



# STAT373

## Design of Surveys and Experiments

S1 Day 2016

*Dept of Statistics*

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## General Information

Unit convenor and teaching staff

Unit Convenor

Kehui Luo

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Level 2 AHH

Tuesday 10-12pm

Hassan Doosti

[hassan.doosti@mq.edu.au](mailto:hassan.doosti@mq.edu.au)

Credit points

3

Prerequisites

6cp at 200 level including (STAT270(P) or STAT271(P) or BIOL235(P) or PSY222(P) 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  
 be able to analyse data from an experiment using Minitab and to interpret the results  
 understand basic survey sampling, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors  
 know the basics of questionnaire design and question construction  
 understand commonly used survey designs and sampling methods, including simple random sampling, stratified sampling, systematic sampling, cluster sampling and quota sampling  
 be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from any one of the commonly used sampling methods  
 have generally improved their problem solving ability  
 have improved their ability to use computing software (Minitab) in solving practical problems

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Tutorial participation</u></a>	5%	No	Ongoing
<a href="#"><u>Tutorial exercises</u></a>	5%	No	Next tutorial class
<a href="#"><u>Assignments</u></a>	30%	No	Tuesday (Week 6, 8 & 12)
<a href="#"><u>Examination</u></a>	60%	No	University Examination Period

### Tutorial participation

Due: **Ongoing**

Weighting: **5%**

Students are required to attend a 1-hour tutorial per week from Week 2. A mark of from 0 (never attended or very rarely attended tutorials) to 5 (attending and actively participating all tutorials) will be awarded according to your attendance and participation in tutorials. To pass the unit, you need to **attend and participate in at least eight (8) tutorials**.

On successful completion you will be able to:

- understand basic survey sampling, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors

### Tutorial exercises

Due: **Next tutorial class**

Weighting: **5%**

Each week a set of tutorial exercises will be made available for you to practice, and then discussed in the tutorial of the following week.

Your solutions to the tutorial must be handed in or shown (as instructed) to the tutor at each tutorial session, and a mark of 0, 1 or 2 will be awarded depending on whether a reasonable attempt has been made. To pass the unit, you need to **complete at least eight (8) tutorial exercises**.

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
- be able to analyse data from an experiment using Minitab and to interpret the results
- understand basic survey sampling, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors
- know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, including simple random sampling, stratified sampling, systematic sampling, cluster sampling and quota sampling
- be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from any one of the commonly used sampling methods
- have generally improved their problem solving ability
- have improved their ability to use computing software (Minitab) in solving practical problems

## Assignments

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

Weighting: **30%**

**Three assignments** are set for students to complete independently, applying the knowledge gained from lecture(s), tutorials and their own reading, with and/or without using the statistical software, Minitab.

### **Note:**

The three assignments will be made available on the unit iLearn. Details about due date and submission for each assignment will be included in the assignment. Students must submit all assignments on-time and perform satisfactorily (ie, achieve pass standard) in order to pass this unit. Students who are unable to submit any assignment on time, because of documented illness or other unavoidable disruption, must report the circumstances in writing to the lecturer in charge and may consider applying for special consideration in relation to *Disruption to Studies*. A web link to *Disruption to Studies* policy is given under *Policies and Procedures* in this unit guide.

Students who have not submitted an assignment prior to the deadline will be awarded a mark of 0 for the assignment, except for cases in which an application for *Disruption to Studies* is made and approved.

Students must keep a soft or hard copy of any assignments that they submit. In the event of their assignments being misplaced, a replacement will be requested.

Marked assignments will be handed back to the student within two to three weeks after the due 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
- be able to analyse data from an experiment using Minitab and to interpret the results
- understand basic survey sampling, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors
- know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, including simple random sampling, stratified sampling, systematic sampling, cluster sampling and quota sampling
- be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from any one of the commonly used sampling methods
- have generally improved their problem solving ability
- have improved their ability to use computing software (Minitab) in solving practical problems

## Examination

Due: **University Examination Period**

Weighting: **60%**

The final examination is used to assess students' understanding of the material presented in the unit.

The final examination will be a three hour written exam (plus ten minutes reading time) and will be held during the examination period which runs from 14 June to 1 July, 2016. It will examine any materials covered in the unit. Relevant statistical tables will be attached to the final examination. Students will be permitted to take **two A4 sheets, typed or handwritten on both sides**, into the final examination. The right to bring two A4 sheets into the examination may be forfeited in any supplementary examination, on the grounds that extra preparation time will have been available to the candidate. **Calculators (non text returnable)** should be brought into the exam. No other electronic devices (e.g. mobile phones, mp3 players) are allowed during the exam.

The University Examination timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations at: <http://www.timetables.mq.edu.au/exam>.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching session, which is the final day of the official examination period.

Attendance at the examination is compulsory. The only exception to not sitting an examination at the designated time is because of documented illness or other unavoidable disruption. In these circumstances you may consider applying for *Disruption to Studies*. A web link to the *Disruption to Studies* policy is given under *Policies and Procedures* in this unit guide. **Disruption to Studies request may be granted to students whose performance in all parts of the coursework is satisfactory.**

If a Supplementary Examination is granted as a result of the *Disruption to Studies*, the examination will be scheduled after the conclusion of the official examination period.

**Note carefully:**

Your final grade in STAT373 will be based on your work during the semester and in the final examination as specified in the *Assessment Tasks*. You need to achieve the same standards in the assessment tasks during the semester and the final examination to be awarded a particular grade as set out in the *Grading Policy*. Your final result will include one of the grades plus a standard numerical grade (SNG).

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, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors
- know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, including simple random sampling, stratified sampling, systematic sampling, cluster sampling and quota sampling
- be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from any one of the commonly used sampling methods
- have generally improved their 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](http://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.

## Recommended Texts and/or Materials

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.

### **The recommended text for this unit:**

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.

### **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>).

We are currently using version 17 (or newer). It is available via iLab in all E4B computing labs on campus. **Remember that any work or results produced via iLab in these labs must be saved to the iLab desktop and then emailed to yourself.**

**Calculator:** An electronic calculator is required throughout this unit. Only non-text returnable calculators are permitted to be used in the final 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, where course materials will be made available.

The **Discussion Forum** on the unit **iLearn** can be used for online discussion with other students enrolled in STAT373/STAT814/STAT714 on any problems or topics related to the unit. The lecturer will visit the Forum from time to time.

**To login into iLearn**, you will be asked for your **Macquarie OneID number** and **myMQ Portal password**. If you have any problem accessing this website, you should visit Student Help web site at [www.mq.edu.au/iLearn/help-pages/students.htm](http://www.mq.edu.au/iLearn/help-pages/students.htm). **Note** that you should visit this web site regularly for updated course materials, and also possible announcements placed by the Lecturer.

If **iLearn** site is down, students can send an e-mail to the lecturer, using their Macquarie University student e-mail accounts. Furthermore, students should check and read their Macquarie University student e-mail account on a regular basis.

## 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.

**Tutorial Exercises:** Each week a set of tutorial exercises will be made available for students to practice. Students are **required** to attend a 1-hour tutorial per week **from Week 2** and **complete the tutorial exercises for the week before coming to their tutorial class**. Its solution will be discussed in the tutorial class of the following week, and 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; Mdel 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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

**New Assessment Policy in effect from Session 2 2016** [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html). For more information visit [http://students.mq.edu.au/events/2016/07/19/new\\_assessment\\_policy\\_in\\_place\\_from\\_session\\_2/](http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/)

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.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.a>

[u/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.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/)

## 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](http://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](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://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](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
- be able to analyse data from an experiment using Minitab and to interpret the results
- understand basic survey sampling, know how to obtain a representative sample, be familiar with concepts such as sampling bias, sampling and non-sampling errors
- know the basics of questionnaire design and question construction
- understand commonly used survey designs and sampling methods, including simple random sampling, stratified sampling, systematic sampling, cluster sampling and quota sampling
- have improved their ability to use computing software (Minitab) in solving practical problems

#### Assessment tasks

- Tutorial exercises
- 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 outcome

- be able to use appropriate statistical technique(s) to estimate population parameters based on a sample from any one of the commonly used sampling methods

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

### Assessment tasks

- Tutorial exercises
- 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:

### **Learning outcome**

- be able to analyse data from an experiment using Minitab and to interpret the results

### **Assessment tasks**

- Tutorial participation
- Tutorial exercises
- Assignments

## **Changes from Previous Offering**

No major differences from previous offering.

## **Changes since First Published**

<b>Date</b>	<b>Description</b>
04/02/2016	Corrected the examination period for S1 2016.