## ***Analysing data*** **(M248)** content listing

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| Unit 1<br>*Exploring and interpreting data* | Populations and samples<br>Graphical representations: bar charts, side-by-side bar charts, frequency and unit-area histograms, boxplots, comparative boxplots, scatterplots<br>Measures of location (mean, median) and measures of spread (variance, standard deviation, interquartile range) |
| Unit 2<br>*Modelling variation* | Probability<br>Discrete and continuous random variables<br>Probability distributions and probability mass functions<br>Probability density functions<br>Calculating probabilities for discrete and continuous random variables<br>Cumulative distribution functions. |
| Unit 3<br>*Models for discrete data* | Bernoulli trials<br>The binomial, geometric, Poisson distributions<br>Discrete and continuous uniform distributions |
| Unit 4<br>*Population means and variances* | The mean of discrete and continuous distributions<br>The variance of discrete and continuous distributions<br>Means and variances of linear functions |
| Unit 5<br>*Events occurring at random and population quantiles* | Bernoulli trials and the Poisson distribution<br>Bernoulli and Poisson processes<br>The exponential distribution<br>Population quantiles of continuous and discrete distributions |
| Unit 6<br>*Normal distributions* | Calculating normal probabilities<br>Linear functions of normal random variables<br>Normal probability plots<br>The sampling distribution of the mean<br>The Central Limit Theorem |
| Unit 7<br>*Point estimation* | Bias<br>Method of Maximum likelihood<br>Maximum likelihood estimators and their properties |
| Unit 8<br>*Interval estimation* | Basic ideas and interpretation<br>Large-sample confidence intervals: confidence intervals for means, proportions, differences between proportions, Poisson parameter<br>The family of t distributions<br>Exact confidence intervals for normal means: one- and two-sample *t*-intervals |
| Unit 9<br>*Testing hypotheses* | Specifying hypotheses and the principles of hypothesis testing<br>One-sample *z*- and *t*-tests, testing a proportion with a large sample<br>The link between confidence intervals and hypothesis tests<br>*p*-values<br>Type I and Type II errors<br>Power of a test and planning sample sizes |
| Unit 10<br>*Nonparametric and goodness-of-fit tests* | Non-parametric tests: Wilcoxon signed rank and Mann-Whitney tests<br>The chi-squared distribution<br>The chi-squared goodness-of-fit test |
| Unit 11<br>*Regression* | Linear regression, the method of least squares and maximum likelihood in regression<br>Residual plots and checking normality of residuals<br>Sampling properties of estimators, testing whether a relationship exists, confidence and prediction intervals<br>Multiple regression with continuous explanatory variables |
| Unit 12<br>*Transformations and the modelling process* | Transformations<br>The ladder of powers<br>Linear regression on a function of the explanatory variable<br>Transforming the response variable<br>Multiple regression with transformed variables<br>The modelling process, choosing a model, writing a statistical report<br>Dealing with outliers |
| Unit 13 *Applications* | Considers several applications to pull together the main statistical ideas |