

# QUEEN MARY, UNIVERSITY OF LONDON

MTH 4106

Introduction to Statistics

Assignment 4

For handing in on 7 February 2012

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*You should attempt all of these questions, as they are designed to help you to learn and understand the material in the course.*

*The 'Feedback' questions are the ones for handing in. Write your name, student number and group number at the top of your answer before handing it in. Staple all the pages together. Hand it to your allocated tutor when (s)he asks for it during your allocated Minitab laboratory session on Tuesday 7 February 2012.*

*If you want help on Question 2, or want to check that you have done it correctly, you may ask any tutor during your laboratory session or ask me in any of my office hours.*

**1 (Feedback)** Find an article in a newspaper or magazine published in 2012 that gives the results of a survey, observational study or experiment. Cut out the article, which should be no bigger than half of an A4 page, and staple it to the top half of an A4 page. Write down the name of the newspaper or magazine, the page where the article appeared, and the date of publication.

In the second half of the page, comment briefly on the article. For example, does it describe a survey, an observational study or an experiment? If a survey, how was the sample chosen? If an observational study, what conditions were compared? If an experiment, what were the treatments and the experimental units? What was measured?

Do you think this investigation was conducted well?

**2** Use Minitab to answer this question, which refers to the worksheet `Pulse.MTW` used in Practical 3.

- (a) Calculate a new variable `Diff` as the difference `Pulse2 - Pulse1`. Draw two boxplots of `Diff` on the same scale, one for each value of the variable `Ran`. Explain why the boxplots look so different.
- (b) Cross-tabulate the qualitative variables `Sex` and `Activity`. Give the rows and columns labels that make it easy for a reader to understand the table. Do women have the same distribution of activity levels as men?

**3 (Feedback)** We want to estimate the unknown proportion  $p$  of registered UK voters who agree with the proposed reform of the NHS. Anne takes a random sample of 30 voters and records the number  $X$  who agree with the proposed reform of the NHS. Ben takes another random sample of 20 voters and records the number  $Y$  who agree with the proposed reform of the NHS. Assume that these two samples are independent of each other.

Anne proposes to estimate  $p$  using the estimator  $A = \frac{X}{30}$ .

Ben proposes to estimate  $p$  using the estimator  $B = \frac{Y}{20}$ .

Craig and Donald are too lazy to take samples themselves, so they propose using Anne's and Ben's data. Craig will use the estimator  $C = \frac{1}{2}(A + B)$ , while Donald will use the estimator  $D = \frac{X + Y}{50}$ .

Find the bias and mean squared error of each of these four estimators. Which one do you think is best?

Fiona is a journalist who wants a good headline. She will estimate  $p$  as the minimum of  $A$  and  $B$ . Comment on the properties of her estimator.

**Hand in your answers to both Feedback questions, stapled together. The submitted work will be randomly divided into two equal batches. For one batch, feedback will be given on Question 1; for the other batch, feedback will be given on Question 3.**