



ITEC876

Applications of Data Science

S2 Day 2018

Dept of Computing

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General Information

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Credit points

4

Prerequisites

Admission to MDataSc or ITEC649 or ITEC657

Corequisites

Co-badged status

COMP777

Unit description

This unit deals with the application of Data Science techniques to the analysis of data in a research context. Topics covered include the management of data and keeping track of intermediate results, small and large scale data processing techniques, scripting experiments, version control for source code and data, the problem of replication of research results, data publication and presentation of results in various forms. Students will complete a significant data analysis project that will use available data sets to address a research question and present results to a well defined target audience.

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:

Define and manage a project involving empirical research.

Apply a knowledge of programming and/or use of appropriate applications (for e.g. data gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.

Articulate clearly a coherent argument in written and oral form to a variety of audiences.

Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.

Demonstrate best practice in document preparation and management in research.

General Assessment Information

Submission of assignments will be for the most part via iLearn; presentations associated with assignments will be given and assessed during class time.

For policy on late assignments, see Policies and Procedures.

Assessment Tasks

| Name | Weighting | Hurdle | Due |
|--|-----------|--------|---------|
| <u>Project Proposal Presentation</u> | 10% | No | Week 5 |
| <u>Project Proposal Document</u> | 10% | No | Week 6 |
| <u>Project Update Presentation</u> | 10% | No | Week 11 |
| <u>Draft Report</u> | 10% | No | Week 11 |
| <u>Final Presentation</u> | 25% | No | Week 13 |
| <u>Final Report</u> | 35% | No | Week 15 |

Project Proposal Presentation

Due: **Week 5**

Weighting: **10%**

The assessment for the unit will be built around a single project you will devise. This initial

presentation is to pitch the idea to the audience (lecturers and students): explain the data you'll be using, give any relevant background, and outline a plan for tackling the project.

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.

Project Proposal Document

Due: **Week 6**

Weighting: **10%**

This is a document that describes what you'll be doing in the project, based on the proposal presentation and feedback on that. It will also include an outline of the structure of the final report you'll be writing on the results of the project.

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Demonstrate best practice in document preparation and management in research.

Project Update Presentation

Due: **Week 11**

Weighting: **10%**

This presentation will give an update on the state of the project.

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.

Draft Report

Due: **Week 11**

Weighting: **10%**

This will be a draft of the final report that you'll be writing about the project, primarily so that you can get feedback.

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Apply a knowledge of the principles of ethical conduct of research, including an

examination of the role of open access to data and publications.

- Demonstrate best practice in document preparation and management in research.

Final Presentation

Due: **Week 13**

Weighting: **25%**

This presentation will describe to an audience the results of your project. Feedback from the presentation can be incorporated into the final report

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Apply a knowledge of programming and/or use of appropriate applications (for e.g. data gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.

Final Report

Due: **Week 15**

Weighting: **35%**

This report will describe the completed project as a whole: what the goals were, what data was used, how it was processed, and what the results were relative to the goals. It may also include any related programs written as part of the project, etc.

On successful completion you will be able to:

- Define and manage a project involving empirical research.
- Apply a knowledge of programming and/or use of appropriate applications (for e.g. data gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.
- Demonstrate best practice in document preparation and management in research.

Delivery and Resources

CLASSES

Each week has a three-hour session which is a mix of lecture (typically for the first two hours), tutorial and practical session. For details of days, times and rooms, consult the University timetables webpage (<http://www.timetables.mq.edu.au>).

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

There is no set text for the unit. We will be providing pointers to reading material over the course of the unit.

The unit has some parallels with the freely available [Software Carpentry](#) course. We'll be using those resources as supplementary ones for the unit.

UNIT WEBPAGE AND TECHNOLOGY USED AND REQUIRED

Web Home Page

The unit will make extensive use of the iLearn course management system, including for delivery of class materials, discussion boards, submission of work and access to marks and feedback. Students should check the iLearn site (<https://ilearn.mq.edu.au>) regularly for unit updates.

Questions and general queries regarding the content of this unit, its lectures or mixed classes, or its assignments should be posted to the discussion boards on the unit iLearn site. In particular, any questions which are of interest to all students in this unit should be posted to one of these discussion boards, so that everyone can benefit from the answers. Questions of a private nature should be directed to the unit teaching staff.

Technology Used and Required

The practical work in this unit will involve a variety of technologies. Note that as this is a master's unit, there will be some self-directed learning.

Unit Schedule

This is a tentative schedule. The weekly topics are intended to cover useful techniques and tools for carrying out a data-oriented project, and may change depending upon chosen student projects, etc.

| | |
|--------|---|
| Week 1 | Reproducible Research: Concepts, Ideas and Structure |
| Week 2 | Reproducibility in Data-based Projects: from Data to Big Data |
| Week 3 | Reproducibility and Organizing Data: Provenance, version control and github |

| | |
|---------|--|
| Week 4 | Reproducibility and Data Curation: from Ingesting to Cleaning and Adding Value |
| Week 5 | Project proposal presentations |
| Week 6 | Reproducibility and Data Processing: Python Tools |
| Week 7 | Reproducibility and Data Analytics: Structure of a Data Analysis |
| | RECESS |
| Week 8 | Reproducibility, Virtual Appliances and Cloud Computing |
| Week 9 | Reproducibility and Data Visualisation - Part I |
| Week 10 | Reproducibility and Data Visualisation - Part II |
| Week 11 | Project update presentations |
| Week 12 | Presentations and Latex |
| Week 13 | no class |
| Week 14 | Final presentations |

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway \(https://students.mq.edu.au/support/study/student-policy-gateway\)](https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/p\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/p)

[olicy-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/study/getting-started/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>.

Late Assignment Policy: No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 40% penalty). This penalty does not apply for cases in which an application for special consideration is made and approved.

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

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

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document
- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

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

- Define and manage a project involving empirical research.
- Apply a knowledge of programming and/or use of appropriate applications (for e.g. data gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document

- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

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

- Define and manage a project involving empirical research.
- Apply a knowledge of programming and/or use of appropriate applications (for e.g. data gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Demonstrate best practice in document preparation and management in research.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document
- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

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

- Define and manage a project involving empirical research.
- Apply a knowledge of programming and/or use of appropriate applications (for e.g. data

gathering, curation, cleaning or analysis) in the context of an empirical research project in a relevant discipline.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document
- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

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

- Define and manage a project involving empirical research.
- Articulate clearly a coherent argument in written and oral form to a variety of audiences.
- Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.
- Demonstrate best practice in document preparation and management in research.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document
- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

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

- Define and manage a project involving empirical research.
- Apply a knowledge of the principles of ethical conduct of research, including an examination of the role of open access to data and publications.

Assessment tasks

- Project Proposal Presentation
- Project Proposal Document
- Project Update Presentation
- Draft Report
- Final Presentation
- Final Report

Changes from Previous Offering

The technologies will be different from the offerings of previous years.

Assessment Process

The assessment standards described above will be used to give a numeric mark out of 100 to each assessment submission during marking. The mark will correspond to a letter grade for that task according to the University guidelines. The final mark for the unit will be calculated by combining the marks for all assessment tasks according to the percentage weightings shown in the assessment summary. There are no hurdle assessments.

Assessment Standards

COMP777 will be graded according to the following general descriptions of the letter grades as specified by Macquarie University; following the general description is additional description of the standards specific to this unit. In the course of the unit, samples of past successful project will be provided in order to illustrate these standards.

High Distinction (HD, 85-100): provides consistent evidence of deep and critical understanding in relation to the learning outcomes. There is substantial originality and insight in identifying, generating and communicating competing arguments, perspectives or problem solving approaches; critical evaluation of problems, their solutions and their implications; creativity in application as appropriate to the discipline.

In the context of this unit, the project has a good design, and has used some data that is interesting or non-obvious, or has required some effort to obtain or use. It involves a good analysis of the data, and fairly extensively draws on the techniques and tools presented in the unit and possibly on others discovered independently by the student. The project is described in

a report and a presentation that are well-structured and essentially free from errors; these would be of a standard that could be presented at a conference with little or no polishing.

Distinction (D, 75-84): provides evidence of integration and evaluation of critical ideas, principles and theories, distinctive insight and ability in applying relevant skills and concepts in relation to learning outcomes. There is demonstration of frequent originality in defining and analysing issues or problems and providing solutions; and the use of means of communication appropriate to the discipline and the audience.

In the context of this unit, the project has a good design, and has used some data that is interesting or non-obvious, or has required some effort to obtain or use. It involves a good analysis of the data, and fairly extensively draws on the techniques and tools presented in the unit. The project is described in a report and a presentation that are well-structured and mostly free from errors; these would be of a standard that could be presented at a conference with some polishing.

Credit (Cr, 65-74): provides evidence of learning that goes beyond replication of content knowledge or skills relevant to the learning outcomes. There is demonstration of substantial understanding of fundamental concepts in the field of study and the ability to apply these concepts in a variety of contexts; convincing argumentation with appropriate coherent justification; communication of ideas fluently and clearly in terms of the conventions of the discipline.

In the context of this unit, the project has a sound design, and demonstrates some thought in the choice of data. It involves a good analysis of the data, and uses a reasonable number of the techniques and tools presented in the unit. The project is described in a report and a presentation that are well-structured and mostly free from errors.

Pass (P, 50-64): provides sufficient evidence of the achievement of learning outcomes. There is demonstration of understanding and application of fundamental concepts of the field of study; routine argumentation with acceptable justification; communication of information and ideas adequately in terms of the conventions of the discipline. The learning attainment is considered satisfactory or adequate or competent or capable in relation to the specified outcomes.

In the context of this unit, the project has a satisfactory design and uses some easily accessible data. It involves a successful, or nearly successful, analysis of data, and shows some familiarity with tools or techniques presented in the unit. The project is described in a satisfactory report and presentation.

Fail (F, 0-49): does not provide evidence of attainment of learning outcomes. There is missing or partial or superficial or faulty understanding and application of the fundamental concepts in the field of study; missing, undeveloped, inappropriate or confusing argumentation; incomplete, confusing or lacking communication of ideas in ways that give little attention to the conventions of the discipline.