



# STAT823

## Statistical Graphics

S1 Day 2014

*Statistics*

### Contents

---

<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	2
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	5
<a href="#"><u>Unit Schedule</u></a>	5
<a href="#"><u>Learning and Teaching Activities</u></a>	8
<a href="#"><u>Policies and Procedures</u></a>	9
<a href="#"><u>Graduate Capabilities</u></a>	10

---

#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Convenor

Peter Petocz

[peter.petocz@mq.edu.au](mailto:peter.petocz@mq.edu.au)

Contact via [peter.petocz@mq.edu.au](mailto:peter.petocz@mq.edu.au)

Credit points

4

Prerequisites

Admission to MAppStat or PGDipAppStat or PGCertAppStat

Corequisites

Co-badged status

Unit description

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 given to 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 is appropriate for study at any stage of the student's: as an introduction early in the program, or as an overview towards the end of the program.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- 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
- be familiar with a range of modern multivariate graphical techniques and know when it is

appropriate to use them

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

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

be aware of the ethical aspects associated with the use of statistical graphics in society

## Assessment Tasks

Name	Weighting	Due
<u>Portfolio</u>	25%	Monday 9 May
<u>Project</u>	40%	Monday 9 June
<u>Take-home exam</u>	35%	Saturday 14 June

### Portfolio

Due: **Monday 9 May**

Weighting: **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.

On successful completion you will be able to:

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- 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
- 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

### Project

Due: **Monday 9 June**

Weighting: **40%**

A (solo or paired) project in an area of interest that you select, including an (individual) presentation (15%) and a written summary (25%). The presentations will be made during the class time in week 12 (Thursday 5 June) and the written summary is due by Monday 9 June.

On successful completion you will be able to:

- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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
- 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
- be aware of the ethical aspects associated with the use of statistical graphics in society

## Take-home exam

Due: **Saturday 14 June**

Weighting: **35%**

You will be given an individual take-home examination during the last week of semester (available on the morning of Saturday 7 June, due by the evening of Saturday 14 June). This will be in the form of a consulting problem requiring data analysis and preparation of a report including presentation graphics, requiring about 3-6 hours work.

On successful completion you will be able to:

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- 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
- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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
- 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
- be aware of the ethical aspects associated with the use of statistical graphics in society

## Delivery and Resources

You will have one 2-hour lecture class on *Thursday 9-11* in *E4B-G214* and one 1-hour practical class *Thursday 11-12* or *12-1* in *E4B-102* (the second of these options will only be used if the class is large enough). If possible, you should attend these classes; but if you are enrolled externally there will be options for participation: materials on iLearn, recorded sessions and conferencing software

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.*)

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 or electronic) 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.

### Technologies used:

The unit will make use of a range of packages, most importantly R, and the graphing packages Mondrian and GGobi.

What has changed from previous years: In previous years we made use of the package SPlus, but this year we will replace the emphasis on this by using R (though SPlus may also be used to a smaller extent).

## Unit Schedule

Date (Thur )	Wk	Topic	Readings/exercises
6 Mar	1	Introduction: what do we know about graphics?	Excellent graphics past and future Examples of graphs (text, excel) to discuss and improve
13 Mar	2	Historical background of graphics	Friendly <i>A brief history of data visualization</i> <a href="http://www.datavis.ca/papers/index.php#history">http://www.datavis.ca/papers/index.php#history</a> [HDV] (see <a href="http://www.datavis.ca/milestones/">http://www.datavis.ca/milestones/</a> )
20 Mar	3	Creating graphics	Using R for creating graphics, using R commander and/or RStudio, getting familiar with these packages Exploration vs presentation graphics
27 Mar	4	Principles of graphics	Unwin <i>Good graphics</i> [HDV]; Tufte <i>Graphical integrity</i> Using these principles to critique graphs
3 April	5	Trellis graphs	Theus <i>Trellis displays</i> <a href="http://www.dm.uniba.it/~delbuono/Trellis_ESS.pdf">http://www.dm.uniba.it/~delbuono/Trellis_ESS.pdf</a>
10 April	6	Linear models and graphics	Assessing statistical models using graphical techniques

17 April		<i>Mid semester break</i>	
24 April		<i>Mid semester break</i>	
1 May	7	Mosaic plots	Hofman <i>Mosaic plots and their variants</i> [HDV]  Displaying categorical data, Mondrian for mosaic plots, Brushing and linking,
8 May	8	Using R for more advanced graphics	Graphics systems in R (including base and lattice), using R to obtain and modify a variety of graphs
15 May	9	Interactive graphics: brushing and linking	Brushing and linking in packages,  Wills <i>Linked data views</i> [HDV]
22 May	10	Web-based graphics	Graphics (static and interactive) online, using html and other programs
29 May	11	Multidimensional graphics, interactive graphs	Theus <i>High dimensional data visualization</i> [HDV]  Interactive graphics, Grand Tours (Ggobi and RGgobi)





expertise.

## Individual preparation

Readings online or from a book. Self-directed learning to use appropriate software.

## Class presentations

Individual or group presentation of researched and prepared materials.

## Class discussion

Collaborative discussion and investigation of problems in graphics.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Late Assessment Tasks

No extensions will be granted for any assessment tasks. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task, except for cases in which you have made an application for special consideration and this has been approved by the lecturer.

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

#### Learning outcomes

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- 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

- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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
- 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

## **Assessment tasks**

- Portfolio
- Project
- Take-home exam

## **Learning and teaching activities**

- Introductions to topics, or summaries of them. Guest lectures from people with particular expertise.
- Collaborative discussion and investigation of problems in graphics.

## **PG - Critical, Analytical and Integrative Thinking**

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

## **Learning outcomes**

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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

## **Assessment tasks**

- Portfolio
- Project
- Take-home exam

## Learning and teaching activities

- Introductions to topics, or summaries of them. Guest lectures from people with particular expertise.
- Individual or group presentation of researched and prepared materials.
- Collaborative discussion and investigation of problems in graphics.

## PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

### Learning outcomes

- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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
- 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

### Assessment tasks

- Portfolio
- Project
- Take-home exam

## Learning and teaching activities

- Introductions to topics, or summaries of them. Guest lectures from people with particular expertise.
- Readings online or from a book. Self-directed learning to use appropriate software.
- Collaborative discussion and investigation of problems in graphics.

## PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

## Learning outcomes

- 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
- 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

## Assessment tasks

- Portfolio
- Project
- Take-home exam

## Learning and teaching activities

- Readings online or from a book. Self-directed learning to use appropriate software.
- Individual or group presentation of researched and prepared materials.
- Collaborative discussion and investigation of problems in graphics.

## PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

## Learning outcomes

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- be aware of the ethical aspects associated with the use of statistical graphics in society

## Assessment tasks

- Portfolio
- Project
- Take-home exam

## Learning and teaching activities

- Individual or group presentation of researched and prepared materials.
- Collaborative discussion and investigation of problems in graphics.

## PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

### Learning outcomes

- be familiar with important historical and contemporary examples of graphics, and be able to use them as models in their own work
- 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
- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them
- 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
- 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
- be aware of the ethical aspects associated with the use of statistical graphics in society

### Assessment tasks

- Project
- Take-home exam

### Learning and teaching activities

- Readings online or from a book. Self-directed learning to use appropriate software.
- Individual or group presentation of researched and prepared materials.
- Collaborative discussion and investigation of problems in graphics.