

Practical 2: Hypothesis tests

November 10, 2011

1. To determine the effectiveness of a new drug on the level of haemoglobin in the blood of anemic patients, 10 randomly selected patients who underwent this treatment were sampled. The table below shows the level of haemoglobin in the patients blood before and after the treatment.

Patient	1	2	3	4	5	6	7	8	9	10
Before	11.2	9.4	9.9	9.3	8.9	8.2	10.5	8.8	10.3	9.8
After	12.9	10.8	10.3	10.9	8.5	8.9	10.4	8.5	11.2	10.1

- (a) Carry out both the two-sample t test and the paired sample t test at a significance level of 0.05 to determine if the drug is effective in increasing the level of haemoglobin in the blood. Given the setting of the experiment, which test is more appropriate? Why?
 - (b) Perform two different non-parametric tests — one for paired samples and one for non-paired samples — and compare the results to the ones you had from the t test.
2. (a) Over a period of time a mens' clothes shop sold 500 pairs of trousers. The numbers sold in various waist sizes were:

Waist (cm)	70	75	80	85	90	95	100	105	110
Frequency	5	13	37	88	114	123	82	29	9

Estimate the mean and standard deviation of the waist measurements, and test whether the figures support the theory that waist measurements follow a normal distribution. Use a 5% level of significance. (Note that a customer with, for example, a waist measurement between 80 and 85cm requires trousers with an 85cm waistband.)

- (b) Responding to anecdotal reports in air squadrons that military pilots father more girls than boys, [Sny61] tabulated the sex of pilots' offspring for three kinds of flight duty during the month of conception. Is there any evidence of an association between father's activity and offspring gender? Use a 5% level of significance.

	Female Offspring	Male Offspring
Flying Fighters	51	38
Flying Transports	14	16
Not Flying	38	46

(This example is taken from [Ric95], p. 500.)

3. Look at the data collected yesterday. Do men and women differ in their drawing scores? Try several different tests at the 0.05 level. What about UK and non-UK students? This year's students and last year's students?
4. Discretise the range of scores for the reaction-time test and for the drawing test (this year, first drawing test).
 - (a) Test this year's scores and last year's scores for independence of the two measurements using a χ^2 test, at the 0.05 level.
 - (b) How do your results change if you discretise differently?
5. Do scores on this year's drawing tests differ between the first and second try? Try testing this at the 0.05 level, first treating the two trials as though they were different sets of people, then taking account the fact that these were the same people.
6. Does it look as though the drawing scores are normal? If not, how does this affect your inference?

References

- [Ric95] John A. Rice. *Mathematical Statistics and Data Analysis*. Duxbury Press, 1995.
- [Sny61] Richard G. Snyder. The sex ratio of offspring of pilots of high performance military aircraft. *Human Biology*, 33(1):1–10, 1961.