STAT7123

Statistical Graphics

Session 2, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

Contents

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
Houying Zhu
houying.zhu@mq.edu.au

Petra Graham
petra.graham@mq.edu.au

Credit points
10

Prerequisites
Admission to MRes

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 R, as well as other standard packages. Participants choose an area for further investigation related to their interests.

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:

ULO1: be familiar with important and contemporary examples of graphics, and be able to use them.

ULO2: 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 to improve them.

ULO3: use the computer to generate appropriate graphics using particular packages or languages and be able to develop the ability to do so in others.

ULO4: be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them.

ULO5: use statistical graphics to investigate and analyse data, check statistical model assumptions and effectively present the results of statistical investigations graphically to a range of audiences.

General Assessment Information

All assignments are individual assessment tasks. There is no group work. More details will be provided on the iLearn page in due course.

Assignment Submission

Assignment submission will be online through the iLearn page. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration. It is your responsibility to make sure your assignment submission is legible. If there are technical obstructions to your submission online, please email us to let us know. You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following late penalty applied. Please see https://students.mq.edu.au/study/assessment-exams/assessments for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is provided to students who experience a technical concern.

In this unit, late submissions will be accepted as follows:

- Assignment 1- YES, Standard Late Penalty applies
- Assignment 2- YES, Standard Late Penalty applies
- Assignment 3- YES, Standard Late Penalty applies

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	25%	No	Week 4
Assignment 2	35%	No	Week 8

Name	Weighting	Hurdle	Due
Assignment 3	40%	No	Week 13

Assignment 1

Assessment Type [1]: Qualitative analysis task
Indicative Time on Task [2]: 20 hours
Due: **Week 4**
Weighting: **25%**

Five statistical graphics should be collected during the first half of the semester from newspaper articles or journal articles published this year. You must not draw your own graphics or get someone else to do so for you. Credit will be given for interesting, carefully chosen graphics which show evidence of searching widely. The five statistical graphics must be included in your submission along with the source of each graphic (title of the article, authors, source, page numbers or url etc.) and each graphic must be discussed.

This discussion must include strengths and weaknesses of each graphic. It may include the reason why you chose the graphic.

On successful completion you will be able to:

- be familiar with important and contemporary examples of graphics, and be able to use them.
- 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 to improve them.
- be familiar with a range of modern multivariate graphical techniques and know when it is appropriate to use them.

Assignment 2

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 20 hours
Due: **Week 8**
Weighting: **35%**

A data set with some documentation will be given. This data set must be analysed and a concise, well-organised report on your analysis must be prepared. The analysis must be appropriate and be substantially graphical. Appropriate statistical graphics explored or

mentioned in the lectures should be used. The statistical package R must be used.

On successful completion you will be able to:

- be familiar with important and contemporary examples of graphics, and be able to use them.
- 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 to improve them.
- use the computer to generate appropriate graphics using particular packages or languages and be able to develop the ability to do so in others.
- 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 graphically to a range of audiences.

Assignment 3

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 23 hours
Due: **Week 13**
Weighting: **40%**

A data set with some documentation will be given. This data set must be analysed and a concise, well-organised report on your analysis must be prepared. The analysis must be appropriate and be substantially graphical. Appropriate statistical graphics explored or mentioned in the lectures should be used. The statistical package R must be used.

On successful completion you will be able to:

- 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 to improve them.
- use the computer to generate appropriate graphics using particular packages or languages and be able to develop the ability to do so in others.
- 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 graphically to a range of audiences.

---

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Lectures

The lectures commence in Week 1 and will be pre-recorded. Videos and lecture materials will be uploaded to iLearn, please refer to the iLearn site for more details.

Small-Group Teaching Activities (SGTAs)

SGTAs classes will start in Week 2, please refer to iLearn for more details.

Recommended Books

The following books are highly recommended reading materials.

- Chen, C., Hardle, W. and Unwin, E. (eds.) (2008), Handbook of Data Visualization. Springer-Verlag, Berlin.

- Cleveland, W. (1993), Visualizing Data. Hobart Press, New Jersey.

- Keen, K. J. (2010), Graphics for statistics and data analysis with R. Chapman and Hall/ CRC.

- Rahlf, T. (2017), Data Visualisation with R. Springer International Publishing AG.

- Sievert, C. (2020), Interactive Web-Based Data Visualization with R, plotly, and Shiny, Chapman and Hall/CRC.

- Wickham, H. (2016), ggplot2: Elegant Graphics for Data Analysis. Springer International Publishing.

- Wickham, H. and Grolemund, G. (2017), R for Data Science Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, Inc, USA.

Unit Schedule

Week 1: A Brief History of Data Visualisation and R Basics.

Week 2: Principle of Statistical Graphs and ggplot Basics.

Week 3: Univariate Plots. Graphs for categorical data and numerical data.

Week 4: Bivariate Plots. Stacked bar charts, cluster bar charts, Mosaic plots, line plots, and violin plots.

Week 5: Multivariate Plots. Multivariate visualisation with grouping, faceting and clustering.

Week 6: Maps. Dot density maps, Choropleth maps, and map-making tools in R: ggplot with sf (simple feature).

Week 7: Statistical Model (Part 1). Scatterplot matrices, correlation plots, linear model and visualisation of regression and diagnostic plots.

Week 8: Statistical Model (Part 2). Residual plots, spline, generalised linear models, and tidy model outputs with broom package.

Week 9: Time-dependent Graphs. Dumbbell graphs, slope graphs, stacked area charts, and visualising time series with dygraphs package.

Week 10: More Graphs. Bubble plots, Waffle charts, flow diagrams word clouds.

Week 11: Interactive Graphs. Basic interactive plot with plotly, interactive maps with leaflet, diagrams with networkD3.

Week 12: Best Practices. Labels, titles, the principles of choosing colours with RColorBrewer, and control the overall appearance of plots.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about

throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

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

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.