ST4241: Design and Analysis of Clinical Trials

2009/2010: Semester I

Tutorial 2

1. Two methods are applied to train patients with senile dementia to care for themselves. After the completion of the training, patients are asked to take 20 tests involving activities of daily living. The response from each patient is the proportion of his or her tests that are successful. The data for the two groups are given below:

`Group 1:  0.05, 0.15, 0.35, 0.25, 0.20, 0.05, 0.10, 0.05, 0.30, 0.05, 0.25`

`Group 2:  0, 0.15, 0, 0.05, 0, 0, 0.05, 0.10.`

(i) Conduct a t test for the difference between the two groups based on the data. Comment on the appropriateness of this t-test.

(ii) Transform the data to $Y = \arcsin\sqrt{X}$. Conduct a t test for the difference between the two groups based on the transformed data. Compare the result with that in part (i).

(iii) Conduct the Mann-Whitney-Wilcoxon test based on the data: (a) without adjustment on ties, and (b) with adjustment on ties. Compare the results.

2. Prove that the MWW test statistic is identical to the expression given below:

$$\chi^2 = \frac{12\left(S_i - \frac{n_i(n_\cdot+1)}{2}\right)^2}{n_1 n_2 (n_\cdot + 1)},$$

where $S_i = n_i\bar{R}_i$ is the sum of the ranks of the n_i measurements in Group i, $i = 1, 2$. Note the MWW test statistic is originally given by

$$\chi\text{mww} = \frac{12 n_1 n_2 (\bar{R}_1 - \bar{R}_2)^2}{n_\cdot^2 (n_\cdot + 1)}.$$

3. The following table summarizes the data from a trial for the comparison of two drugs to a control. The response variable is a blood count (in millions of cells per cubic millimeter).

Group	n_i	X_i	s_i
Control	6	8.25	0.94
Drug A	4	8.90	0.90
Drug B	5	10.88	1.56

(i) Compute s^2 and the two test statistics L_1 and L_2 for testing whether the drugs are significantly different from the control.

(ii) Test whether the mean for Drug B is significantly greater than the control mean at level 0.01. Should a two-sided test or a one-sided test be used? What is the appropriate critical value to be used for the test?

4. Suppose that a total of $n_\cdot$ experimental subjects are to be assigned randomly to a control group or to one of p experimental groups. Let n_0 denote the number to receive the control treatment and n_t the number to receive each experimental treatment, so that $n_\cdot = n_0 + pn_t$. Show that the variance of $\bar{X}_i - \bar{X}_0$ is minimized if

$$n_0 = \frac{n_\cdot}{1+\sqrt{p}}, \quad n_t = \frac{n_\cdot}{p+\sqrt{p}}.$$