

Department of Statistics, Faculty of Science
STAT823: Statistical Graphics
Unit Outline: First Semester 2013
Convenor: Associate Professor Peter Petocz

Please read this unit outline carefully. It contains important information about the unit. If anything in it is unclear, please consult your lecturer.

ABOUT THIS UNIT

Stat823 is a four credit point unit offered by the Department of Statistics as part of the Master of Applied Statistics program and enrolment can be in internal or distance mode. We present the principles of effective graphical presentation, set them in a historical context and apply them to a variety of statistical data sets. Emphasis is on the use of modern multivariate graphical techniques such as trellis/lattice graphs and mosaic plots to show a variety of displays of data and model fits, and to display model consistency with data. To present graphics, we introduce and use S-Plus and R software, as well as other standard packages. Participants choose an area for further investigation related to their interests. This unit may be taken at any stage of the Master of Applied Statistics program: as an introduction early in the program, or as an overview towards the end of the program.

TEACHING STAFF

The lecturer for the unit is Associate Professor Peter Petocz
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UNIT WEB PAGE

The web page http://www.stat.mq.edu.au/postgraduate_programs/stat_units/stat/stat823/ is the unit's main page (you can get there from the Department of Statistics website www.stat.mq.edu.au by selecting Postgraduate programs, then Coursework degree programs, then Statistics PG units, then Stat units, then Stat823: you can see why you need the unit webpage).

There is an iLearn page for the unit that will contain all the required course materials and allows communication between participants and lecturer. We will be using this extensively during the course. You can access this from the address <https://ilearn.mq.edu.au> (or from the Stat823 web page). You will be asked for your Macquarie OneID username and password. Any problems – please try the links to help from this page.

CLASSES

You will have one 3-hour lecture/practical class on *Wednesday 10am-1pm* in *EMC-G210* (the EMC building is on 'Innovation Drive' between the hospital and Mac Centre. If possible, you should attend these classes; but if you are enrolled externally there will be a range of options for participation: materials on iLearn, recorded sessions and conferencing software.

LEARNING OUTCOMES

This course will help prepare students for professional work as a statistician, particularly for the graphical communication of statistical ideas and results to non-statistical (and statistical) users. Students will develop critical thinking skills about how information can be best presented visually, and they will learn how to communicate quantitative information effectively. At the end of the course students will:

1. be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work (PC 1,2,5,6)
2. be aware of the elements of graphical design, and use them to critically appraise presented graphics in articles and web pages and suggest appropriate ways of improving them (PC 1,6)
3. be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them (PC 1,2,3,6)
4. be able to use the computer to generate appropriate graphics using particular packages or languages and be able to develop the ability to do so in others (PC 1,3,4,6)
5. use statistical graphics to investigate and analyse data, check statistical model assumptions and effectively present the results of statistical investigations to a range of audiences (PC1,2,3,4,6)
6. be aware of the ethical aspects associated with the use of statistical graphics in society (PC 5,6)

Academic programs at Macquarie aim to develop students' generic skills and dispositions. In this unit you will develop to a level appropriate for a university masters graduate your: (1) discipline knowledge and skills; (2) critical, analytical and integrative thinking; (3) research and problem solving capability; (4) effective communication; (5) position as engaged and responsible, active and ethical citizens; (6) capacity for professional and personal judgement and initiative. These *Postgraduate Capabilities* can be linked with the specific learning outcomes (in brackets above).

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

There is no specified textbook for this unit and a variety of readings will be made available internet. The following books are good general references that will be used during the semester:

- Tufte, E. (2001). *The Visual Display of Quantitative Information* (second edition). Graphics Press, Cheshire Conn. (2001). Also *Envisioning Information* (1990), *Visual Explanations* (1997), *Beautiful Evidence* (2006) by the same author.
- Cleveland, W. (1993). *Visualizing Data*. Hobart Press, New Jersey.
- Chen, C., Hardle, W. and Unwin, E. (eds.) (2008). *Handbook of Data Visualization*. [HDV] Springer-Verlag, Berlin. (Available in the library as an electronic resource.)

ASSESSMENT AND ITS RELATION TO LEARNING OUTCOMES

The assessment has three components:

- Portfolio 25%. An individual portfolio of five items relating to statistical graphics, each item using a maximum of two pages, on topics or questions presented in classes (and on the website). You will be asked to submit these online, and they will be graded on a scale of 1-5 each. (PC1-5)
- Project 40%. A group project in an area of interest that you select, including a presentation (15%) and a written summary (25%). The presentations will be made during the class time in week 12 (Wednesday 29 May) and the written summary is due by Monday 3 June. (PC1-6)

- Exam 35%. You will be given an individual take-home examination during the last week of semester (available on the morning of Saturday 1 June, due by the evening of Saturday 8 June). This will be in the form of a consulting problem requiring data analysis and preparation of a report including presentation graphics, requiring about 3 hours work. (PC1-6)

The portfolio will allow you to demonstrate the whole range of learning outcomes (particularly 1, 2 and 4) and postgraduate capabilities 1-5: it may also be a useful way for you to collect examples of your work for later professional use.

The group project will address outcomes 3, 4, 5 and 6 in a group of two colleagues and will allow you to develop teamwork, communication and information technology skills (all 6 of the postgraduate capabilities). I will allocate you to a group in pairs, and since many of you are taking the unit as external students, you will probably need to work electronically (though you may be able to arrange face-to-face meetings at your convenience). In the presentation, your individual as well as group contribution will be assessed. Your written summary will need to indicate clearly each group member's contribution (ideally, each person contributing equally throughout).

The exam will assess elements of the whole range of learning outcomes, but particularly outcomes 3, 4, 5 and 6, in an individual setting, and contribute to developing all 6 of the postgraduate capabilities. You are expected to do the exam on your own with whatever print and electronic resources you wish to use.

Note: If you have unavoidable problems with assessment tasks, please contact me and we will work out an alternative that is acceptable to both parties.

TEACHING AND LEARNING STRATEGIES

With the relatively number of students enrolled and the advanced (masters) level of this unit, we will be relying less on formal lectures and more on individual reading, preparation and learning to use the computer, and on collaborative investigation and discussion of problems. However, we will have a number of 'guest lectures' which will be presented live and be available in some electronic form afterwards. There will be weekly readings (usually electronic), weekly data investigations (using a computer package or language), weekly discussions (live and using iLearn and a conferencing package – Adobe Connect) and regular opportunities to create and add materials to your portfolio. Live class discussions will be recorded and the recording placed on the iLearn site soon after.

The following standard information is included in all Macquarie unit outlines:

EXAMINATIONS – GENERAL INFORMATION

Since this unit has a take-home exam, there is no relevant information about examinations. If you have some medical or other reason for not being able to complete the take-home exam in the scheduled time period, please contact the lecturer to make alternative arrangements. The same applies for the group project and presentation. If you feel you need special consideration (that has not be taken into account by your lecturer) in your assessment due to individual adverse circumstances you may consider applying for a Special Consideration (see <https://ask.mq.edu.au/index.php>).

ACADEMIC HONESTY – IMPORTANT NOTES

The University defines academic honesty as: "act[ing] with integrity in the creation, development, application and use of ideas and information." You must read the University's *Academic Honesty Policy* at:

http://www.mq.edu.au/policy/docs/academic_honesty/policy.html where more details are given, and the particular dishonest behaviours of deception, fabrication, plagiarism and sabotage are defined and illustrated. There are various penalties for not acting with academic honesty, and these can be found following a link on the page.

STUDENT SUPPORT SERVICES

Macquarie University provides a range of welfare and academic student support services. Details of these can be accessed at <http://students.mq.edu.au/support/>. There is also a faculty page for student resources and support at http://web.science.mq.edu.au/new_and_current_students/student_resources.

Stat823 Statistical Graphics – Semester 1, 2013

Date (Wed)	Wk	Topic	Readings/exercises
27 Feb	1	Introduction: what do we know about graphics?	Excellent graphics past and future Examples of graphs (text, excel) to discuss and improve
6 Mar	2	Historical background of graphics	Friendly <i>A brief history of data visualization</i> http://www.math.yorku.ca/SCS/Papers/hbook.pdf [HDV] (see http://www.math.yorku.ca/SCS/Gallery/milestone)
13 Mar	3	Creating graphics	Using S-plus and R for creating graphics – S-plus tutorial, using R commander, getting familiar with these packages Exploration vs presentation graphics
20 Mar	4	Principles of graphics	Unwin <i>Good graphics</i> [HDV]; Tufte <i>Graphical integrity</i> Using these principles to critique graphs
27 Mar	5	Trellis graphs	Theus <i>Trellis displays</i> http://www.dm.uniba.it/~delbuono/Trellis_ESS.pdf
3 April	6	<i>Guest lecture:</i> Linear models and graphics (PP)	Assessing statistical models using graphical techniques
10 April	7	Mosaic plots	Hofman <i>Mosaic plots and their variants</i> [HDV] Displaying categorical data, Mondrian for mosaic plots, Brushing and linking,
17 April		<i>Mid semester break</i>	
24 April		<i>Mid semester break</i>	
1 May	8	<i>Guest lecture:</i> Using R for graphics (TK)	Graphics systems in R (including base and lattice), use R to obtain and modify a variety of graphs
8 May	9	Interactive graphics: brushing and linking	Brushing and linking in packages, Wills <i>Linked data views</i> [HDV]
15 May	10	<i>Guest lecture:</i> Web-based graphics (HG)	Graphics (static and interactive) online, using html and other programs
22 May	11	Multidimensional graphics, interactive graphs	Theus <i>High dimensional data visualization</i> [HDV] Interactive graphics, Grand Tours (Ggobi and Rggobi)
29 May	12	Project presentations	
5 June	13	Take-home exam	