



STAT373

Design of Surveys and Experiments

S1 Day 2017

Dept of Statistics

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General Information

Unit convenor and teaching staff

Unit Convenor

Kehui Luo

kehui.luo@mq.edu.au

Contact via kehui.luo@mq.edu.au

Room 545, 12 Wally's Walk

Thursday 10-11am and 2-3pm

Hassan Doosti

hassan.doosti@mq.edu.au

Credit points

3

Prerequisites

6cp at 200 level including (STAT270 or STAT271 or BIOL235(P) or PSY222 or PSY248(P))

Corequisites

Co-badged status

Co-taught with STAT814/STAT714

Unit description

This unit deals with the gathering and analysis of data. Students are given the foundations of survey design with some discussion of quota sampling; question construction; common ambiguities and unintended biases; probability sampling; simple random sampling; stratified sampling; ratio and regression estimators; systematic sampling; and cluster sampling. The other component of the unit is a discussion of designed experiments and covers the following topics: the completely randomised design; randomised blocks; random effects models; and analysis of covariance.

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:

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design

understand basic survey sampling, be familiar with concepts such as sampling bias, sampling and non-sampling errors, and know the basics of questionnaire design and question construction

understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design

have generally improved problem solving ability

have improved the ability to use computing software (Minitab) in solving practical problems

General Assessment Information

Students enrolled in this unit are required to participate a 1-hour tutorial class per week from Week 2, complete independently three assignments and submit each of them by its due date specified in the assignment, and sit a three-hour written examination during the University examination period for the semester.

No extension will be granted for any assessment task without an application for Disruption to Studies being submitted and approved.

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial participation	10%	No	Weeks 2 to 13
Assignments	30%	No	Thursday (Week 6, 8 & 12)
Examination	60%	No	University Examination Period

Tutorial participation

Due: **Weeks 2 to 13**

Weighting: **10%**

Each week a set of tutorial exercises is made available on iLearn for students to practice. Students are required to participate a 1-hour tutorial class per week from Week 2, contributing to the class discussion with fellow students and the tutor.

On successful completion you will be able to:

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design
- understand basic survey sampling, be familiar with concepts such as sampling bias, sampling and non-sampling errors, and know the basics of questionnaire design and

question construction

- understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design

Assignments

Due: **Thursday (Week 6, 8 & 12)**

Weighting: **30%**

Three assignments (10% each) are set for students to complete independently, applying the knowledge gained from lectures, tutorials and their own reading, with and/or without using the statistical software, Minitab. They will be made available on iLearn.

Each of the three assignments should be submitted electronically on the unit iLearn by its due date and time, which will be included in the assignment. Students must keep a soft or hard copy of any assignment submitted. In the event of an assignment being misplaced, a replacement of it will be requested.

Students who have not submitted an assignment by its due date and time will be awarded a mark of 0 for the assignment, except for cases in which an application for Disruption of Studies is made and approved.

On successful completion you will be able to:

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design
- understand basic survey sampling, be familiar with concepts such as sampling bias, sampling and non-sampling errors, and know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design
- have generally improved problem solving ability
- have improved the ability to use computing software (Minitab) in solving practical problems

Examination

Due: **University Examination Period**

Weighting: **60%**

There will be a three-hour written examination that will be timetabled within the official University Examination Timetable. The University Examination Timetable will be available in draft form approximately eight weeks before the commencement of the the University examinations and in final form approximately four weeks before the commencement of the examinations at:

http://students.mq.edu.au/student_admin/exams/

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In this case, you may notify the University of your disruption to studies by providing required documentation through <https://ask.mq.edu.au/>. Please see **Disruption to Studies policy** at http://www.mq.edu.au/policy/docs/disruption_studies/policy.html for further information.

If you notify the University of your disruption to studies for your examination, you must make yourself available for the week of July 24 – 28, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

On successful completion you will be able to:

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design
- understand basic survey sampling, be familiar with concepts such as sampling bias, sampling and non-sampling errors, and know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design
- have generally improved problem solving ability

Delivery and Resources

Classes

Students are required to attend a 3-hour lecture per week beginning in Week 1, and a 1-hour tutorial class in computer laboratory **beginning in Week 2**.

Times and locations for all classes can be found on the University web site at: www.timetables.mq.edu.au. In the case of changing classes, time and/or location, you will be informed at the lecture and/or on the unit iLearn in advance.

Note: You are welcome to come to see the lecturer during staff consultation time with questions related to the unit. You could also contact the lecturer by e-mail or telephone. Only the **Macquarie University student e-mail accounts** may be used to communicate with staff.

Course materials, recommended text and other references

Weekly lecture notes will be made available on the unit iLearn (<https://iLearn.mq.edu.au/>) at least

one day before the lecture. Students should print out and bring the relevant lecture notes into the lecture.

Recommended text

Kuehl, R.O. (2000 or newer). Statistical Principles of Research Design and Analysis, Second edition, Duxbury Press, *for Experiment Design*; Lohr, S.L. (2010). Sampling: Design and Analysis, Duxbury Press, *for Survey Design*. These are available from the Co-Op Bookshop and the University library.

Other useful references (available in library Reserve):

Lindman HR (1992). Analysis of Variance in Experimental Design.

Montgomery DC. Design and Analysis of Experiments, 5th or 4th Edition.

Neter J, Wasserman W and Kutner M. Applied Linear Statistical Models.

Scheaffer RL, Mendenhall W and Ott RL (1996). Elementary Survey Sampling, 5th (or newer) Edition.

Cochran WG (1977). Sampling Techniques.

Moser CA & Kalton G (1971). Survey Methods in Social Investigations.

Barnett V (1974). Elements of Sampling Theory.

Technology Used and Required

Software: Minitab is used in this unit. Information about Minitab can be found on its web site at <http://www.minitab.com>. This software is provided for free to Macquarie students, and can be downloaded from the student portal at <http://students.mq.edu.au/home/> for home use. Students can also use Minitab online via iLab (<https://wiki.mq.edu.au/display/iLab/About>). **Remember that any work or results produced via iLab in all computing labs on the University campus must be saved onto iLab desktop and then emailed to yourself.**

Calculator: An electronic calculator is required throughout this unit. Only calculators with no text retrieval capacity are permitted to be used in the examination.

Unit Web Page and iLearn access: The unit web page is available on iLearn and can be accessed at: <http://ilearn.mq.edu.au>, under the 'STAT373 Design of Surveys and Experiments /STAT814_STAT714 Statistical Design' link. Note that you should visit this web site regularly for course materials including lecture slides, lecture recordings, tutorials and assignments, and also possible announcements placed by the Lecturer.

The **Discussion Forum** on the unit iLearn can be used for online discussion with other students enrolled in STAT373 or STAT814_STAT714 on any problems or topics related to the unit. The lecturer will visit the Forum from time to time.

Learning and Teaching activities

Lectures: Lectures begin in Week 1. Students are required to attend a 3-hour lecture each week. Topic(s) for each week are set in the Unit Schedule in this unit guide. Students are encouraged to read the relevant chapter(s) recommended before coming to the lecture.

An iLecture will be recorded for each lecture **when possible** and made available on the unit iLearn (under echo360) soon after the lecture is completed.

Tutorials and Tutorial exercises: Students are required to attend a 1-hour tutorial per week from Week 2. A set of tutorial exercises will be made available each week for students to practice, which is usually presented on the last slide(s) of each lecture. Students are encouraged to complete relevant tutorial exercises before coming to their tutorial class where the solution to the tutorial exercises is discussed. The tutorial solution will be also made available on iLearn soon after the class.

Assignments: Three assignments are set in this unit for students to complete independently. To assist with further learning, solutions to the assignments (when possible) will be made available later on iLearn.

Unit Schedule

STAT 373

Experimental design:

Week	Topic	Chapter (Kuehl)
1	Designed experiments vs observational studies; Completely randomized design (CRD): one-way ANOVA	1, 2
2	One-way ANOVA (contd); Contrasts	2, 3
3	Contrasts (contd) and multiple comparisons; Model checking	3, 4
4	More on CRD; Randomized block design (RBD)	4, 8
5	Factorial experiments: two-way ANOVA; Random effects – one-way	6, 5, 11
6	Analysis of covariance	7, 17, 11

Survey design:

Week	Topic	Chapter (Lohr)
7	Introduction to surveys: sample survey and its principal steps, probability and non-probability sampling, sources of error and simple random sampling	1
8	Simple random sampling (SRS): infinite population, finite population and parameter estimation	2

9	SRS (contd): estimation of proportion; Stratified random sampling	2, 4
10	Stratified random sampling (contd); Choosing strata sample sizes	4, 3
11	Ratio and regression estimators	3
12	Cluster sampling; Systematic sampling	5
13	Revision	

Note: There may be minor deviations from this timetable if insufficient time is available for some topics.

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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/

Results

Results shown in *iLearn*, 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.

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) 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

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.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Assessment task

- Assignments

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge,

scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design
- understand basic survey sampling, be familiar with concepts such as sampling bias, sampling and non-sampling errors, and know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design
- have improved the ability to use computing software (Minitab) in solving practical problems

Assessment tasks

- Assignments
- Examination

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- understand commonly used experimental designs and be able to apply appropriate statistical method(s) for the analysis of data arising from each design
- understand commonly used survey designs and sampling methods, and be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from each design

Assessment tasks

- Assignments
- Examination

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- have generally improved problem solving ability
- have improved the ability to use computing software (Minitab) in solving practical problems

Assessment tasks

- Assignments
- Examination

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Assessment tasks

- Tutorial participation
- Assignments

Changes from Previous Offering

No major differences from previous offering.