



# COMP257

## Data Science

S2 Day 2019

*Dept of Computing*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	3
<a href="#"><u>General Assessment Information</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	4
<a href="#"><u>Delivery and Resources</u></a>	6
<a href="#"><u>Unit Schedule</u></a>	6
<a href="#"><u>Policies and Procedures</u></a>	7
<a href="#"><u>Graduate Capabilities</u></a>	9
<a href="#"><u>Changes from Previous Offering</u></a>	11
<a href="#"><u>Assessment Standards</u></a>	11
<a href="#"><u>Changes since First Published</u></a>	12

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## General Information

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### Credit points

3

### Prerequisites

(COMP115 or COMP125) and (STAT150 or STAT170 or STAT171)

### Corequisites

### Co-badged status

ITEC657

### Unit description

This unit introduces students to the fundamental techniques and tools of data science, such as the graphical display of data, predictive models, evaluation methodologies, regression, classification and clustering. The unit provides practical experience applying these methods using industry-standard software tools to real-world data sets. Students who have completed this unit will be able to identify which data science methods are most appropriate for a real-world data set, apply these methods to the data set, and interpret the results of the analysis they have performed.

## 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:

Identify the appropriate Data Science analysis for a problem and apply that method to the problem.

Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.

Present the results of their Data Science analyses both verbally and in written form.

Discuss the broader implications of Data Science analyses.

## General Assessment Information

### Late Submission

No extensions will be granted without an approved application for Special Consideration. There will be a deduction of 10% 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 for an assignment worth 10 marks – 20% penalty or 2 marks deducted from the total. No submission will be accepted after solutions have been posted.

### Supplementary Exam

If you receive [special consideration](#) for the final exam, a supplementary exam will be scheduled after the normal exam period, following the release of marks. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Workshop Checkpoints</a>	10%	Yes	Every Week
<a href="#">Portfolio</a>	20%	No	Weeks 4, 6, 8, 10
<a href="#">Data Science Project</a>	30%	No	Weeks 7, 13
<a href="#">Final Exam</a>	40%	No	TBC

### Workshop Checkpoints

Due: **Every Week**

Weighting: **10%**

**This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)**

When you attend each weekly workshop you will be asked to complete or make a serious attempt at a task, either practical or involving discussion with the class. **You must complete the checkpoint at least 8 out of 12 weekly classes to pass the course.**

This is a **hurdle assessment**. In order to pass the hurdle you will need to attend 8 workshop and make a serious attempt at completing the checkpoints.

There will be **no opportunity to repeat work that you have missed** unless you have a confirmed Special Consideration request for the day of your workshop (e.g. if you were ill). This means that you must attend at least 8 out of the 12 weeks of workshop and make a serious attempt at the set task each week.

On successful completion you will be able to:

- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.

### Portfolio

Due: **Weeks 4, 6, 8, 10**

Weighting: **20%**

The portfolio assessment will consist of **three** small data analysis problems that you will be given through the semester. These will involve writing code to analyse one or more data sets. You will show the versions in the workshops in weeks 4, 6 and 8 and then submit a final version in week 10 as an assignment for the final 20%.

On successful completion you will be able to:

- Identify the appropriate Data Science analysis for a problem and apply that method to the problem.
- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.
- Present the results of their Data Science analyses both verbally and in written form.
- Discuss the broader implications of Data Science analyses.

## Data Science Project

Due: **Weeks 7, 13**

Weighting: **30%**

In groups of 3-4 (**all members of your group must be from the same workshop session**), students will be given or will find one or more datasets and are asked to develop an analysis of this data and present a report. This project should include using more than one dataset, cleaning and analysing the data, training at least two different predictive models and using the model to make some conclusions. The report should be reproducible, all methods not only documented but available as an executable archive along with the data.

- Proposal and scoping document (week 7): 5%
- Final report (week 13): 15%
- Project presentation (week 13): 10%

On successful completion you will be able to:

- Identify the appropriate Data Science analysis for a problem and apply that method to the problem.
- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.
- Present the results of their Data Science analyses both verbally and in written form.
- Discuss the broader implications of Data Science analyses.

## Final Exam

Due: **TBC**

Weighting: **40%**

The exam will assess your knowledge and understanding of the data analysis and machine learning methods covered in the semester.

On successful completion you will be able to:

- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.

- Discuss the broader implications of Data Science analyses.

## Delivery and Resources

### Classes

There will be one two hour lecture each week and one two hour workshop in the computing laboratory. You are expected to attend both classes as they provide complimentary learning activities each week. In practical classes you will write code and experiment with various data sets; in lectures we will discuss the methods you are learning and how the results of your analysis can be interpreted.

### Textbooks

We will refer to the following texts during the semester:

*Introduction to Data Science A Python Approach to Concepts, Techniques and Applications*  
Iguar, Laura, Seguí, Santi (electronic edition available via [MQ Library](#))

*Computational and Inferential Thinking: The Foundations of Data Science* By Ani Adhikari and John DeNero (available on [GitBooks](#))

You will be given readings from these and other sources each week.

### Technology Used and Required

We will make use of Python 3.6 for data analysis, including a range of modules such as *scikit-learn*, *pandas*, *numpy* that provide additional features. These can all be installed via the [Anaconda Python](#) distribution. We will discuss this environment and the installation process in the first week of classes.

We will use [Jupyter Notebook](#) as a way of developing and presenting the analysis results. This is included in the full Anaconda distribution.

### Project Work

A major part of the assessment in this unit is based on a project that you will complete in groups. This will allow you to explore the techniques you are learning in class in a real-world data analysis exercise.

## Unit Schedule

The indicative list of topics is shown here, this is subject to change based on feedback from the class.

1	Overview of DS, Learning Python, Notebooks	SC/JW
2	Data formats, Python input and output	SC

3	Descriptive Statistics, simple visualisation	SC
4	Causality and correlation; Visualisation	SC
5	Predictive Modelling: Linear and Logistic Regression	SC
6	Software Engineering for Data Science	SC
7	Feature sets and spaces; Unsupervised learning	SC
8	Supervised Learning: K-Nearest Neighbours	JW
9	Naive Bayes Classifiers	JW
10	Artificial Neural Networks	JW
11	Learning Decision Trees	JW
12	Data Science Applications	JW
13	Project Presentations	SC/JW

## 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 \(htt](#)

[ps://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 \(http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@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:

#### Learning outcomes

- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.
- Present the results of their Data Science analyses both verbally and in written form.
- Discuss the broader implications of Data Science analyses.

#### Assessment tasks

- Workshop Checkpoints
- Portfolio
- Data Science Project
- Final Exam

### 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

- Identify the appropriate Data Science analysis for a problem and apply that method to the problem.
- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.
- Present the results of their Data Science analyses both verbally and in written form.

## Assessment tasks

- Workshop Checkpoints
- Portfolio
- Data Science Project
- Final Exam

## 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

- Identify the appropriate Data Science analysis for a problem and apply that method to the problem.
- Interpret Data Science analyses and summarise and identify the most important aspects of a Data Science analysis.
- Discuss the broader implications of Data Science analyses.

## Assessment tasks

- Workshop Checkpoints
- Portfolio
- Data Science Project
- Final Exam

## 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

- Identify the appropriate Data Science analysis for a problem and apply that method to the problem.
- Present the results of their Data Science analyses both verbally and in written form.

- Discuss the broader implications of Data Science analyses.

## Assessment tasks

- Portfolio
- Data Science Project
- Final Exam

## 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 outcomes

- Present the results of their Data Science analyses both verbally and in written form.
- Discuss the broader implications of Data Science analyses.

## Assessment tasks

- Portfolio
- Data Science Project
- Final Exam

## Changes from Previous Offering

The portfolio task has been simplified a little so that it is all assessed in one go but you are provided feedback on the three different tasks. The project groups will be larger this year so we hope that you are able to complete a more challenging project. The weightings of the different assessment tasks has been adjusted.

## Assessment Standards

COMP257 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.

**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 Portfolio and Project tasks provide an opportunity to show your*

*deep and critical understanding of the methods of Data Science in this unit. An HD student will show some originality and insight in these reports; they will show that they have mastered the techniques we have covered and have gone beyond these to discover new methods.*

**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, a D student will display some integration and evaluation in the Portfolio and Project reports - these will go beyond being a simple account of a data analysis, they will make it clear that the student has mastered the techniques and methods covered in the unit and understands how and why they are used together.*

**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, a Cr. student shows good performance in all assessment tasks, in particular the portfolio and project reports will show their complete understanding of the tools that they have learned to use.*

**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 P student shows good performance in most assessment tasks and is able to complete the major parts of all portfolio notebook tasks satisfactorily. The student is able to complete an analysis using the tools we have learned with some guidance.*

**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.

## Changes since First Published

Date	Description
15/08/2019	Update due dates for portfolio submissions.
25/07/2019	Provide more details for the workshop checkpoint rule.

