Week 7 ANOVA

7.1 One-way ANOVA for Independent Groups

`hairpain`

A study has indicated that there may be a difference between the pain thresholds of blondes and brunettes. Men and women of various ages were divided into four categories according to hair colour: light blond, dark blond, light brown and dark brown. The purpose of the experiment was to determine whether hair colour is related to the amount of pain evoked by common types of mishaps and assorted types of trauma. Each person in the experiment was given a pain threshold score based on his or her performance in a pain sensitivity test (the higher the score, the higher the person's pain tolerance).

1. Conduct a test to determine whether the mean pain thresholds differ among people having the four types of hair colour.
2. Compute and interpret the observed significance level for this test.
3. What assumptions must be met to ensure the validity of the inferences?

`inoculin`

An experiment is conducted to determine whether there is a difference among mean increases in growth produced by five inoculins of growth hormones for plants. The experimental material consists of 20 cuttings of a shrub (all of equal weight), with four cuttings randomly assigned to each of the five different inoculins. The file contians the results of the experiment: all measurements represent an increase in weight (in grams) following treatment.

1. Construct an ANOVA table for this experiment
2. Find the observed significance level for the test, and discuss its value.
3. Is there evidence of a difference among the mean increases in weight for the five inoculins of growth hormone?

`soprate`

A study was conducted to examine the chemical properties of three different types of hazardous organic solvents: aromatics, chloroalkanes and esters. One variable studied was the *sorption rate*. Independent samples of solvents from each type were tested and their sorption rates recorded.

1. Perform an ANOVA test on the data.
2. Is there evidence of differences among the mean sorption rates of the three solvents?
3. Compute Bonferroni confidence intervals for all six pairs of means.
4. Use the confidence intervals to determine which pairs of means are significantly different.

7.2 One-way ANOVA for Repeated Measures

`walkers`

A study was conducted to investigate the effect of prompting in a walking programme. Five groups of 30 people agreed to participate by walking for 20 minutes at least one day per week over a 6-week period. People were prompted by telephone, with different prompting schemes used for each group of walkers. The file contains the number of participants in each group who walked the minimum requirement for each week.

C	Control	No prompting phone calls
FL	Frequent/Low	Simple reminder once a week
FH	Frequent/High	Set definite goals once a week
IL	Infrequent/Low	Simple reminder once every three weeks
IH	Infrequent/High	Set definite goals once every three weeks

1. Is there sufficient evidence of a difference in the mean number of walkers reaching the minimum requirement per week among the five groups?
2. Compute the pairwise comparisons. What conclusions can you draw?

7.3 Two-way ANOVA

`ocd`

Davey *et al.* (2003) looked at processes underlying obsessive compulsive disorder. They asked different participants in negative, positive or neutral moods to imagine that they were going on holiday. The participants were then asked to list everything that they should check before going away. Within each mood group, half of the participants were told to list as many things as possible within 2 minutes (the 'time limited' group), while the other half were told to continue for as long as they wished (the 'time unlimited' group). Test to see whether people in different moods and with different time constraints make lists of different lengths. Check that the conditions required for the test are satisfied before discussing the results.

`langprof`

The file contains marks achieved by students in a multiple choice test, classified by both gender and the country in which the test was administered. Use two-way ANOVA to test whether gender or geographical location has a significant influence on the marks achieved.

`schooling`

A researcher investigates the hypothesis that achievement at university is affected by (a) the type of schooling a student received (home schooling vs public schooling) and (b) whether they come from a two-parent family or single-parent family. Use two-way ANOVA to investigate whether either of these variables, or an interaction between them, affects the proportion of questions the pupils answer correctly in an exam.

`households`

The file lists the number of bedrooms people have in their homes and the number of cars they own, classified by whether or not they live in a rural area or an urban area. Investigate whether the type of area (rural vs urban) has a significan effect on the number of bedrooms people have in their homes, and the number of cars they own.