

STAT2114/STAT6114: Design of Surveys and Experiments

Assignment 2

Due: 11:55 pm Monday 24 October 2022

Instructions:

- This is an individual assessment task. Your results and writing up must be your own work.
- Your assignment must be word processed and converted to a single pdf file for online submission in iLearn using **Assignment 2** in the **Assessments** section.
- This assignment has 8 questions to answer. The end of your solutions should include the requested appendices. These will be marked.
- Only very relevant R output should be included into this document. You will lose marks, if you insert an R code or irrelevant R output.
- All questions should be attempted.
- A diagram or calculation alone is not enough to earn full marks in a question or part.
- For all hypothesis tests you should state the null and alternative hypotheses, test statistic, distribution of the test statistic under H_0 , p-value and conclusion.
- This assignment is worth 15% of the total assessment for this unit.

Weight Reduction Program

A study was carried out to compare four different weight-reduction programs (1-4). Twenty-four overweight people were chosen for the study and each was then randomly assigned to take one of the four programs for one year (ie, having six people in each program). Data obtained is given below (negative and positive values indicate weight losses and gains respectively).

Program	Weight Loss/Gain					
1	-59	22	-29	10	23	12
2	-7	25	7	-8	40	5
3	-29	-54	-19	-44	-22	-20
4	-27	-2	-30	-46	-11	55

1. Read the data into R calling it `weight`. Find average, median, standard deviation of weight change for different program. Comment on your findings. [2 marks]

Any R output produced to answer this question along with the R commands should be placed in **Appendix 1** which should be the first appendix at the end of all of your solutions.

2. Explain what design is used here. [1 mark]
3. Examine weight changes for different programs graphically and comment. [3 marks]

Any R output produced to answer this question along with the R commands should be placed in **Appendix 2** which should be the Second appendix at the end of all of your solutions.

4. Carry out an analysis of variance using the data given, and test if there is any difference in mean weight loss/gain across the four programs at the 5% significance level. Interpret the results. For the test, you should state the null and alternative hypothesis, give the F statistic value and its associated degrees of freedom and provide relevant evidence before drawing a conclusion. (Please save the model fitted in R as `m1`.) [4 marks]

Any R output produced to answer this question along with the R commands should be placed in **Appendix 3** which should be the third appendix at the end of all of your solutions.

5. Check and comment on model assumptions. Use Barlett test for checking equality of variances. [3 marks]

Any R output produced to answer this question along with the R commands should be placed in **Appendix 4** which should be the fourth appendix at the end of all of your solutions.

6. Suppose that this study was initially planned to compare weight-reduction Program 3 with Program 4, as well as Program 2 with the other three programs. Write down the two corresponding contrasts. Show if the two contrasts are orthogonal to each other, and suggest an appropriate method (test) to test simultaneously whether each of the two contrasts differs from zero. [4 marks]
7. Based on the graph from part 3, suggest and write down one more contrast of interest such that together with the two contrasts above form a full orthogonal contrast set for this experiment/study. [2 marks]
8. Which test/method will you consider to investigate the three contrasts simultaneously? Why? [1 mark]