

MATH 204 - ASSIGNMENT 1

Please Hand in Assignment in the Lecture on Friday 25th January.

1. A clinical study into the utility of using mean platelet volume in the blood as a predictive biomarker for myocardial infarction (heart attack). In the study four groups of patients seeking treatment for chest pain with different symptoms were identified, and random samples of patients from these groups were recruited. Blood samples were obtained from the patients and their mean platelet volume recorded.

The four groups studied were

1. Noncardiac chest pain
2. Stable angina pectoris
3. Unstable angina pectoris
4. Myocardial infarction

Reference: Kiliçli-Camur N, Demirtunç R, Konuralp C, Eskiser A, Başaran Y (2005), Could mean platelet volume be a predictive marker for acute myocardial infarction?, *Medical Science Monitor*, 11(8), 387-92.

Summary data for the study are recorded below in terms of group sample means and standard deviations (s.d.):

Group	Sample size n_i	Sample mean \bar{x}_i	Sample s.d. s_i
1	35	10.89	0.69
2	35	11.25	0.74
3	35	11.37	0.91
4	35	11.75	1.07

where the sample standard deviation is given for $i = 1, 2, 3, 4$ by

$$s_i = \sqrt{\frac{1}{n_i - 1} \sum_{j=1}^{n_i} (x_{ij} - \bar{x}_i)^2}.$$

Using the approach and formulae described in the lecture notes (slides 41-55), carry out an ANOVA F-test of the hypothesis that there is no difference between the means across the four subgroups. Assume that the assumptions behind the ANOVA F-test all hold.

NB: The table gives s_i for $i = 1, \dots, 4$. For the ANOVA F-test, you need s_i^2 , and s_P^2 where

$$s_P^2 = \frac{1}{n - k} \sum_{i=1}^k (n_i - 1) s_i^2$$

8 Marks

2. In a randomized experimental study, 57 subjects were allocated to one of four treatment groups to discover whether a particular treatment led to higher weight loss. The treatments comprised two components, an injection of a growth hormone, and an injection of a steroid. However, some subjects received a placebo (inactive compound) injection instead of one or other, or both, active compounds. After 26 weeks of treatment, the change in body fat mass was recorded for each subject. The four groups studied were
1. P+P : Placebo for steroid, placebo for growth hormone
 2. P+S : Placebo for growth hormone, steroid
 3. G+P : Growth hormone, placebo for steroid
 4. G+S : Growth hormone, steroid.

Reference: Blackman, MR, *et al.* (2002), Growth Hormone and Sex Steroid Administration in Healthy Aged Women and Men: A Randomized Controlled Trial, *Journal of the American Medical Association*, **288**, 2282-2292.

These data are recorded below

P+P	P+S	G+P	G+S
0.1	-0.1	1.6	-3.1
0.6	0.2	-0.4	-3.2
2.2	0.0	0.4	-2.0
0.7	-0.4	-2.0	-2.0
-2.0	-0.9	-3.4	-3.3
0.7	-1.1	-2.8	-0.5
0.0	1.2	-2.2	-4.5
-2.6	0.1	-1.8	-0.7
-1.4	0.7	-3.3	-1.8
1.5	-2.0	-2.1	-2.3
2.8	-0.9	-3.6	-1.3
0.3	-3.0	-0.4	-1.0
-1.0	1.0	-3.1	-5.6
-1.0	1.2		-2.9
			-1.6
			-0.2

and may be downloaded

- in plain text format from
<http://www.math.mcgill.ca/~dstephens/204/Data/HormoneSteroid.txt>
- in SPSS format from
<http://www.math.mcgill.ca/~dstephens/204/Data/HormoneSteroid.sav>

Research question: Do the different treatments lead to different changes in the amount of body fat mass ?

Test a hypothesis to answer this question using an ANOVA F-test. Specifically

- (a) Form the ANOVA table, and report the result of the ANOVA F-test. 8 Marks
- (b) Discuss whether the assumptions of behind the ANOVA F-test hold for this example. 4 Marks

You may use SPSS, and the output generated, provided that you write comments pointing out the key results. For (a), you MUST present the ANOVA table in the form described in lectures.