

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

**Problem Sheet 5 (HT 10): Kolmogorov-Smirnov Test, Power of tests**

1. The baby-boom data set (Table 1.2 in the lecture notes, also available to download from the course web site) includes the times of birth of 44 babies born at one hospital on one day. Test at the 0.05 level whether these times could reasonably be considered to be uniformly distributed throughout the day. Can you see a problem which could make the significance levels unreliable in this case? (Hint: This is a common application of the Kolmogorov-Smirnov test in the social sciences, and a conceptual error that is made routinely in the published literature.)
2. Table 11.3 in the lecture notes lists 15 differences in hippocampal volume between schizophrenic and healthy monozygotic twins. Test at the 0.05 level whether these differences could reasonably be considered normally distributed.
3. Suppose we have the observations from two different samples

$X$  : 0.4, 1.4, 0.9, 0.2, 0.4, 1.9, 1.1, 1.6, 0.7, 0.5;

$Y$  : 0.9, 0.9, 1.4, 1.1, 1.2, 0.9, 0.9, 1.8, 1.0, 1.0, 1.6, 0.5, 0.7, 1.1, 0.8.

Apply the Kolmogorov-Smirnov test to test whether the  $X$  samples and the  $Y$  samples came from the same distribution.

4. *The first parts of this question appeared on the sheet two weeks ago.* Suppose we have designed a new cognitive test, and we wish to determine whether men and women perform equally well on average. We recruit 100 men and 50 women, obtaining the following results:

	Men	Women
mean	105	110
SD	20	25

- (a) Compute a 95% confidence interval for the difference between the male and female means.
- (b) Perform a significance test for the null hypothesis  $\mu_{male} = \mu_{female}$  against the two-tailed alternative  $\mu_{male} \neq \mu_{female}$ , at the 0.05 level.
- (c) Someone argues that your study doesn't really prove anything. She does a power computation, and shows that if the true difference in means were 5, with SD of 25, the power would be only 0.21. What does this imply about the importance of your results?
- (d) She shows you, further that the difference between the population means would have to be 14 in order to get the power up to 0.9. What does this imply about the importance of your results?

- (e) Suppose you want your study to have only a 10% chance of making a type II error if the men and women really differ by 5 points on average. How many men and women do you need to recruit for your study?
- (f) Your subjects were probably not a random sample from the general population. How does this affect the interpretation of your results?