STAT373

Design of Surveys and Experiments

S1 Day 2014

Statistics

Contents

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General Information

Unit convenor and teaching staff
Unit Convenor
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E4A532
Thursday 10-12pm

Hassan Doosti
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Credit points
3

Prerequisites
39cp 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
Tutorial participation	5%	No	Ongoing
Tutorial exercises	5%	No	Next tutorial class
Assignments	30%	No	Friday (Week 6, 8 & 12)
Examination	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**.

Tutorial exercises

Due: **Next tutorial class**
Weighting: **5%**

Each week a set of tutorial exercises will be made available for you to work on 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. For each tutorial exercise, a mark of 0, 1 or 2 will be awarded depending on whether a reasonable attempt has been made. Marked tutorial will be returned to you at the tutorial class in the following week. To pass the unit, you need to **complete at least eight (8) tutorial exercises**.

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

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: **Friday (Week 6, 8 & 12)**
Weighting: **30%**

Three assignments are set for students to complete independently, applying the knowledge gained from lecture(s) 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 who are unable to submit any assignment on time, because of illness or some other causes, must report the circumstances in writing to the lecturer in charge and may consider applying for Special Consideration. Request for Special Consideration should be lodged via MQ Student Admin at https://ask.mq.edu.au/index.php. **No extensions will be granted. 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 special consideration is made and approved.**

Marked assignments will be handed back to the student within two to three weeks after the due date.

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

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 16 June to 4 July, 2014. 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**, **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 unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process and policy is available at: http://www.mq.edu.au/policy/docs/special_consideration/policy.html. Student Request for Special Consideration should be lodged via MQ Student Admin at https://ask.mq.edu.au/index.php.

Special Consideration will only be granted to students whose performance in all parts of the coursework is satisfactory. In particular, you must have obtained at least 20 out of the total 40 marks in the coursework and participated at least eight tutorial classes.

If a Supplementary Examination is granted as a result of the Special Consideration process, 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. 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.

In order to pass STAT373 students must satisfy each of the following requirements:

* Attend, participate and complete exercises in **at least eight (8) tutorials**.

* Submit all assignments **on time and perform satisfactorily** (ie, achieve pass standard).

* Perform satisfactorily (ie, achieve pass standard) in the final examination.

* Perform satisfactorily (ie, achieve pass standard) in the overall assessment.

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 laboratory tutorial class **beginning in Week 2**.

Times and locations for all classes can be found on the University web site at: www.ti metables.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 at https://iLearn.mq.ed u.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 is

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. We are currently using version 16 (or newer). It is available in all E4B computing labs on campus. 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/.

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.

Weekly lecture notes, including power point slides and iLectures**,** will be made available on iLearn. Other course materials including assignments, tutorial exercises and their solutions, and relevant data files can also be downloaded from iLearn.

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.

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. **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 to students later on iLearn.

Grading

Your final grade in STAT373 will be based on your work during semester and in the final examination as specified in the Assessment Tasks. The grades allocated are as set out in the Grading Policy at http://www.mq.edu.au/policy/docs/grading/policy.html. Your final result will include one of these grades plus a standardised numerical grade (SNG).

Changes

No major differences from previous offering.

Unit Schedule

STAT 373/STAT 814/STAT714

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), multiple comparisons and 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 randome sampling (SRS): infinite population, finite population, 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.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

Disruption to Studies Policy 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/

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://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

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