

**Probability and Statistics for Psychology  
and Quantitative Methods for Human Sciences**

**Problem Sheet 4 (HT 10): Nonparametric Tests**

1. Table 1 repeats the data discussed in section 3.3 of the lecture notes (and copied from [Ric95]), from an experiment on the effect of cigarette smoking on blood clotting. Perform two different non-parametric tests to test whether the before and after measurements might be equivalent, differing only by random variation. State your null hypothesis and alternative hypothesis clearly.

Before	After
25	27
25	29
27	37
44	56
30	46
67	82
53	57
53	80
52	61
60	59
28	43

Table 1: Percentage of blood platelets that aggregated in 11 different patients, before and after smoking a cigarette.

2. Two different strains of fruit flies were studied, one of which (called SO) had been bred to be particularly long-lived, compared with the standard strain (CO). It is known that the mortality rates of fruit flies increase rapidly early in life, and then taper off later. The question was whether the longer-lived flies would also have a lower “plateau” level. An experiment was performed [DGS<sup>+</sup>00] in which about 600 flies of each sex and of each type were followed from birth until death, and their lifespans recorded. A statistical procedure was used [Ste05] to estimate the plateau mortality level. This experiment was repeated 5 times, yielding 20 different plateau estimates, summarised in Table 2.

Are the plateau levels for the CO really different from those of the SO flies? Perform two different non-parametric significance tests at the 0.05 level. Compare these results to the results you obtain from a t test.

You should analyse the male and the female data separately. Why?

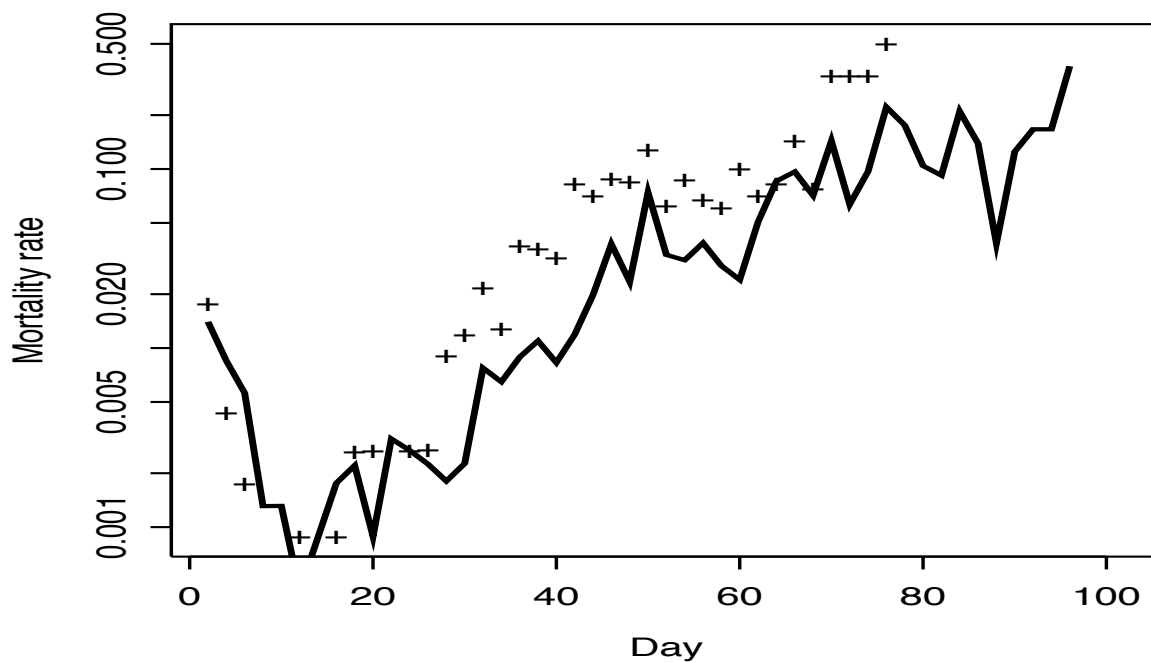


Figure 1: Empirical hazard rates for one replicate of each of two strains of male flies. The lines are for the SO flies, while the '+' symbols represent the CO flies.

Replicate	Male		Female	
	CO	SO	CO	SO
1	0.0786	0.0454	0.118	0.0541
2	0.109	0.0329	0.0755	0.0519
3	0.124	0.0221	0.101	0.0544
4	0.115	0.0547	0.0660	0.0749
5	0.0919	0.0336	0.0594	0.0545

Table 2: Plateau mortality levels.

## References

- [DGS<sup>+</sup>00] Mark D. Drapeau, Erin K. Gass, Michael D. Simison, Laurence D. Mueller, and Michael R. Rose. Testing the heterogeneity theory of late-life mortality plateaus by using cohorts of *drosophila melanogaster*. *Exp. Geron.*, 35:71–84, 2000.
- [Ric95] John A. Rice. *Mathematical Statistics and Data Analysis*. Duxbury Press, 1995.
- [Ste05] David Steinsaltz. Reevaluating a test of the heterogeneity explanation for mortality plateaus. *Exp. Geron.*, 40:101–13, 2005.