution a reasonable assumption?

   In this data set, there are some large values which may be of huge influence on averages. In such cases it may be advantageous to use instead a non-parametric method.

b) Examine with a suitable non-parametric tests on the level 0.05 if there exists differences between treatments.

c) Compare each of the treatments ('no drug' is also a treatment) with placebo treatment with help of Wilcoxons signed rank tests (or corresponding confidence intervals) each on the significance level 2%. What is your conclusion?

d) Why do we use signed rank test and not the ordinary rank sum test in c)?

e) Estimate using the Bonferroni inequality the simultaneous significance level in c), i.e., the probability that we, at least once, mistakenly reject the hypothesis that the placebo and some other treatment are the same good.

f) Do 98% confidence interval for the systematic difference betweenPlacebo and Papaverine. (e.g., using the routine **Nonparametrics/Averages** in Minitab and table for signed rank test.This does not provide the same range as in c) since Minitab put k using normal approximation for W_S.)

3 – Trial according to a Graeco-Latin square

To study the effectiveness of five different protection systems in the car, A, B, C, D and E, we use the following Graeco-Latin square. The rows represent different collision speeds of cars, columns represents difference size classes of cars, and the Greek letters α, β, γ, δ, and ε represents different angles of incidence. The results are given in the form of an index of forces at critical areas of the test doll that relate to the probability of fatal injury.

Aα	Bβ	Cγ	Dδ	Eε
0.50	0.21	0.43	0.35	0.46
Bγ	Cδ	Dε	Eα	Aβ
0.51	0.20	0.40	0.25	0.39
Cε	Dα	Eβ	Aγ	Bδ
0.45	0.07	0.29	0.20	0.31
Dβ	Eγ	Aδ	Bε	Cα
0.39	0.10	0.31	0.24	0.27
Eδ	Aε	Bα	Cβ	Dγ
0.43	0.17	0.31	0.22	0.32

a) Set up a suitable model and conduct an analysis using Minitab.

b) Are there differences between systems of protection?

c) Is the speed at collision significant? Make the appropriate pairwise comparisons and draw conclusions.