Probability and Statistics for Psychology and Quantitative Methods for Human Sciences

Problem Sheet 6 (HT 10): ANOVA

1. Genetics researchers use a device called a *microarray* to study the activity of genes. Each gene will get an "intensity score" which measures this activity. Their goal is typically to measure the activity under different conditions — diseased cell *vs.* healthy cell, quiescent cell *vs.* dividing cell, *etc.* They want to know which genes are more or less active when the cell is performing certain activities, or in certain conditions.

   Suppose the researchers are trying to determine which genes are differentially expressed at different points in the cell cycle. They run 50 microarrays: five cells at each of ten different timepoints in the cell cycle. Below are the average intensity scores for one particular gene at each of the ten timepoints. Assuming the intensity measures are normally distributed, perform a significance test to determine whether this gene really has different activity levels at these different timepoints, or whether the differences in means might be due simply to chance variation.

Timepoint	1	2	3	4	5	6	7	8	9	10
mean	9.09	8.17	8.79	8.26	9.54	8.42	7.85	9.01	9.29	9.49
SD	0.93	1.35	0.37	0.65	0.68	0.96	0.69	0.50	0.71	0.74

2. On a previous sheet we described an experiment in which the "plateau mortality rates" of different strains of fruit flies were estimated. Each strain was studied 5 times, males and females separately. In the earlier problem we said there were two strains, CO and SO, but in fact there were three different strains, the third one being called RSO. Analyse the data (males and females separately) to test the hypothesis that the plateau rates for all three strains are the same. Do the analysis first under the assumption that the data came from normal distributions, and then perform a non-parametric test that does not assume normality.

	Male			Female		
Replicate	CO	RSO	SO	CO	RSO	SO
1	0.0786	0.0306	0.0454	0.118	0.0354	0.0541
2	0.109	0.0515	0.0329	0.0755	0.0428	0.0519
3	0.124	0.0301	0.0221	0.101	0.0540	0.0544
4	0.115	0.0602	0.0547	0.0660	0.0767	0.0749
5	0.0919	0.0577	0.0336	0.0594	0.0733	0.0545