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encouraging academics to share statistics support resources

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Stcp-marshall\_owen-pocket

# **The Statistics Tutor's Pocket Book Guide to Statistics Resources**

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Please note that if printed, this guide has been designed to be printed as an A5 booklet double sided on A4 paper.



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# Introduction

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This guide contains information on a wide range of popular statistics learning resources, used within a statistics support context in Higher Education (HE) in many Universities across the UK. The information could be used to identify a suitable resource for a student, to assist with the CPD of statistics support tutors or indeed to determine which book/resources to download/purchase for a mathematics support centre.

This guide is by no means finished and the resources listed may not be the best that are available. But they represent the combined suggestions and views of a number of statistics support practitioners working in HE in the UK. We see the guide as an evolving resource which can be improved over time, through the help of other statistics support practitioners suggesting new or alternative resources. It is hoped that in time this guide will be developed into an electronic interactive guide, but this represents a starting point in that process.

The guide is divided into five sections:

- Section 1 provides a short overview of the most popular statistics learning resources.
- Section 2 lists some really useful resources for where students should start, with designing an experiment or survey, and suggests some valuable resources for dealing with one of the most difficult but commonly asked questions asked of statistics support tutors that of “what test should I use?”.
- Section 3 looks at resources to recommend to students and provides comprehensive details of books and online resources (most of which are free to access), relevant to the most common statistical techniques and the use of statistical software such as SPSS and R. In time we would hope other practitioners will suggest additional resources for other software such as Minitab, SAS, and STATA etc.
- Section 4 lists student resources for other statistical techniques that we might not consider to be standard techniques, but which do occur quite frequently within the requests for help to statistics support tutors. Again suggestions for additional topics along with suitable resource suggestions are very welcome!
- Section 5 completes the guide by providing useful suggestions that statistics support tutors might make direct use of themselves, either when providing help to a student, or when undertaking CPD in this area.

Within each section, there are quick guide tables that summarise the essential features of each resource, along with a more detailed written summary of each resource.

Where appropriate, these tables indicate the level of ability or type of student we consider the resource to be suitable for. This uses the following coding which is also repeated underneath each table where the level of student is listed:

1 = Beginner, 2 = Undergraduate (Non-Mathematics), 3 = Advanced Undergraduate (Non-Mathematics), 4 = Undergraduate (Mathematics)

In addition, where appropriate, these tables indicate the level of detail the resource as follows:

1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

For brevity the tables also use the following acronyms for certain topic areas when listed within the tables:

Multivariate methods: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, Cl = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = Classification Trees, MDS = Multi-dimensional Scaling.

Reliability: CA = Cronbach's alpha, ICC = Intraclass correlation, Ka = Kappa.

Medical statistics: MA = Meta-analysis, SA = Survival analysis, LR = Log rank, CR = Cox's regression, KM = Kaplan-Meier, SS = Sensitivity/specificity, OR = Odds ratios, R = Risk.

Advanced regression: GLM = Generalised Linear Models, BL = Binary Logistic, ML = Multinomial Logistic, Po = Poisson.

The tables include wherever possible links to the relevant online resources or webpages associated with books and software that has been suggested. A general link is contained in the title row of each table and specific links in some tables for individual techniques. For books the link associated with the title is to the Vitalsource (formally Coursesmart) page for the text, which allows lecturers to view entire copies of books once registered with Vitalsource and the publisher. Where this link is not available a link to the publisher's page is provided instead.

The guide was compiled by Dr Alun Owen (University of Worcester) and Ellen Marshall (University of Sheffield) with the help of Dr Jonathan Gillard (Cardiff University) and Chris Knox (University of Sheffield), and was supported by funding from a sigma resource development grant. There were also many recommendations from colleagues within the statistics support community and the sigma-network more widely that we are very grateful for. We would particularly like to acknowledge David Bowers, Christine Pereira and Cheryl Voake-Jones who each contributed a large number of resources.

If you would like to suggest additional resources for inclusion in this guide then please complete our survey at

[https://sheffieldpsychology.eu.qualtrics.com/SE/?SID=SV\\_0ujxNHECdyltf37](https://sheffieldpsychology.eu.qualtrics.com/SE/?SID=SV_0ujxNHECdyltf37)

Or alternatively email Alun Owen at [a.owen@worc.ac.uk](mailto:a.owen@worc.ac.uk) or Ellen Marshall at [ellen.marshall@sheffield.ac.uk](mailto:ellen.marshall@sheffield.ac.uk).



# **Section 1**

## **Most popular resources**

# The most recommended statistics books

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## *SPSS for Psychologists. Brace, Kemp and Snelgar.*

This book offers students quick examples of using SPSS to undertake statistical analyses and interpret the results. Great book for students undertaking projects who are learning to use SPSS for the first time.

## *SPSS Survival guide. Julie Pallent.*

Literally a 'survival manual' on how to use, interpret and report statistics using SPSS. A brief intro is given for each technique in a fairly easy to understand way with further references if more statistical detail is needed. Steps to carry out each task are clear and concise. Output is displayed, key statistics interpreted in the context of the problem and an example paragraph of how results could be reported given. New statistics tutors can use this book to learn SPSS as well as with students. Advanced topics include Factor Analysis and MANOVA.

## *Discovering Statistics Using SPSS. Andy Field.*

## *Discovering Statistics Using R. Field, Miles and Field.*

Highly recommended texts within psychology with amusing examples and detailed explanations. Andy Field is a highly respected and award winning author in this area and has a youtube channel and website which have tutorials related to content. For each topic he provides a good background, the mathematical calculations, how to run the test in SPSS (or R), how to interpret the output and examples of how to report results. However it is a large book and a perhaps a bit too detailed for beginners but great as a tutor resource. Advanced topics include Factor Analysis, MANOVA and multilevel modelling.

## *Multivariate Statistical Methods: A Primer. Bryan Manly.*

We like this book because it gives a good overview of multivariate methods that allows a student to assess whether these are useful. It does include some mathematics and so is mostly accessible to anyone having studied some mathematics as part of their undergraduate degree. However the more mathematical elements could be omitted and the book would still provide a very useful overview.

## *100 Statistical Tests. Gopal Kanji.*

A great resource if you can't remember the details of a particular test. Also useful to find a test for less common situations.



# The most recommended online statistics resources

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## ***Statstutor***

<http://www.statstutor.ac.uk/>

Trusted site containing a growing collection of downloadable resources for use in statistics support as well as videos, workshop materials and online quizzes for some topics. Mostly with applications to SPSS, but some R which will be added to in the very near future. Includes training resources for new statistics tutors.

## ***CAST:***

[http://cast.massey.ac.nz/collection\\_public.html](http://cast.massey.ac.nz/collection_public.html)

Written by Doug Stirling, this is a collection of computer assisted statistics textbooks. This has lots of great apps for illustrating concepts such as confidence intervals, standard errors, the Central Limit Theorem and why samples above 30 can relax assumptions of normality, and least squares in linear regression. This covers core introductory statistics aimed at non-mathematics undergraduates, but also includes sections on statistics theory and advanced statistics. The apps can also be used in lectures etc. There are also videos included and the material can be printed off as pdfs if required.

## ***Statistics Hell:***

<http://www.statisticshell.com/>

Site attached to the Andy Field book. Contains the most commonly used techniques in detail using recorded lectures and sections of the book under each technique. The length of both can be offputting although a good reference for tutors wanting to check finer details. The site follows a strong satanic theme which may not be to everyone's taste!

## ***STEPS glossary:***

<http://www.stats.gla.ac.uk/steps/glossary/index.html>

This is a glossary of statistics definitions which gives a quick introduction to each topic. Great for students who are not familiar with statistical terminology and need a quick heads up.

## ***UCLA:***

<http://www.ats.ucla.edu/stat/>

This website offers a thorough explanation of output and statistical techniques including more advanced techniques such as non-linear regression and multivariate analysis. It offers support for SPSS, SAS, STATA and some R and has recommended books with downloadable chapters. It's probably better for tutors and those wanting to cover more advanced techniques rather than most undergraduate students as it uses syntax for SPSS and is very detailed.

## ***Laerd Statistics:***

<https://statistics.laerd.com/>

A commercial site which is very popular with students. It is clear, concise and spells out the necessary assumptions for tests as well as taking students through the steps in SPSS, interpretation and write up. Some of the site requires a subscription but it's fairly cheap to subscribe and the basics of most tests are free.

## ***G\*Power sample size calculator:***

<http://www.gpower.hhu.de/en.html>

A free program (download from the website) for undertaking statistical power calculations. Applicable to a wide range of designs, but can be complicated to use and requires an understanding of the concepts of standard errors and effect sizes etc.



# **Section 2**

## **Designing a study and choosing a test**

# Designing an experiment or survey and choosing a test

## Summary of resources

Resource		<a href="#">Allison, Research Skills for Students</a>	<a href="#">Box, Statistics for Experimenters</a>	<a href="#">Scheaffer, Elementary Survey Sampling</a>	<a href="#">Chatfield, Problem Solving: A Statistician's Guide</a>	<a href="#">whattest</a>	<a href="#">Questionnaire design by Sheffield Hallam University</a>
Level	Level of student <sup>a</sup>	1-2	1-4	2-3	2-4	1-3	1-2
	Level of detail <sup>b</sup>	3	4	3	3	2	2
Maths	Some mathematics		✓	✓	✓	✓	
	Mathematical focus						
Resources for students	Associated website		✓			✓	
	Datasets		✓				
	Practice questions	✓	✓		✓		
Resources for tutors		✓		✓			
Software	Software used		R				SPSS
	Data manipulation						
	Procedures shown						✓
	Interpretation						✓
Topic	Choosing a test				✓	✓	
	Experimental design		✓	✓	✓	✓	
	Factorial designs		✓				
	Fractional factorial designs		✓				
	Inference		✓		✓	✓	
	Response surface methods		✓				
	Sample size and/or power		✓	✓	✓	✓	
	Sample survey design	✓		✓	✓	✓	
Questionnaire design		✓					✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

## Books

### *Research Skills for Students. Allison, O'Sullivan, Owen, Rice, Rothwell and Saunders.*

A collection of self-study workbooks in four parts, which includes useful self-study resources for planning a sample survey by Alun Owen (Part B) and questionnaire design by Arthur Rothwell (Part C).

### *Statistics for Experimenters. Box, Hunter and Hunter.*

A classic must read for anyone serious about understanding experimental design. Very accessible with some parts discussing the main issues without recourse to the mathematics. Includes (in the 2<sup>nd</sup> edition) procedures using R.

### *Elementary Survey Sampling. Scheaffer, Mendenhall and Ott.*

The book includes simple formulae to calculate margins of error (and sample sizes for a required margin of error) from sample surveys and is especially useful where the population being studied is not large.

### *Problem Solving: A Statistician's Guide. Chris Chatfield.*

This book provides ideas and summaries of many different statistical analyses so students can see if these might be applicable to their work. Aimed at students who have studied some basic theory but are unsure what to do when faced with real data, especially if the data are 'messy' or the objectives are unclear.

## Online resources

### *whattest:*

<http://whattest.lboro.ac.uk/>

A website designed by students for students to help them understand the structure of their data, the design of their study, and how to choose a statistical technique to answer their research question(s). It takes them through a set of questions to reach the correct test.

### *Questionnaire design by Sheffield Hallam University:*

[https://students.shu.ac.uk/lits/it/documents/pdf/questionnaire\\_analysis\\_using\\_spss.pdf](https://students.shu.ac.uk/lits/it/documents/pdf/questionnaire_analysis_using_spss.pdf)

A tutorial from Sheffield Hallam University (UK) on how to create a questionnaire and then how to analyse the results using SPSS.

### *Choosing the right test (University of Sheffield) handout:*

[http://www.sheffield.ac.uk/polopoly\\_fs/1.575549!/file/What\\_test\\_flowchart\\_and\\_table.pdf](http://www.sheffield.ac.uk/polopoly_fs/1.575549!/file/What_test_flowchart_and_table.pdf)

Popular download with flow chart and table options for choosing the right test. There is an accompanying sheet with definitions [here](#).



# **Section 3**

## **Resources for students for most common statistical techniques**

# SPSS resources: Books

Title		<a href="#">Morgan, IBM SPSS for Introductory Statistics</a>	<a href="#">Brace, SPSS for Psychologists</a>	<a href="#">Pallent, SPSS Survival Guide</a>	<a href="#">Dancey, Statistics Without Maths for Psychology</a>	<a href="#">Gray, IBM SPSS 19 Statistics Made Simple</a>	<a href="#">Leech, IBM SPSS for Intermediate Statistics</a>	<a href="#">Field, Discovering Statistics Using SPSS</a>
Level	Level of student <sup>a</sup>	1-2	1-2	1-2	1-2	1-2	2-3	2-3
	Level of detail <sup>b</sup>	2	3	3	3	4	2	4
Some mathematics								✓
Resources for students	Associated website	✓		✓		✓	✓	✓
	Datasets	✓		✓		✓	✓	✓
	Practice questions	✓		✓	✓	✓	✓	✓
Resources for tutors		✓		✓	✓	✓	✓	✓
Software	SPSS syntax					✓	✓	
	Data manipulation	✓	✓	✓		✓		✓
	Procedures shown	✓	✓	✓	✓	✓	✓	✓
	Interpretation	✓	✓	✓	✓	✓	✓	✓
Topics	Standard tests and modelling techniques	✓	✓	✓	✓	✓	✓	✓
	Advanced regression <sup>c</sup>							BL, ML
	Multilevel modelling						✓	✓
	Multivariate <sup>d</sup>		MA, FA, LDA	MA, FA	MA, FA	MA	MA, FA, PCA, LDA, CC	MA, FA
	Reliability <sup>e</sup>	Ka, CA	CA	CA			Ka, CA, ICC	CA, ICC
	Sample size and/or power					✓		
	Study design			✓				✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Advanced regression: GLM=Generalised Linear Models, BL=Binary Logistic, ML=Multinomial Logistic, Po=Poisson

d: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling

e: Reliability: CA = Cronbach's alpha, ICC = Intraclass correlation, Ka = Kappa



### ***IBM SPSS for Introductory Statistics: Use and Interpretation. Morgan, Leech, Gloeckner and Barrett.***

Good beginners book for using SPSS, from defining variables, coding and entering data, data types and how to check for errors to descriptive stats, charts and graphs to reliability testing and inferential stats (up to ANOVA). This book focuses on using SPSS, but provides some conceptual understanding for tests, walks through the procedures and how to interpret results. Good as a quick reference for 'how to' in SPSS because everything is presented very clearly and concisely. This is not a statistical guide so some students may need more information e.g. about assumptions. The associated web site (via link in table) has data sets, chapter study guides, extra SPSS problems and chapter outlines.

### ***SPSS for Psychologists. Brace, Kemp and Snelgar.***

This book offers students quick examples of using SPSS to undertake statistical analyses and interpret the results. Most of the standard topics are covered along with some topics in multivariate analysis and reliability assessments.

### ***SPSS Survival Guide. Julie Pallent.***

Literally a 'survival manual' on how to use, interpret and report statistics using SPSS. A brief intro is given for each technique in a fairly easy to understand way with further references if more statistical detail is needed. Steps to carry out each task are clear and concise. Output is displayed, key statistics interpreted in the context of the problem and an example paragraph of how results could be reported given. New PGR tutors use this book to learn SPSS as well as use with students. Advanced topics include Factor Analysis and MANOVA.

### ***Statistics Without Maths for Psychology. Dancey and Riley.***

For students who need to understand and use statistics but find the mathematical formulae daunting, Statistics Without Maths for Psychology is the ideal guide. The clear, straightforward style and step-by-step SPSS walkthroughs take you through all the statistical procedures you will need. Activities and questions enable you to test your learning and increase your understanding in a practical, manageable way.

### ***IBM SPSS 19 Statistics Made Simple. Gray and Kinnear.***

Good all round book for reference in a support centre but it might be a bit expensive and students might find the "serious" style a bit off-putting. Very clear screen dumps with "call-out" annotation boxes.

### ***IBM SPSS for Intermediate Statistics: Use and Interpretation. Leech, Barrett and Morgan.***

Some overlap with IBM SPSS for Introductory Statistics: Use and Interpretation by Morgan, Leech, Gloeckner and Barrett (see above). Includes data coding, checking for errors, descriptive stats and graphs but goes up to Exploratory Factor Analysis, PCA and multilevel linear modeling. It focuses on using SPSS, but provides some conceptual understanding for tests and how to interpret and report results. It's good as a quick reference for 'how to' in SPSS because everything is presented very clearly and concisely but some details are missing e.g. details of assumptions.

### ***Discovering Statistics Using SPSS. Andy Field.***

Highly recommended within psychology with amusing examples and detailed explanations. Andy Field also has a youtube channel and website which have tutorials related to content. For each topic he provides a good background, the mathematical calculations, how to run the test in SPSS, how to interpret the output and examples of how to report results. However it is a large book and a perhaps a bit too detailed for beginners but great as a tutor resource. Advanced topics include Factor Analysis, MANOVA and multilevel modelling. The associated web site called ***Statistics Hell*** has lots of additional resources (see next section re online resources).

# SPSS resources: Online resources

Resource		<a href="#">Statstutor</a>	<a href="#">Brunel/ASK videos</a>	<a href="#">Northampton Skills hub videos</a>	<a href="#">Laerd Statistics</a>	<a href="#">A guide to SPSS for Information Science</a>	<a href="#">SPSS-tutorials.com</a>	<a href="#">Statistics hell</a>	<a href="#">SPSS On-line videos Central Michigan University</a>	<a href="#">UCLA SPSS</a>
Level	Level of student <sup>a</sup>	1-3	1-2	1-2	1-2	1-2	1-2	2-3	2-4	2-4
	Level of detail <sup>b</sup>	2-3	2	2	3	3	3	4	3	3-4
Some mathematics		✓						✓		✓
Resources for students	Datasets					✓			✓	
	Practice questions	✓				✓				
	Worksheets	✓						✓		
	Videos	✓	✓	✓				✓	✓	
Software	SPSS syntax						✓			✓
	Data manipulation	✓	✓	✓	✓	✓	✓		✓	✓
	Procedures shown	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Interpretation	✓	✓	✓	✓	✓	✓	✓	✓	✓
Topic	Standard tests and modelling techniques	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Advanced regression <sup>c</sup>	BL			BL			BL, ML	GLM, BL,	GLM, BL, ML, Po
	Multilevel modelling	✓						✓		✓
	Multivariate <sup>d</sup>	FA, PCA, CI			PCA			MA, FA	MA, FA	MA, FA, LDA, CC
	Reliability <sup>e</sup>	CA, ICC, BA			CA, Ka			CA, ICC	CA	
	Sample size and/or power	✓								
	Study design							✓		

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Advanced regression: GLM=Generalised Linear Models, BL=Binary Logistic, ML=Multinomial Logistic, Po=Poisson

d: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling

e: Reliability: CA = Cronbach's alpha, ICC = Intraclass correlation, Ka = Kappa

### ***Statstutor:***

<http://www.statstutor.ac.uk/>

Trusted site containing a growing collection of downloadable resources for use in statistics support as well as videos, workshop materials and online quizzes for some topics.

### ***BrunelASK Videos:***

<https://www.youtube.com/user/BrunelASK>

These short videos, concentrating on data entry and manipulation, were created by Christine Pereira at Brunel University. These videos also appear on statstutor.

### ***Northampton skills hub:***

<https://video.northampton.ac.uk/category/Skills+Hub/31777471>

Created by Paul Rice at Northampton University these short videos cover most standard procedures and include SPSS instructions and interpretation as well as questions for students to answer within the videos.

### ***Laerd Statistics:***

<https://statistics.laerd.com/>

A commercial site which used to be free, although many of the resources can still be accessed for free. It's clear, concise and spells out the necessary assumptions for tests as well as taking students through the steps in SPSS, interpretation and write up. Some of the site requires a subscription.

### ***A Guide to SPSS for Information Science, Loughborough University:***

<http://www.statstutor.ac.uk/resources/uploaded/spssguide1mar2012.pdf>

Useful and clear SPSS instruction ebook produced by Anne Morris and David Green of Loughborough University and downloadable from statstutor. Covers data entry and manipulation in detail before moving on to summary statistics, graphs and the most common statistical tests.

### ***SPSS-tutorials.com:***

<http://www.spss-tutorials.com/>

Great beginner web guide for SPSS syntax. Shows the procedures with menu steps then resulting syntax so good for both. Links within each webpage to go to specific statistics procedures and the data set associated with the procedure.

### ***Statistics Hell:***

<http://www.statisticshell.com/>

Site attached to the Andy Field book. Contains the most commonly used techniques in detail using recorded lectures and sections of the book under each technique. The length of both can be offputting although a good reference for tutors wanting to check finer details. The site follows a strong satanic theme which may not be to everyone's taste.

### ***SPSS On-line videos, Central Michigan University:***

<http://calcnet.mth.cmich.edu/org/spss/toc.htm>

This website contains a neat table with webpages, videos and the associated datasets for each topic ranging from data entry to more complex topics such as introductory time series and control charts. The only downside to the videos is that they feature SPSS version 16 although the data sets are for version 22.

### ***UCLA SPSS:***

<http://www.ats.ucla.edu/stat/spss/>

Offers thorough explanations of output and statistical techniques including more advanced techniques such as non-linear regression and multivariate analysis. It offers support for SPSS as well as other software and has recommended books with downloadable chapters. Probably better for tutors and those wanting to cover more advanced techniques as it uses syntax for SPSS and is very detailed.

# Online SPSS resources: Data entry and manipulation

Resource		<a href="#">Statstutor</a>	<a href="#">BrunelASK videos</a>	<a href="#">Northampton Skills hub videos</a>	<a href="#">SPSS-tutorials.com</a>	<a href="#">SPSS On-line videos Central Michigan University</a>	<a href="#">Statistics hell!</a>	<a href="#">UCLA SPSS</a>
General	Getting started with SPSS	✓				✓		✓
	SPSS-tutorials for SPSS syntax				✓			✓
	Data editor window							
	Comprehensive guide to SPSS	✓						
Data entry	Data entry		✓	✓			✓	✓
	Defining variables		✓	✓				✓
	Importing from Excel	✓	✓	✓		✓	✓	.
	Missing values			✓				✓
	Questionnaire: Multiple response		✓					
	Questionnaire: Open response		✓					
	Questionnaire: Ranked response		✓					
	Questionnaire: Single Likert		✓					
	Questionnaire: Single response		✓					
Recode	Categorise scale variables	✓	✓					
	Create dummy variables		✓					
	Recode groups	✓	✓					
	Recode into same variable		✓					
	Reverse coding		✓					
Calculate	Calculate a mean score		✓					
	Calculate a total score		✓					
	Compute if					✓		
Other	Restructure data					✓		✓
	Select cases/ split file	✓				✓	✓	✓
	Sort, merge and transpose					✓		

# Online SPSS resources: Standard topics in statistics

Resource		<a href="#">Statstutor</a>	<a href="#">University of Northampton Skills Hub</a>	<a href="#">Sheffield MASH Resource</a>	<a href="#">Laerd Statistics</a>	<a href="#">Statistics hell</a>
Level	Level of student <sup>a</sup>	1-2	1-2	1-2	1-2	2-3
	Level of detail <sup>b</sup>	2-3	2-3	2-3	3	4
Some mathematics						✓
Content	Resouce/Video/webpage	R	V	R	W	W
	Datasets			✓		✓
	Practice questions		✓			✓
Software	SPSS		✓	✓		✓
	Data manipulation					
	Procedures shown		✓	✓		
	Interpretation		✓	✓		
Introductory statistics	Data types	✓				
	Descriptive statistics in SPSS		✓			
	Descriptive statistics	✓	✓			
	Graphs	✓				✓
	Confidence intervals	✓				✓
	Hypothesis testing	✓	✓			
T-tests	One sample t-test	✓			✓	
	Independent t-test	✓	✓		✓	✓
	Paired t-test	✓	✓		✓	
ANOVA	ANOVA and related					✓
	One way ANOVA	✓	✓	✓	✓	✓
	Two-way ANOVA	✓		✓	✓	✓
	Interactions in ANOVA			✓		
	ANCOVA	✓		✓		✓
	Repeated measures ANOVA		✓		✓	✓
	Two-way repeated measures				✓	
	Mixed Between-within ANOVA				✓	✓
Non-parametric	Sign Test	✓				
	Friedman	✓	✓		✓	✓
	Wilcoxon signed rank	✓	✓		✓	✓
	Chi-squared test Association	✓	✓		✓	✓
	Chi-squared test Goodness of fit	✓			✓	
	Fisher's Exact test	✓				
	Kruskall-Wallis	✓	✓		✓	✓
	Mann-Whitney	✓	✓		✓	✓
Correlation and regression	Regression and related					✓
	Scatterplots			✓	✓	
	Correlation	✓	✓	✓	✓	✓
	Spearman's correlation	✓			✓	
	Kendall's correlation	✓				
	Simple linear regression	✓	✓	✓	✓	✓
	Multiple linear regression	✓	✓	✓	✓	✓
	Further regression			✓		✓
	Logistic regression	✓			✓	
	Ordinal logistic regression				✓	

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

# R resources: Books

Title		<a href="#">Stowell, Using R for Statistics</a>	<a href="#">Paradis, R for Beginners (Free e-Book)</a>	<a href="#">Field, Discovering Statistics Using R</a>	<a href="#">Crawley, Statistics: An Introduction Using R</a>	<a href="#">Hothorn, A Handbook of Statistical Analyses Using R</a>	<a href="#">Dalgaard, Introductory Statistics with R</a>	<a href="#">Crawley, The R Book</a>	<a href="#">Faraway, Linear Models with R</a>
Level	Level of student <sup>a</sup>	2	2	2-3	2-4	2-4	2-4	3-4	4
	Level of detail <sup>b</sup>	2	2	4	2-3	3	3	4	4
Some mathematics				✓		✓	✓	✓	✓
Resources for students	Associated website		✓	✓	✓	✓			✓
	Datasets	✓		✓	✓		✓	✓	✓
	Practice questions			✓	✓		✓		
Resources for tutors		✓		✓	✓				
Software	R scripts	✓	✓	✓	✓	✓	✓	✓	✓
	Data manipulation	✓	✓	✓	✓	✓	✓	✓	
	Procedures shown	✓	✓	✓	✓	✓	✓	✓	✓
	Interpretation	✓		✓	✓	✓	✓	✓	✓
Topics	Standard tests and modelling techniques	✓		✓	✓	✓	✓	✓	✓
	Advanced regression <sup>c</sup>			BL, ML	GLM, BL	GLM, BL	BL	GLM, BL, Po	GLM
	Medical Statistics <sup>d</sup>				SA, CR	MA, SA, KM, LR, CR	SA, KM, LR, CR	MA, SA, KM, CR	
	Multilevel modelling			✓		✓		✓	
	Multivariate <sup>e</sup>			FA, MA		PCA, CI, MDS		CT, PCA, CI, LDA	
	Reliability <sup>f</sup>			CA, ICC					
	Sample size and/or power						✓	✓	
	Study design			✓					✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Advanced regression: GLM=Generalised Linear Models, BL=Binary Logistic, ML=Multinomial Logistic, Po=Poisson

d: Medical statistics: MA = Meta-analysis, SA = Survival analysis, LR = Log rank, CR = Cox's regression, KM = Kaplan-Meier, SS =Sensitivity/specificity, OR = Odds ratios, R = Risk

e: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling

f: Reliability: CA = Cronbach's alpha, ICC = Intraclass correlation, Ka = Kappa

### ***Using R for Statistics. Sarah Stowell.***

A quick and easy to access text for R beginners. Does not include any discussion of the mathematics behind any of the techniques so better for those with some experience of statistics looking to learn to use R for the first time.

### ***R for Beginners. Emmanuel Paradis.***

A free to download text via the CRAN (Comprehensive R Archive Network) website at <https://cran.r-project.org/>. Covers only the basics in statistics and concentrates on how to use the software.

### ***Discovering Statistics Using R. Field, Miles and Field.***

Highly recommended within psychology with amusing examples and detailed explanations. Andy Field also has a youtube channel and website which have tutorials related to content. For each topic he provides a good background, the mathematical calculations, how to run the test using R and R Commander, how to interpret the output and examples of how to report results. However it is a large book and a perhaps a bit too detailed for beginners but great as a tutor resource. Advanced topics include Factor Analysis, MANOVA and multilevel modelling.

### ***Statistics: An Introduction Using R. Michael J. Crawley.***

A good introductory text that covers standard introductory material as well more challenging topics in modelling, ANOVA and ANCOVA etc. Sometimes skips some important explanations but this makes it a quicker text to work through. Probably better for the more mathematically inclined such as engineers and other science based students.

### ***A Handbook of Statistical Analyses Using R. Hothorn and Everitt.***

A copy of the very well known text on statistical analysis using R. Covers a wide range of topics from introductory methods to more advanced techniques. A lot of information from the third edition of the book, along with functions and datasets used in the book, can be accessed for free at <https://cran.r-project.org/web/packages/HSAUR3/>.

### ***Introductory Statistics with R. Peter Dalgaard.***

Introductory material on R, as well as how to use R for commonly encountered statistical techniques.

### ***The R Book. Michael J. Crawley.***

Comprehensive coverage of many of the R commands you might need to use. Can be used by those considered to be beginners to statistics and command line packages such as R, or equally can be used by more experienced users of statistics and/or R. Best as a reference source to dip into rather than as a source for learning statistical analysis in R.

### ***Linear Models with R. Julian J. Faraway.***

A more advanced R book with a clear summary of linear models. Helpful sample code and many realistic examples/case studies.

# R resources: Online resources

Resource		<a href="#">Little Book of R for...</a>	<a href="#">An Introduction to R</a>	<a href="#">CRAN contributed documentation</a>	<a href="#">UCLA R</a>	<a href="#">Quick R</a>	<a href="#">Engineering Statistics Handbook</a>	<a href="#">statstutor</a>
Level	Level of student	1-2	2-4	2-4	2-4	3-4	3-4	1-3
	Level of detail	1	2	2-4	3-4	3	4	2-3
Some mathematics				✓	✓			
Resources for students	Datasets		✓	✓	✓		✓	✓
	Practice questions			✓				
	Worksheets			✓				✓
	Videos							
Software	R scripts		✓	✓			✓	✓
	Data manipulation		✓	✓	✓	✓		✓
	Procedures shown	✓	✓	✓	✓	✓		✓
	Interpretation	✓	✓	✓	✓	✓	✓	✓
Topic	Standard tests and modelling techniques	<a href="#">Some</a>		✓	✓	✓	✓	✓
	Advanced regression			✓	GLM, BL, ML, Po	GLM, BL, Po		
	Medical Statistics	MA, OR, R						
	Multilevel modelling			✓	✓			
	Multivariate	<a href="#">PCA, LDA</a>		✓	MA, FA, LDA, CC	MA		
	Reliability			✓			✓	
	Sample size and/or power	✓			✓	✓		
	Study design							

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Advanced regression: GLM=Generalised Linear Models, BL=Binary Logistic, ML=Multinomial Logistic, Po=Poisson

d: Medical statistics: MA = Meta-analysis, SA = Survival analysis, LR = Log rank, CR = Cox's regression, KM = Kaplan-Meier, SS =Sensitivity/specificity, OR = Odds ratios, R = Risk

e: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling



### *Little Book of R for...*

<http://a-little-book-of-r-for-biomedical-statistics.readthedocs.org/en/latest/>

<http://little-book-of-r-for-multivariate-analysis.readthedocs.io/en/latest/>

<http://a-little-book-of-r-for-time-series.readthedocs.io/en/latest/>

There are 3 ebooks in this series (little book of R for Biomedical statistics, multivariate analysis and time series), all of which assume that the reader has some basic knowledge of statistical analysis, and therefore focuses on how to carry out these analyses using R. The pages are easy to read and some interpretation is included.

### *An Introduction to R:*

<https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>

A manual for getting started with R with a useful appendix of some R commands to try.

### *CRAN contributed documentation:*

<https://cran.r-project.org/other-docs.html>

A comprehensive list of a wide range of pdf based learning resources for R in many different languages contributed to the CRAN site (the home site for R!).

### *UCLA R:*

<http://www.ats.ucla.edu/stat/r/>

This website offers a thorough explanation of output and statistical techniques including more advanced techniques such as non-linear regression and multivariate analysis.

### *Quick R:*

<http://www.statmethods.net/index.html>

This website contains easy to find commands and an overview for a range of data manipulation and analysis techniques. It assumes that readers already understand statistics and just need to find commands quickly.

### *Engineering Statistics Handbook:*

<http://itl.nist.gov/div898/handbook/index.htm>

Online, interactive textbook covering elementary statistics with an engineering focus. On some pages links to script files for R and also Dataplot (a free statistics software package available at <http://www.itl.nist.gov/div898/software/dataplot/>) are included. However, it is difficult to locate specific R files quickly as their names are codes in the zip file.

### *Statstutor:*

<http://www.statstutor.ac.uk/topics/r/statistical-analyses-using-r/>

Student self help resources for use in statistics support which include the data set and script files associated with the sheets. Most key topics to be uploaded by Dec 16.

# Mathematical understanding: Books

Title		<a href="#">Kirkwood, Essential Medical Statistics</a>	<a href="#">Altman, Practical Statistics for Medical Research</a>	<a href="#">Scheaffer, Elementary Survey Sampling</a>	<a href="#">Field, Discovering Statistics Using SPSS</a>	<a href="#">Field, Discovering Statistics Using R</a>	<a href="#">Manly, Multivariate analysis: A primer</a>	<a href="#">Kanji, 100 Statistical Tests</a>	<a href="#">Wackerly, Mathematical Statistics with Applications</a>	<a href="#">Wood, Core Statistics</a>
Level	Level of student <sup>a</sup>	1-2	2	2-3	2-3	2-3	2-4	2-4	3-4	4
	Level of detail <sup>b</sup>	4	3	3	4	4	4	4	4	4
Maths	Some mathematics	✓	✓	✓	✓	✓				
	Mathematical focus						✓	✓	✓	✓
Resources for students	Associated website				✓	✓				✓
	Datasets				✓	✓	✓			✓
	Practice questions		✓		✓	✓			✓	✓
Resources for tutors				✓	✓	✓				
Software	Software used		STATA		SPSS	R				R
	Data manipulation				✓	✓				
	Procedures shown				✓	✓				✓
	Interpretation		✓		✓	✓				
Topic	ANOVA	✓	✓		✓	✓		✓	✓	✓
	Categorical data analysis	✓	✓		✓	✓		✓	✓	
	Estimation and Estimators	✓		✓					✓	✓
	Experimental or study design	✓	✓	✓	✓	✓			✓	
	Functions of Random Variables								✓	
	Hypothesis testing	✓	✓		✓	✓		✓	✓	✓
	Medical Statistics <sup>c</sup>	All	SA, CR, R							
	Multivariate <sup>d</sup>				FA, MA	FA, MA	PCA, FA, LDA, CI, CA, CC, MDS			
	Non-parametric statistics		✓		✓	✓		✓	✓	
	Regression	✓	✓		✓	✓			✓	✓
	Sample size and/or power	✓	✓	✓						✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Medical statistics: MA = Meta-analysis, SA = Survival analysis, LR = Log rank, CR = Cox's regression, KM = Kaplan-Meier, SS = Sensitivity/specificity, OR = Odds ratios, R = Risk

d: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling

### ***Essential Medical Statistics. Kirkwood and Sterne.***

A sound run through of standard statistical methods firmly rooted in clinical/medical practice. It shows the formulae and methods for calculation "by hand" from means and standard deviation through to basic ANOVA and survival analysis (Cox regression).

### ***Practical Statistics for Medical Research. Doug Altman.***

Clear, comprehensive and methodical summary of the most common techniques used in the biological sciences and medicine. Contains output from STATA (without instructions) and more detailed maths in separate sections so the reader can choose the amount they want to know.

### ***Elementary Survey Sampling. Schaeffer, Mendenhall and Ott.***

A great introductory book with a focus on sample surveys rather than experiments. Includes the design of sample surveys but also the mathematical explanation of sample sizes required to achieve a desired margin of error. Very accessible by non-mathematics students as well as by mathematics specialists.

### ***Discovering Statistics Using SPSS. Andy Field.***

### ***Discovering Statistics Using R. Field, Miles and Field.***

Although primarily an SPSS book and an R book respectively, these texts cover some of the mathematics behind the statistics, but in a way that is more accessible to students than a standard statistics textbook. Even mathematics students doing applied statistics projects prefer these texts to more rigorous statistics texts recommended by mathematics lecturers.

### ***Multivariate Statistical Methods: A Primer. Bryan Manly.***

We like this book because it gives a good overview of multivariate methods that allows a student to assess whether these are useful. It does include some mathematics and so is mostly accessible to anyone having studied some mathematics as part of their undergraduate degree. However the more mathematical elements could be omitted and the book would still provide a very useful overview.

### ***100 Statistical Tests. Gopal Kanji.***

A great resource if you can't remember the details of a particular test. Also useful to find a test for less common situations.

### ***Mathematical Statistics with Applications. Dennis Wackerly.***

Excellent book for mathematics specialists, economists, engineers, etc., who are able to understand aspects of mathematical statistics and the derivation of many important theoretical results in statistics.

### ***Core Statistics. Simon Wood.***

Well written overview of the core statistics a graduate in statistics would be expected to know. A free pdf version is also available from Simon's website at

<http://www.maths.bris.ac.uk/~sw15190/>



# **Section 4**

## **Resources for students for other statistical techniques**

# Multivariate: Books

Title		<a href="#">Brace, SPSS for psychologists</a>	<a href="#">Dancey, Statistics Without Maths for Psychology</a>	<a href="#">Dytham, Choosing and Using Statistics: A Biologist's Guide.</a>	<a href="#">Leech, IBM SPSS for Intermediate Statistics</a>	<a href="#">Everitt, An R and S-PLUS Companion to Multivariate Analysis</a>	<a href="#">Field, Discovering Statistics Using SPSS</a>	<a href="#">Field, Discovering Statistics Using R</a>	<a href="#">Manly, Multivariate analysis: A primer</a>	<a href="#">Hastie, Elements of Statistical Learning</a>
Level	Level of student <sup>a</sup>	1-2	1-2	1-2	2-3	2-3	2-3	2-3	2-4	4
	Level of detail <sup>b</sup>	3	3	3	2	3	4	4	4	4
Maths	Some mathematics					✓	✓	✓		
	Mathematical focus								✓	✓
Resources for students	Associated website				✓		✓	✓		✓
	Datasets				✓	✓	✓	✓	✓	✓
	Practice questions		✓		✓	✓	✓	✓		
Resources for tutors					✓		✓	✓		✓
Software	Software used	SPSS	SPSS	SPSS, R, Minitab, Excel	SPSS		SPSS	R		
	Data manipulation	✓					✓	✓		
	Procedures shown	✓	✓	✓	✓	✓	✓	✓		
	Interpretation	✓	✓	✓	✓	✓	✓	✓		
Topic	Canonical Correlation			✓	✓	✓			✓	
	Cluster Analysis			✓		✓			✓	✓
	Correspondance analysis								✓	
	Factor Analysis	✓	✓	-	✓	✓	✓	✓	✓	
	Linear discriminant analysis	✓		✓	✓	✓			✓	✓
	MANOVA	✓	✓	✓	✓	✓	✓	✓		
	Multi-dimensional scaling					✓			✓	
	Principal Components Analysis			✓	✓	✓			✓	✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

### ***SPSS for Psychologists. Brace, Kemp and Snelgar.***

Not a book on multivariate analysis, but includes some nice quick examples of MANOVA, Factor Analysis and Linear Discriminant Analysis using SPSS so a good starting point for how to use SPSS to apply those methods.

### ***Statistics Without Maths for Psychology. Dancey and Riley.***

For students who need to understand and use statistics but find the mathematical formulae daunting. Covers MANOVA and Factor Analysis. The clear, straightforward style and step-by-step SPSS walkthroughs are very helpful.

### ***Choosing and Using Statistics: A Biologist's Guide. Calvin Dytham.***

More of a text on introductory statistics for biologists than for multivariate analysis, but the chapter on multivariate analysis is based around the use of R and has some good applications in the biological sciences.

### ***IBM SPSS for Intermediate Statistics: Use and Interpretation. Leech, Barrett and Morgan.***

Includes Exploratory Factor Analysis and PCA. It focuses on using SPSS, but provides some conceptual understanding and how to interpret and report results. It's good as a quick reference for 'how to' in SPSS because everything is presented very clearly and concisely.

### ***An R and S-PLUS Companion to Multivariate Analysis. Brian Everitt.***

A useful book for implementing multivariate analysis using R, aimed at the more advanced user. Possibly a little dated now.

### ***Discovering Statistics Using SPSS. Andy Field.***

### ***Discovering Statistics Using R. Field, Miles and Field.***

Highly recommended within psychology with amusing examples and detailed explanations. Andy Field also has a youtube channel and website which have tutorials related to content. For each topic the book provides a good background, the mathematical calculations, how to run the test in SPSS or R (and R Commander), how to interpret the output and examples of how to report results. However it is a large book and a perhaps a bit too detailed for beginners but great as a tutor resource. Includes topics on Factor Analysis and MANOVA.

### ***Multivariate Statistical Methods: A Primer. Bryan Manly.***

We like this book because it gives a good overview of multivariate methods that allows a student to assess whether these are useful. It does include some mathematics and so is mostly accessible to anyone having studied some mathematics as part of their undergraduate degree. However the more mathematical elements could be omitted and the book would still provide a very useful overview.

### ***Elements of Statistical Learning. Hastie, Tibshirani and Friedman.***

Free to download text which covers many some aspects of multivariate analysis in great detail along with a detailed account of other techniques such as neural networks and random forests. More for the advanced mathematics specialists.

# Multivariate: Online resources

Resource		<a href="#">Statstutor</a>	<a href="#">Statistics hell</a>	UCLA				<a href="#">Little book of R for multivariate analysis</a>	<a href="#">Statsoft</a>
Level	Level of student <sup>a</sup>	1-3	2-3	2-4	2-4	2-4	2-4	3-4	3-4
	Level of detail <sup>b</sup>	2-3	4	3-4	3-4	3-4	3-4	1	1-4
Some mathematics		✓	✓						✓
Resources for students	Datasets			✓	✓	✓	✓	✓	
	Practice questions	✓							
	Worksheets	✓	✓						
	Videos	✓	✓						
Software	Software used	SPSS	SPSS	SPSS	R	SAS	STATA	R	
	Data manipulation	✓							
	Procedures shown	✓	✓	✓	✓	✓	✓		
	Interpretation	✓	✓	✓	✓	✓	✓		
Topic	Canonical Correlation			✓	✓	✓	✓		✓
	Cluster Analysis	✓	✓						✓
	Correspondance analysis								✓
	Factor Analysis	✓	✓	✓		✓	✓		✓
	Linear discriminant analysis			✓		✓	✓	✓	✓
	MANOVA		✓	✓		✓	✓		✓
	Multi-dimensional scaling								✓
	Principal Components Analysis	✓	✓			✓		✓	✓

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive



### ***Statstutor:***

<http://www.statstutor.ac.uk/>

Trusted site containing a growing collection of downloadable resources for use in statistics support as well as videos, workshop material and online quizzes for some topics.

### ***Statistics Hell:***

<http://www.statisticshell.com/>

Site attached to the Andy Field book. Contains recorded lectures and sections of the book. The length of both can be offputting although a good reference for tutors wanting to check finer details. The site follows a strong satanic theme which may not be to everyone's taste.

### ***UCLA:***

<http://www.ats.ucla.edu/stat/>

This website offers a thorough explanation of output and statistical techniques including more advanced techniques such as non-linear regression and multivariate analysis. It offers support for SPSS, SAS, STATA and some R and has recommended books with downloadable chapters. It's probably better for tutors and those wanting to cover more advanced techniques rather than most undergraduate students as it uses syntax for SPSS and is very detailed.

### ***Little Book of R for Multivariate Analysis:***

<http://little-book-of-r-for-multivariate-analysis.readthedocs.io/en/latest/>

There are 3 ebooks in this series (little book of R for Biomedical statistics, multivariate analysis and time series), all of which assume that the reader has some basic knowledge of statistical analysis, and therefore focuses on how to carry out these analyses using R. The pages are easy to read and some interpretation is included.

### ***StatSoft:***

<http://www.statsoft.com/textbook/>

This e-textbook, which is linked to Statsoft's own program Statistica, covers overviews of a large number of multivariate techniques.

# Engineering Statistics: Books and online resources

Resource		<a href="#">Montgomery, Applied Statistics and Probability for Engineers</a>	<a href="#">Mendenhall, Statistics for Engineering and the Sciences</a>	<a href="#">HELM</a>	<a href="#">Engineering Statistics Handbook</a>	<a href="#">SPSS On-line videos</a> <a href="#">Central Michigan University</a>
Level	Level of student <sup>a</sup>	1-3	1-3	1-3	3-4	2-4
	Level of detail <sup>b</sup>	3	3	4	4	3
Maths	Some mathematics	✓	✓	✓		
	Mathematical focus			✓		
Resources for students	Associated website	<a href="#">✓</a>	<a href="#">✓</a>	<a href="#">✓</a>	<a href="#">✓</a>	<a href="#">✓</a>
	Datasets	<a href="#">✓</a>	<a href="#">✓</a>			<a href="#">✓</a>
	Practice questions	✓	✓	✓		
Resources for tutors		<a href="#">✓</a>		<a href="#">✓</a>		
Software	Software used	SAS, Minitab, Excel, JMP	SPSS, SAS, Minitab, Excel		R	SPSS
	Data manipulation					✓
	Procedures shown					✓
	Interpretation	✓	✓		✓	✓
Topic	Standard tests and modelling techniques	✓	✓	✓	✓	✓
	Advanced regression <sup>c</sup>					GLM, BL,
	Multivariate <sup>d</sup>					MA, FA
	Experimental or study design	✓	✓		✓	
	Non-parametric statistics	✓	✓	✓		✓
	Quality/Process Control	✓	✓	✓	✓	✓
	Reliability engineering		✓	✓	✓	
	Sample size and/or power	✓	✓			

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

c: Advanced regression: GLM=Generalised Linear Models, BL=Binary Logistic, ML=Multinomial Logistic, Po=Poisson

d: Multivariate: MA = MANOVA, FA = Factor Analysis, PCA = Principal Components Analysis, DA = Discriminant Analysis, CI = Cluster Analysis, CA = Correspondence Analysis, CC = Canonical Correlation, CT = classification Trees, MDS = Multi-dimensional Scaling

## Books

### *Applied Statistics and Probability for Engineers, Montgomery and Runger.*

Lots of examples and straight to the point. Focus is on Minitab but many of the data sets used in the book are available for free download for SAS, JMP and Excel as well as for Minitab.

### *Statistics for Engineering and the Sciences, Mendenhall and Sincich.*

A popular book for engineering statistics with a good mix of theory and practical applications. Focus is on Minitab but many of the data sets used in the book are available for free download for SPSS, SAS and Excel as well as for Minitab.

## Online resources

### *HELM (Help Engineers Learn Maths):*

[https://learn-pilot.lboro.ac.uk/archive/olmp/olmp\\_resources/pages/wbooks\\_fulllist.html](https://learn-pilot.lboro.ac.uk/archive/olmp/olmp_resources/pages/wbooks_fulllist.html)

A series of workbooks on many maths topics which contain teaching, worked examples and exercises, including problems in an engineering context. Includes lots of workbooks on statistics topics. The latest versions of the workbooks can be downloaded by HE institutions by registering at <http://www.lboro.ac.uk/departments/mec/activities/helm/helmworkbooklist/>

### *Engineering Statistics Handbook:*

<http://itl.nist.gov/div898/handbook/index.htm>

Online, interactive textbook covering elementary statistics with an engineering focus. On some pages links to script files for R and also Dataplot (a free statistics software package available at <http://www.itl.nist.gov/div898/software/dataplot/>) are included. However, it is difficult to locate specific R files quickly as their names are codes in the zip file.

### *SPSS On-line Videos, Central Michigan University:*

<http://calcnet.mth.cmich.edu/org/spss/toc.htm>

This website contains a neat table with webpages, videos and the associated datasets for each topic ranging from data entry to more complex topics including control charts. The only downside to the videos is that they feature SPSS version 16 although the data sets are for version 22.

# Medical Statistics: Books

Title		<a href="#">Peacock, Oxford Handbook of Medical Statistics</a>	<a href="#">Petrie, Medical statistics at a glance</a>	<a href="#">Kirkwood, Essential Medical Statistics</a>	<a href="#">Bowers, Understanding Clinical Papers</a>	<a href="#">Bruce, Quantitative Methods for Health research</a>	<a href="#">Gray, IBM SPSS 19 Statistics Made Simple</a>	<a href="#">Altman, Practical Statistics for Medical Research</a>	<a href="#">Dalggaard, Introductory Statistics with R</a>	<a href="#">Borenstein, Introduction to Meta-Analysis</a>
Level	Level of student <sup>a</sup>	1-2	1-2	1-2	1-2	1-2	1-2	2	2-4	4
	Level of detail <sup>b</sup>	1	2	4	4	4	4	3	3	4
Some mathematics		✓		✓				✓	✓	✓
Resources for students	Associated website		✓				✓			
	Datasets		✓				✓		✓	
	Practice questions		✓			✓	✓	✓	✓	
Resources for tutors			✓				✓			
Software	Software used		SPSS, STATA, SAS				SPSS	STATA	R	
	Data manipulation						✓		✓	
	Procedures shown						✓		✓	
	Interpretation		✓				✓	✓	✓	
Topic	Diagnostic tests	✓	✓	✓	✓	✓		✓		
	Measures of risk (OR/RR)	✓	✓	✓	✓	✓		✓		
	Meta-analysis	✓	✓	✓		✓				✓
	Sample size	✓	✓		✓	✓	✓	✓	✓	
	Survival Analysis (inc Kaplan-Meier and Cox regression)	✓	✓	✓	✓	✓		✓	✓	

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

### ***Oxford Handbook of Medical Statistics. Peacock and Peacock.***

Great summary guide covering a wide range statistical techniques and definitions.

### ***Medical Statistics at a Glance. Petrie and Sabin.***

This book gives an overview of each topic, (2-3 pages) using output from SPSS, STATA and SAS and has an additional workbook and multiple choice questions via it's website available. An associated workbook is available to buy and the associated website <http://www.medstatsaag.com/> contains self-check multiple choice question tests on every topic which anyone can access.

### ***Essential Medical Statistics. Kirkwood and Sterne.***

A sound run through of standard statistical methods firmly rooted in clinical/medical practice. It shows the formulae and methods for calculation "by hand" from means and standard deviation through to basic ANOVA and survival analysis (Cox regression).

### ***Understanding Clinical Papers. Bowers, House and Owens.***

Extremely readable guidance on how to read and understand clinical research papers which is particularly useful for nursing and health students who have had a few "Cook's Tour" lectures on basic stats. This book is full of extracts from actual published research papers, with clear and detailed annotations and can be used in class. The author has some other books, e.g., "Statistics from Scratch".

### ***Quantitative Methods for Health Research. Bruce, Pope and Stanistreet.***

A rather different approach, based around the practicalities of health research. Embeds the actual statistical analysis within chapters titled "Descriptive Epidemiology", "Surveys", "Cohort Studies", "Case-Control Studies", "Intervention Studies", etc. Looks rather different from a standard statistics textbook but is actually a good read and makes sense to Health students. The book includes topics up to survival analysis and meta analysis and has self assessment questions and answers.

### ***IBM SPSS 19 Statistics Made Simple. Gray and Kinnear.***

Good all round book for reference in a support centre but it might be a bit expensive and students might find the "serious" style a bit off-putting. Very clear screen dumps with "call-out" annotation boxes.

### ***Practical Statistics for Medical Research. Doug Altman.***

Clear, comprehensive and methodical summary of the most common techniques used in the biological sciences and medicine. The book uses STATA output but also includes mathematical calculations in separate sections.

### ***Introductory Statistics with R. Peter Dalgaard.***

Introductory material on R, as well as how to use R for commonly encountered statistical techniques.

### ***Introduction to Meta-Analysis. Borenstein, Hedges, Higgins and Rothstein.***

The bible on meta-analysis! A general text, covering everything from basic to very advanced topics using maths and table/graph interpretation. Clear discussion of SMD, OR, CIs, heterogeneity, forest plots, funnel plots etc which are the basic toolkit.

# Medical Statistics: Online resources

		General medical statistics								Sample size		
Resource		<a href="#">Little book of R for medical statistics</a>	<a href="#">Statstutor</a>	<a href="#">SPSS On-line videos, Central Michigan University</a>	<a href="#">Bandolier</a>	<a href="#">TRLO: Meta-analysis</a>	<a href="#">Statistics hell</a>	<a href="#">UCLA</a>	<a href="#">RevMan 5 (Review Manager)</a>	<a href="#">G*Power (Software for power/sample size)</a>	<a href="#">Biomath sample size</a>	<a href="#">Sealed Envelope sample size calculator</a>
Level	Level of student	1-2	1-3	1-2	1-2	2	2-3	3-4	3	3-4	1-2	2-3
	Level of detail	1	2-3	3	3	1	4	3-4	4	3-4	1	2
Some mathematics			✓				✓					✓
Resources for students	Datasets			✓				✓				
	Practice questions		✓									
	Worksheets		✓				✓		✓			
	Videos		✓	✓			✓					
Software	Software used	R	SPSS	SPSS			SPSS	SPSS, R, SAS, STATA, Mplus, MLwiN				
	Data manipulation		✓	✓								
	Procedures shown	✓	✓	✓	✓		✓	✓				
	Interpretation	✓	✓	✓	✓		✓	✓				
Topic	Diagnostic tests											
	Measures of risk (OR/RR)	✓			✓							
	Meta-analysis	✓			✓	✓	✓		✓			
	Sample size	✓	✓							✓	✓	✓
	Survival Analysis			✓	✓			✓				

a: Level of student: 1 = Beginner, 2 = Undergraduate (Non-Maths), 3 = Advanced Undergraduate (Non-Maths), 4 = Undergraduate (Maths)

b: Level of detail: 1 = Overview, 2 = Introduction, 3 = Some depth, 4 = Extensive

### ***Little Book of R for Biomedical Statistics:***

<http://a-little-book-of-r-for-biomedical-statistics.readthedocs.org/en/latest/>

This ebook assumes that the reader has some basic knowledge of biomedical statistics and therefore focuses on how to carry out these analyses using R. The pages are easy to read and some interpretation is included.

### ***Statstutor:***

<http://www.statstutor.ac.uk/>

Trusted site containing a growing collection of downloadable resources for use in statistics support as well as videos, workshop material and online quizzes for some topics.

### ***SPSS On-line videos, Central Michigan University:***

<http://calcnnet.mth.cmich.edu/org/spss/toc.htm>

Includes videos and the associated datasets ranging from data entry to more complex topics such as introductory time series and control charts. The only downside to the videos is that they feature SPSS version 16 although the data sets are for version 22.

### ***Bandolier:***

<http://www.medicine.ox.ac.uk/bandolier/learnzone.html>

Downloadable journal worksheets on a range of evidence based learning topics such as understanding trials, guidelines for medics and health economics for self directed learning.

### ***TRLO: Meta-analysis:***

<http://www.nottingham.ac.uk/nursing/sonet/rlos/ebp/meta-analysis/index.html>

This is one of several "re-usable learning objects" on clinical education produced by Nottingham University. It is a simple and clear online exposition to introduce the idea of meta-analysis.

### ***Statistics Hell:***

<http://www.statisticshell.com/>

Site attached to the Andy Field book. Contains recorded lectures and sections of the book under each technique. The site follows a strong satanic theme which may not be to everyone's taste.

### ***UCLA:***

<http://www.ats.ucla.edu/stat/>

Offers thorough explanations of output and statistical techniques including more advanced techniques such as non-linear regression and multivariate analysis. It offers support for SPSS, SAS, STATA and some R and has recommended books with downloadable chapters. Probably better for tutors.

### ***RevMan 5 (Review Manager):***

<http://tech.cochrane.org/revman>

This is an excellent free to download software tool, recommended by the Cochrane Foundation. Used to store and analyse material for systematic reviews, but it can produce high quality forest plots and results of standard meta-analysis of SMD and OR data.

# Sample size calculations: Online resources

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## ***G\*Power sample size calculator:***

<http://www.gpower.hhu.de/en.html>

A free program (download from the website) for undertaking statistical power calculations. Applicable to a wide range of designs, but can be complicated to use and requires an understanding of the concepts of standard errors and effect sizes, etc. You also need administrator rights to download which can cause issues in a centre. You can ask computing services to add it to packages available within the university though.

## ***Biomath sample size calculator :***

<http://www.biomath.info/power/index.htm>

Provides sample size calculations based on effect sizes or vice versa for most common tests. It's free and easy to use.

## ***Sealed Envelope sample size calculator:***

<https://www.sealedenvelope.com/>

This is a commercial website that provides a randomisation service for clinical RCT trials. However, in the top menu there is a link to some free online sample size calculators ("power calculators") that clinical researchers use, and which seem to be valid. It includes calculations for superiority, equivalence and non-inferiority trials for binary and continuous outcome data. The formula for each calculation is shown underneath the menu options.



# **Section 5**

## **Resources for tutors**

# Tutor training

Resource Title	Resource Type with link	Details
Sigma guide on tutoring in a mathematics support centre: a guide for postgraduate students	<a href="#">Booklet</a>	This guide is a great starting point for new tutors. It is more of a guide for new maths tutors but the general guidance applies to both maths and stats and there is a specific section for statistics support.
SPSS Workbook for New Statistics Tutors	<a href="#">Work Book</a>	New statistics tutors should know their subject but may not have used SPSS before. This workbook provides self-study training for tutors to carry out key topics in SPSS but assumes the new tutor is able to interpret the output.
	<a href="#">Solutions</a>	Solutions to the workbook.
	<a href="#">Excel file</a>	Data sets for the workbook.
The Statistics Tutor's Quick Guide to Commonly Used Statistical Tests	<a href="#">Booklet</a>	A handy quick guide to statistical tests and techniques for those providing statistics support. This covers when to use each technique along with the interpretation of results, checking assumptions and what to do if the assumptions are not met.
Workshop on Statistics and Hypothesis Testing	<a href="#">Powerpoint slides</a>	These slides are aimed to be used in a workshop to train mathematics (or new statistics) tutors who need to provide statistics support. They cover key topics including hypothesis testing and choosing the right test.
	<a href="#">Emissions Scenario Role Play</a>	This is a paper-based scenario aimed to be used as part of the tutor training workshop using the resource entitled "Introductory Statistics and Hypothesis Testing."
Video Based Statistics Tutor Training: Mass Customisation Scenario	<a href="#">Video (download)</a>	This scenario-based training video is aimed at statistics tutors and intersperses a recorded statistics support session with discussion points, questions and issues to consider. The video was designed for use in a training workshop but can be used for self study.
	<a href="#">Video (stream)</a>	
	<a href="#">Paper Transcript</a>	
Video Based Statistics Tutor Training: Porosity Scenario	<a href="#">Video (download)</a>	This scenario-based training video is aimed at statistics tutors and intersperses a recorded statistics support session with discussion points, questions and issues to consider.
	<a href="#">Video (stream)</a>	
	<a href="#">Paper Transcript</a>	
Video Based Statistics Tutor Training Do's and Don'ts: "Careful with the maths!"	<a href="#">Video (download)</a>	This short video is aimed at statistics tutors and provides an illustration of how not to provide statistics support.
	<a href="#">Video (stream)</a>	
	<a href="#">Paper Transcript</a>	
Video Based Statistics Tutor Training Do's and Don'ts: "Conjoint Analysis"	<a href="#">Video (download)</a>	This short video is aimed at statistics tutors and provides an illustration of good and bad practice in providing statistics support when the tutor is asked about an unfamiliar technique.
	<a href="#">Video (stream)</a>	
	<a href="#">Paper Transcript</a>	

# Web Links in Full

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## *Sigma guide on tutoring in a maths support centre: guide for postgraduate students*

<http://www.sigma-network.ac.uk/wp-content/uploads/2012/11/46836-Tutoring-in-MSC-Web.pdf>

## *SPSS workbook for new statistics tutors*

<http://www.statstutor.ac.uk/resources/uploaded/tutortrainingspssworkbook.pdf>

## *The Statistics Tutor's Quick Guide*

<http://www.statstutor.ac.uk/resources/uploaded/tutorsquickguidetostatistics.pdf>

## *Workshop on Statistics and Hypothesis Testing*

<http://www.statstutor.ac.uk/resources/uploaded/statisticsforsupportslides.pptx>

## *Emissions scenario role play*

<http://www.statstutor.ac.uk/resources/uploaded/emissionsscenario.docx>

## *Video Based Statistics Tutor Training: Mass Customisation Scenario*

Download:

<http://www.statstutor.ac.uk/resources/uploaded/masscustomisationvideostcp-marshallowen-1a.m4v>

Stream:

<https://www.youtube.com/watch?v=xizhEeRUM0E&list=UUzrSTIsMw2LGm5hHqaaaaWA>

Paper transcript:

<http://www.statstutor.ac.uk/resources/uploaded/masscustomtranscriptstcp-marshallowen-1b.pdf>

## *Video Based Statistics Tutor Training: Porosity Scenario*

Download:

<http://www.statstutor.ac.uk/resources/uploaded/porosityvideostcp-marshallowen-2a.m4v>

Stream:

<https://www.youtube.com/watch?v=rvvIXUP-XsY&list=UUzrSTIsMw2LGm5hHqaaaaWA>

Paper transcript:

<http://www.statstutor.ac.uk/resources/uploaded/porositytranscriptstcp-marshallowen-2b.pdf>

## *Video Based Statistics Tutor Training Do's and Don'ts: Careful with the maths!*

Download:

<http://www.statstutor.ac.uk/resources/uploaded/carefulwiththemathtcp-marshallowen-3a.m4v>

Stream:

<https://www.youtube.com/watch?v=sFtR7JR7TvQ&list=UUzrSTIsMw2LGm5hHqaaaaWA>

Paper transcript:

<http://www.statstutor.ac.uk/resources/uploaded/carefulwiththemathttrans-stcp-marshallowen-3b.pdf>

## *Video Based Statistics Tutor Training Do's and Don'ts: Conjoint Analysis!*

Download:

<http://www.statstutor.ac.uk/resources/uploaded/conjointanalysisvideostcp-marshallowen-4a.m4v>

Stream:

<https://www.youtube.com/watch?v=HD06CQgFFIY&list=UUzrSTIsMw2LGm5hHqaaaaWA>

Paper transcript:

<http://www.statstutor.ac.uk/resources/uploaded/conjointanalysistranscriptstcp-marshallowen-4b.pdf>

# Datasets and associated resources

***Sigma data sets:*** A collection of datasets developed via a sigma funded project by Chetna Patel and Ellen Marshall (University of Sheffield), Ant Edwards (University of York), Katy Dobson (University of Leeds), Andrew Mead (University of Warwick) and Alun Owen (University of Worcester). Available via <http://www.sheffield.ac.uk/mash/statistics2/data>

Data Set	Tomato Rooting data 1	Tomato Rooting data 2	Crime Rate data	Birth Weight data	Titanic data	Diet	Cholesterol	Video
<a href="#">SPSS data</a>	✓	✓	✓	✓	✓	✓	✓	✓
<a href="#">csv data (also use for R)</a>	✓	✓	✓	✓	✓	✓	✓	✓
<b>Description of data</b>	✓	✓	✓	✓	✓	✓	✓	✓
<b>Summary Statistics</b>								
Bar/pie Charts			✓	✓	✓			✓
Scatter plots	✓	✓	✓	✓		✓		
Histograms	✓	✓	✓	✓	✓	✓	✓	
Box-and-whisker plots	✓	✓	✓	✓		✓	✓	✓
Descriptive statistics (categorical)	✓	✓	✓	✓	✓	✓		✓
Descriptive statistics (scale)	✓	✓	✓	✓	✓	✓	✓	✓
Contingency tables			✓	✓	✓			✓
Skewed data			✓		✓			✓
Confidence intervals	✓	✓	✓	✓	✓			
<b>Data manipulation</b>								
Recoding variables	✓	✓	✓	✓	✓	✓		
Computing variables			✓			✓	✓	
Normal probability calculations	✓	✓	✓	✓		✓	✓	
<b>T-tests</b>								
One-sample t-test	✓	✓	✓	✓		✓	✓	✓
Two-sample (independent) t-test	✓	✓	✓	✓		✓		✓
Two-sample (paired) t-test			✓	✓		✓	✓	✓
<b>ANOVA</b>								
One way ANOVA	✓	✓				✓		
Two-way ANOVA						✓		
ANCOVA						✓		
Repeated measures ANOVA							✓	
Mixed between within ANOVA							✓	
<b>Correlation and regression</b>								
Pearson's correlation	✓	✓	✓	✓				
Simple linear regression (SLR)	✓	✓	✓	✓				
Multiple linear regression (MLR)	✓	✓	✓	✓				
MLR with groups	✓	✓	✓	✓				
Logistic regression				✓	✓			
<b>Non-parametric</b>								
Mann-Whitney			✓		✓			✓
Kruskal-Wallis					✓			
Wilcoxon signed rank								✓
Friedman								✓
Chi-squared			✓	✓	✓			
Spearman's correlation								✓

***Data and Story Library (DASL)*** <http://lib.stat.cmu.edu/DASL>

Online library of data files and stories that illustrate the use of basic statistical methods.

***JSE Data Archive:*** [www.amstat.org/publications/jse/jse\\_data\\_archive.htm](http://www.amstat.org/publications/jse/jse_data_archive.htm)

Collection of data sets, many associated with articles in the Journal of Statistics Education.

# Websites

<a href="#">Suggest another resource via our survey</a>		Website contents						Maths		Level of student	Level of detail	Resources for tutors				Discipline		All standard topics
Title	web address	E-textbooks	Interactive	Worksheets	Quizzes/exercises	Videos	Datasets	Some mathematics	Mathematical focus			Tutor reference	Test questions/exercises	Datasets	Applets	Engineering	Medical statistics	
ARTIST	<a href="http://apps3.cehd.umn.edu/artist">http://apps3.cehd.umn.edu/artist</a>			✓	✓			✓		1-2	2		✓					✓
CAST	<a href="http://cast.massey.ac.nz/collection_public.html">http://cast.massey.ac.nz/collection_public.html</a>	✓						✓		1-3	1-4							✓
CAUSEweb	<a href="http://www.causeweb.org/">http://www.causeweb.org/</a>	✓		✓				✓		1-2	1	✓						✓
Chance	<a href="http://www.dartmouth.edu/~chance">http://www.dartmouth.edu/~chance</a>	✓						✓		1-2	1							✓
DASL	<a href="http://lib.stat.cmu.edu/DASL">http://lib.stat.cmu.edu/DASL</a>						✓			1-2	1-2			✓				✓
Duke Statistical Applets	<a href="https://www2.stat.duke.edu/sites/java.html">https://www2.stat.duke.edu/sites/java.html</a>		✓							1-2	2				✓			✓
HELM	<a href="http://www.lboro.ac.uk/departments/mec/activities/helm/">http://www.lboro.ac.uk/departments/mec/activities/helm/</a>			✓					✓	3-4	4	✓	✓			✓		✓
Engineering Statistics Handbook	<a href="http://itl.nist.gov/div898/handbook/index.htm">http://itl.nist.gov/div898/handbook/index.htm</a>	✓						✓		1-2	2					✓		✓
JSE Data Archive	<a href="http://www.amstat.org/publications/jse/jse_data_archive.htm">www.amstat.org/publications/jse/jse_data_archive.htm</a>						✓			1-2	1-2			✓				
Rice Virtual Lab in Statistics	<a href="http://onlinestatbook.com/rvls.html">http://onlinestatbook.com/rvls.html</a>	✓	✓	✓	✓		✓	✓		1-2	1-2			✓	✓			✓
Rossmann chance applets	<a href="http://rossmanchance.com/applets">http://rossmanchance.com/applets</a>		✓							1-2	1				✓		✓	
SOCR	<a href="http://www.socr.ucla.edu/SOCR.html">http://www.socr.ucla.edu/SOCR.html</a>		✓					✓		1-2	1-2				✓			✓
STAT-ATTIC	<a href="http://rossmanchance.com/applets">http://rossmanchance.com/applets</a>		✓							1-2	1				✓		✓	
StatSoft	<a href="http://www.statsoft.com/textbook/">http://www.statsoft.com/textbook/</a>	✓						✓		1-2	1							✓
SticiGui online	<a href="http://www.stat.berkeley.edu/~stark/SticiGui/">http://www.stat.berkeley.edu/~stark/SticiGui/</a>	✓	✓			✓		✓		2	2				✓			✓
SurfStat	<a href="https://surfstat.anu.edu.au/surfstat-home/">https://surfstat.anu.edu.au/surfstat-home/</a>	✓	✓					✓		1-2	2				✓			✓
UCLA	<a href="http://www.ats.ucla.edu/stat/">http://www.ats.ucla.edu/stat/</a>	✓								2-4	3-4	✓						
VideoLectures.NET	<a href="http://videolectures.net/Top/Mathematics/Statistics">http://videolectures.net/Top/Mathematics/Statistics</a>					✓			✓	4	3	✓						

# Websites: Further Details

[Suggest another resource via our survey](#)

Title	web address	Description
<i>ARTIST</i>	<a href="http://apps3.cehd.umn.edu/artist">http://apps3.cehd.umn.edu/artist</a>	Searchable database of test questions for introductory statistics concepts.
<i>CAST</i>	<a href="http://cast.massey.ac.nz/collection_public.html">http://cast.massey.ac.nz/collection_public.html</a>	Collection of electronic textbooks that teach introductory and advanced statistical methods.
<i>CAUSEweb</i>	<a href="http://www.causeweb.org/">http://www.causeweb.org/</a>	Contains lesson plans and teaching materials for elementary statistics concepts.
<i>Chance</i>	<a href="http://www.dartmouth.edu/~chance">http://www.dartmouth.edu/~chance</a>	Materials and links to related internet resources that can be used to illustrate introductory topics in probability and statistics.
<i>DASL</i>	<a href="http://lib.stat.cmu.edu/DASL">http://lib.stat.cmu.edu/DASL</a>	Online library of data files and stories that illustrate the use of basic statistical methods.
<i>Duke Statistical Applets</i>	<a href="https://www2.stat.duke.edu/sites/java.html">https://www2.stat.duke.edu/sites/java.html</a>	Collection of Java applets for elementary statistical concepts.
<i>HELM</i>	<a href="http://www.lboro.ac.uk/departments/mec/activities/helm/">http://www.lboro.ac.uk/departments/mec/activities/helm/</a>	Free workbooks aimed at engineering students but useful to all disciplines
<i>Engineering Statistics Handbook</i>	<a href="http://itl.nist.gov/div898/handbook/index.htm">http://itl.nist.gov/div898/handbook/index.htm</a>	Online text covering elementary statistics with an engineering focus.
<i>JSE Data Archive</i>	<a href="http://www.amstat.org/publications/jse/jse_data_archive.htm">www.amstat.org/publications/jse/jse_data_archive.htm</a>	Collection of data sets, many associated with articles in the Journal of Statistics Education
<i>Rice Virtual Lab in Statistics</i>	<a href="http://onlinestatbook.com/rvls.html">http://onlinestatbook.com/rvls.html</a>	Collection of JAVA applets that demonstrate various statistical concepts, online statistics textbook, data analysis programs for some basic statistical tools, case studies with examples of real data with analyses and interpretations.
<i>Rossman chance applets</i>	<a href="http://rossmanchance.com/applets">http://rossmanchance.com/applets</a>	Collection of Java applets for elementary statistical concepts.
<i>SOCR</i>	<a href="http://www.socr.ucla.edu/SOCR.html">http://www.socr.ucla.edu/SOCR.html</a>	Collection of Java applets.
<i>STAT-ATTIC</i>	<a href="http://rossmanchance.com/applets">http://rossmanchance.com/applets</a>	Collection of Java applets for elementary statistical concepts.
<i>StatSoft</i>	<a href="http://www.statsoft.com/textbook/">http://www.statsoft.com/textbook/</a>	An online glossary offering an overview of many statistical topics ranging from introductory to more advanced.
<i>SticiGuonline</i>	<a href="http://www.stat.berkeley.edu/~stark/SticiGui/">http://www.stat.berkeley.edu/~stark/SticiGui/</a>	An online introductory statistics textbook together with Java applets and some videos.
<i>SurfStat</i>	<a href="https://surfstat.anu.edu.au/surfstat-home/">https://surfstat.anu.edu.au/surfstat-home/</a>	An online text in introductory statistics that includes java applets
<i>UCLA</i>	<a href="http://www.ats.ucla.edu/stat/">http://www.ats.ucla.edu/stat/</a>	A thorough explanation of introductory and more advanced statistical techniques including support for SPSS, SAS, STATA and some R.
<i>VideoLectures.NET</i>	<a href="http://videlectures.net/Top/Mathematics/Statistics">http://videlectures.net/Top/Mathematics/Statistics</a>	Video lectures given at events such as conferences, summer schools, workshops.

## Alphabetical List of Resources with page numbers

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