

# Unit Outline

**COS10022**

## **Data Science Principles**

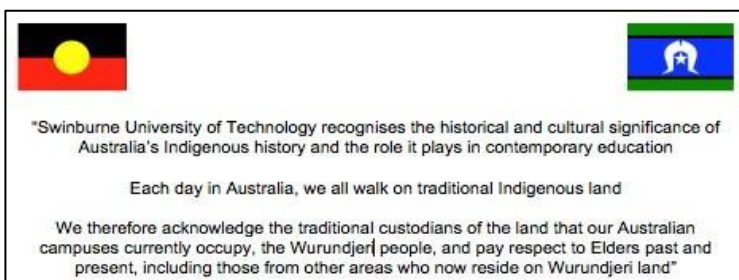
Semester May, 2025

**Please read this Unit Outline carefully. It includes:**

**PART A** Unit summary

**PART B** Your Unit in more detail

**PART C** Further information



## PART A: Unit Summary

<b>Unit Code(s)</b>		COS10022
<b>Unit Title</b>		Data Science Principles
<b>Duration</b>		One semester or equivalent
<b>Total Contact Hours</b>		48 hours
<b>Requisites:</b>		
	<b>Pre-requisites</b>	Nil
	<b>Co-requisites</b>	Nil
	<b>Concurrent pre-requisites</b>	Nil
	<b>Anti-requisites</b>	Nil
	<b>Assumed knowledge</b>	Students are expected to have basic programming skills.
<b>Credit Points</b>		12.5 credit points
<b>Campus/Location</b>		Ho Chi Minh City
<b>Mode of Delivery</b>		Blended
<b>Assessment Summary</b>		Assignment 1 (Individual, 20%) Assignment 2 (Individual, 30%) Online Test 1 (Individual, 10%) Online Test 2 (Individual, 10%) Online Test 3 (Individual, 30%)

### Aims

This unit aims at introducing students to the key concepts and techniques in data science and Big Data analytics. Students will be introduced to different stages in data analytics and given the opportunity to plan and design data science projects that address business and organisational needs.

### Unit Learning Outcomes

Students who successfully complete this unit can:

1. Appreciate the roles of data science and Big Data analytics in organisational contexts
2. Compare and analyse the key concepts, techniques and tools for discovering, analysing, visualising and presenting data
3. Describe the processes within the Data Analytics Lifecycle
4. Analyse organisational problems and formulate them into data science tasks
5. Evaluate suitable techniques and tools for specific data science tasks
6. Develop and execute an analytics plan for a given case study

## Graduate Attributes

This unit may contribute to the development of the following Swinburne Graduate Attributes:

- Communication 1 - Verbal communication
- Communication 2 - Communicating using different media
- Teamwork 1 - Collaboration and negotiation
- Teamwork 2 - Teamwork roles and processes
- Digital literacies 1 – Information literacy
- Digital Literacies 2 – Technical literacy

This unit contributes to the development of the following Swinburne Graduate Attributes:

• GA2 Communication - Communicating using different media: Students in this unit must use texts, images, tables, graphs or even videos to communicate findings to the audience. (Week 01, Week 07, Week 08, and Week 09, Week 11, assignment 1 and assignment 2)

• GA5 Digital literacies– Information literacy: Recognising when information is needed, locating, evaluating, and effectively using information, and responsibly creating and sharing information in various formats. Students are trained to gain skills, including critical thinking, problem-solving, research, and communication, that allow individuals to navigate the vast amount of information available in today's digital age. (Week 02, Week 07, Week 08, Week 09, Week 11, assignment 1 and assignment 2)

• GA6 Digital Literacies– Technical literacy: Understanding, using, and interacting with technology effectively. Students are trained to have the knowledge, skills, and competencies necessary to navigate and utilize various technological tools, devices, and systems in different contexts. (Week 01, Week 02, Week 03, Week 04, Week 05, Week 06, Week 10, and assignment 2).

Other graduate attributes may be practised in the unit but are not formally taught as part of the unit content, nor incorporated within formal assessment

## Content

- Introduction to Data Science and Big Data Analytics
- Roles of Data Science for Business
- Contemporary data structures and management
- Data Science tools, techniques and technologies
- The Data Analytics Lifecycle
- Analytical techniques and methods
- Analytics plan development

## PART B: Your Unit in more detail

### Unit Improvements

Feedback provided by previous students through the Student Survey has resulted in improvements that have been made to this unit. Recent improvements include:

Adjusting the level of assignments and lab tasks.

### Unit Teaching Staff

Name	Role	Email	Consultation Times
Mr Anh HOANG	Unit Coordinator	manh@swin.edu.au	By email appointment

### Learning and Teaching Structure

Categories	Activity	Total Hours	Hours per Week	Teaching Period Weeks
In-person	Lectures	24 hours	2 hours	Weeks 1 to 12
In-person	Tutorial	24 hours	2 hours	Weeks 1 to 12
Unspecified Activities	Independent Learning	90 hours	90 hours	Weeks 1 to 12

### Week by Week Schedule

Week	Week Beginning	Teaching and Learning Activity	Student Task or Assessment
1	May 05	<ul style="list-style-type: none"><li>▪ <b>Lecture:</b> Overview of Data Science and the Big Data Ecosystem.</li><li>▪ <b>Online materials:</b> Week 1 lecture slides.</li><li>▪ <b>Lab:</b> Basic of Python programming.</li></ul>	<ul style="list-style-type: none"><li>▪ Readings: Chapter 1 of “Data Science for Dummies.”</li><li>▪ Readings: Chapters 1 and 2 of “Python for Data Science for Dummies.”</li><li>▪ Readings: K. Cukier and V. Mayer-Schoenberger, 2013, “The Rise of Big Data: How It’s Changing the Way We Think about the World,” <i>Foreign Affairs</i>, 92(3): pp. 28-[ii].</li><li>▪ Get familiar with the Python coding environment and the basic programming skills in Python.</li></ul>
2	May 12	<ul style="list-style-type: none"><li>▪ <b>Lecture:</b> Regression Model: Linear Regression and Evaluation/Diagnostic.</li></ul>	<ul style="list-style-type: none"><li>▪ Study the principle of linear regression.</li><li>▪ Readings: Chapter 14 of “Data Science from Scratch.”</li></ul>

		<ul style="list-style-type: none"> <li>▪ <b>Online materials:</b> Week 2 lecture slides.</li> <li>▪ <b>Lab:</b> Python Programming and basic of KNIME.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Get familiar with the Python coding environment and the basic programming skills in Python.</li> <li>▪ Get familiar with the KNIME environment.</li> </ul>
3	May 19	<p><b>Lecture:</b> Unsupervised Mode: k-Means Clustering, DBSCAN, and Evaluation/Diagnostic</p> <ul style="list-style-type: none"> <li>▪ <b>Online materials:</b> Week 3 lecture slides.</li> <li>▪ <b>Lab:</b> Linear Regression and Logistic Regression.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study the concept and the classical method for unsupervised learning.</li> <li>▪ Readings: Chapter 20 of “Data Science from Scratch.</li> <li>▪ Practice on the linear regression and the logistic regression models.</li> </ul>
4	May 26	<ul style="list-style-type: none"> <li>▪ <b>Lecture:</b> Classification Mode: Naïve Bayes Classifier and Evaluation/Diagnostic.</li> <li>▪ <b>Online materials:</b> Week 4 lecture slides.</li> <li>▪ <b>Lab:</b> k-means clustering and DBSCAN.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study the principle of Naïve Bayes Classifier and the use cases.</li> <li>▪ Readings: Chapter 13 of “Data Science from Scratch. ▪ Practice k-means clustering and DBSCAN clustering.</li> </ul> <p>Assignment 1 (individual) due on Sunday, 01 June at 23:59 (VN Time)</p>
5	Jun 02	<ul style="list-style-type: none"> <li>▪ <b>Lecture:</b> Ensemble Learning: Bagging, Boosting, Stacking with Decision Tree and Random Forest.</li> <li>▪ <b>Online materials:</b> Week 5 lecture slides.</li> <li>▪ <b>Lab:</b> <ul style="list-style-type: none"> <li>▪ (1) Online Test 1 (2) Naïve Bayes classifier.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Study the principle of ensemble learning and related techniques.</li> <li>▪ Readings: Chapter 17 of “Data Science from Scratch.</li> <li>▪ Practice with examples of using Naïve Bayes classifier.</li> <li>▪ <b>Online Test 1 in class organized by lecturer</b></li> </ul>
6	Jun 09	<ul style="list-style-type: none"> <li>▪ <b>Lecture:</b> Association Rules Mining</li> <li>▪ <b>Online materials:</b> Week 6 lecture slides.</li> <li>▪ <b>Lab:</b> Decision Tree and Random Forest classifier.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Study the concept and the classical algorithm in association rules.</li> <li>▪ Readings: Market Basket Analysis using R. (<a href="https://www.datacamp.com/community/tutorials/marketbasket-analysis-r#firstthead">https://www.datacamp.com/community/tutorials/marketbasket-analysis-r#firstthead</a>)</li> <li>▪ Readings: Market Basket Analysis and Recommendation Engines. (<a href="https://www.knime.com/blog/market-basket-analysisand-recommendation-engines">https://www.knime.com/blog/market-basket-analysisand-recommendation-engines</a>)</li> <li>▪ Practice the decision tree classifier. <ul style="list-style-type: none"> <li>• Practice the Random Forest Classifier.</li> </ul> </li> </ul>
7	Jun 16	<ul style="list-style-type: none"> <li>▪ <b>Lecture:</b> Translating Business Problems into Analytic</li> </ul>	<ul style="list-style-type: none"> <li>▪ Readings: Chapter 3 of “Data Science for Dummies.”</li> <li>▪ Readings: Chapter 3 of “Python for Data Science for Dummies.”</li> </ul>

		Problems, Hypothesis Formulation, and Data Store. ▪ <b>Online materials:</b> Week 7 lecture slides. ▪ <b>Lab:</b> ▪ Association Rule Mining.	▪ <A data science framework advocated by DELL EMC > case study. • Practice finding association rules with the topic of market basket analysis.
8	Jun 23	▪ <b>Lecture:</b> Data Preparation ▪ <b>Online materials:</b> Week 8 lecture slides. ▪ <b>Lab:</b> ▪ Data Preparation with Samples.	▪ Details of Data preparation processes study. ▪ Readings: Chapter 10 of “Data Science from Scratch.” ▪ Practicing on data preparation procedures.
9	Jun 30	▪ <b>Lecture:</b> Exploratory Data Analysis and Statistical Methods for Evaluation ▪ ▪ <b>Online materials:</b> Week 9 lecture slides. ▪ <b>Lab:</b> ▪ Introduction to statistics and Feature Selection.	▪ Study the exploratory process of data analysis and the concept of statistics. ▪ Readings: Chapter 3 and 5 of “Data Science from Scratch.” ▪ Practice on the descriptive statistics and the inferential statistics.
<b>Mid-Semester Break - Monday 07 July to Sunday 13 July inclusive</b>			
10	Jul 14	▪ <b>Lecture:</b> Advanced Predictive Mode: Artificial Neural Network. ▪ <b>Online materials:</b> Week 10 lecture slides. ▪ <b>Lab:</b> ▪ Artificial Neural Network.	▪ Study the popular structures of artificial neural networks. ▪ Readings: Chapter 18 of “Data Science from Scratch.” ▪ Practice the usage of the artificial neural network. ▪ <b>Assignment 2 (individual) due on Sunday, 20 July at 23:59 (VN Time)</b>
11	Jul 21	▪ <b>Lecture:</b> Communicate Results and Model Deployment. ▪ <b>Online materials:</b> Week 11 lecture slides. ▪ <b>Lab:</b> ▪ Online Test 2	▪ Study the principle of communicating results and deploying models. ▪ Readings: Chapters 26 and 27 of “Data Science from Scratch.” ▪ <b>Online Test 2 in class</b>
12	Jul 28	▪ <b>Lecture:</b> Revision. ▪ <b>Online materials:</b> Week 12 lecture slides. ▪ <b>Lab:</b> ▪ Online Test 3	▪ Review whole contents of this semester. Discussing questions and answers. ▪ <b>Online Test 3 in class</b>

## Assessment

### a) Assessment Overview

Tasks and Details	Individual or Group	Weighting	Unit Learning Outcomes that this assessment task relates to	Assessment Due Date
1. Assignment 1	Individual	20%	4,5,6	End of Week 04
2. Assignment 2	Individual	30%	1,2,3	End of Week 10
3. Online Test 1	Individual	10%	4,5,6	Week 05 Class
4. Online Test 2	Individual	10%	2,3,4,5,6	Week 11 Class
5. Online Test 3	Individual	30%	1,2,3,4,5,6	Week 12 Class

**b) Minimum requirements to pass this Unit**

To pass this unit, you must:

- achieve an **overall mark** for the unit of 50% or more,
- submit all assignments, and
- participate in all online tests.

Students who do not participate in all assignments and tests will receive a maximum of 44% as the total mark for the unit.

**c) Examinations**

The online tests are hosted in the class time. You will be expected to be available for the time slots stated in your timetable.

**d) Submission Requirements**

Assignments and other assessments are generally submitted online through the Canvas assessment submission system which integrates with the Turnitin plagiarism checking service.

Please ensure you keep a copy of all assessments that are submitted.

In cases where a hard copy submission is required an Assessment Cover Sheet must be submitted with your assignment. The standard Assessment Cover Sheet is available from the [Submitting work](#) webpage or [www.swinburne.edu.au/studentforms/](http://www.swinburne.edu.au/studentforms/)

All submissions must be reviewed by at least one colleagues assigned on Canvas. The peer review should be completed before the assignment submission deadline. A submission is considered completed only if it has been reviewed by peers before the submission deadline.

**e) Extensions and Late Submission**

- **Late Submissions** - Unless an extension has been approved from the Unit Convenor, late submissions will result in a penalty. You will be penalised 10% of your achieved mark for each working day the task is late, up to a maximum of 5 working days. After 5 working days, a zero result will be recorded. For example, if a student achieves 90/100 on an assessment task but the task was submitted two days late. A late penalty of 20% (of that 90/100 mark) will be applied and the student's final mark will be recorded as 72/100 (being 90 less 09marks/1st day and another 09 mark/2nd day).

- **Extension** – please check the university policy for obtaining an extension.

#### f) Referencing

To avoid plagiarism, you are required to provide a reference whenever you include information from other sources in your work. Further details regarding plagiarism are available in Section C of this document under 'Academic Integrity'.

Referencing conventions required for this unit are:

Helpful information on referencing can be found at

<http://www.swinburne.edu.au/library/referencing/>

#### g) Groupwork Guidelines

For any of the assignment, at least one peer is required to review on your submission and give comments.

#### Required Textbook(s)

- Joel Grus, 2019. Data Science from Scratch – First Principles with Python, 2nd Edition, O'Reilly Media, Inc.
- Dietrich, D. ed., 2015. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. EMC Education Services.
- Schutt, R. and O'Neil, C., 2013. Doing data science: Straight talk from the frontline. O'Reilly Media, Inc.
- Pierson, L., Data Science for Dummies, 2nd Edition, John Wiley & Sons © 2017
- Mueller, J. P. and Massaron, L., Python for Data Science for Dummies, 2nd Edition, John Wiley & Sons © 2019 (432 pages), ISBN:9781119547624

#### Recommended Reading Materials

The Library has a large collection of resource materials, both texts and current journals. Listed below are some references that will provide valuable supplementary information to this unit. It is also recommended that you explore other sources to broaden your understanding.

- Han, J., Pei, J., & Kamber, M. (2011). Data mining: concepts and techniques. Elsevier.
- D. Lucy. (2005). Introduction to Statistics for Forensic Scientists Chichester: Wiley.
- KNIME® Beginner's Luck: A Guide to KNIME analytics Platform for Beginners by Rosaria Silipo
- KNIME® Advanced Luck: A Guide to KNIME Analytics Platform for Advanced Users by Rosaria Silipo and Jeanette Prinz
- KNIME® A Collection of Case Studies: Practicing Data Science by Rosaria Silipo
- More recommended readings are listed in the lecture slides.

## PART C: FURTHER INFORMATION



For further information on any of these topics, refer to Swinburne's Student webpage <http://www.swinburne.edu.au/student>

#### Student behaviour and wellbeing

All students are expected to: act with integrity, honesty and fairness; be inclusive, ethical and respectful of others; and appropriately use University resources, information, equipment and facilities. All students are expected to contribute to creating a work and study environment that is safe and free from bullying, violence, discrimination, sexual harassment, vilification and other forms of unacceptable behaviour.

The [Student Charter](#) describes what students can reasonably expect from Swinburne in order to enjoy a quality learning experience. The Charter also sets out what is



expected of students with regards to your studies and the way you conduct yourself towards other people and property.

You are expected to familiarise yourself with University regulations and policies and are obliged to abide by these, including the [Student Academic Misconduct Regulations](#), [Student General Misconduct Regulations](#) and the [People, Culture and Integrity Policy](#). Any student found to be in breach of these may be subject to disciplinary processes.

Examples of expected behaviours are:

- conducting yourself in teaching areas in a manner that is professional and not disruptive to others
- following specific safety procedures in Swinburne laboratories, such as wearing appropriate footwear and safety equipment, not acting in a manner which is dangerous or disruptive (e.g. playing computer games), and not bringing in food or drink
- following emergency and evacuation procedures and following instructions given by staff/wardens in an emergency response

### **Canvas**

You should regularly access the Swinburne learning management system, Canvas, which is available via the Current Students webpage or <https://swinburne.instructure.com/> Canvas is updated regularly with important unit information and communications.

### **Communication**

All communication will be via your Swinburne email address. If you access your email through a provider other than Swinburne, then it is your responsibility to ensure that your Swinburne email is redirected to your private email address.

### **Academic Integrity**

Academic integrity is about taking responsibility for your learning and submitting work that is honestly your own. It means acknowledging the ideas, contributions and work of others; referencing your sources; contributing fairly to group work; and completing tasks, tests and exams without cheating. Swinburne University uses the Turnitin system, which helps to identify inadequate citations, poor paraphrasing and unoriginal work in assignments that are submitted via Canvas. Your Unit Convenor will provide further details.

- Plagiarising, cheating and seeking an unfair advantage with regards to an exam or assessment are all breaches of academic integrity and treated as academic misconduct.
- Plagiarism is submitting or presenting someone else's work as though it is your own without full and appropriate acknowledgement of their ideas and work. Examples include:
  - using the whole or part of computer program written by another person as your own using the whole or part of somebody else's written work in an essay or other assessable work, including material from a book, journal, newspaper article, a website or database, a set of lecture notes, current or past student's work, or any other person's work
  - poorly paraphrasing somebody else's work
  - using a musical composition or audio, visual, graphic and photographic work created by another
  - using realia created by another person, such as objects, artefacts, costumes, models
  - submitting assessments that have been developed by another person or service (paid or unpaid), often referred to as contract cheating
  - presenting or submitting assignments or other work in conjunction with another person or group of people when that work should be your own independent work. This is regardless of whether or not it is with the knowledge or consent of the other person(s).
- Swinburne encourages students to talk to staff, fellow students and other people who may be able to contribute to a student's academic work but where an independent assignment is required, the work must be the student's own
- enabling others to plagiarise or cheat, including letting another student copy your work or by giving access to a draft or completed assignment

The penalties for academic misconduct can be severe, ranging from a zero grade for an assessment task through to expulsion from the unit and, in the extreme, exclusion from Swinburne.

### **Student support**

Swinburne offers a range of services and resources to help you complete your studies successfully. Your Unit Convenor or studentHQ can provide information about the study support and other services available for Swinburne students. See <https://portal.swin.edu.vn/> for further information.

### **Special consideration**

If your studies have been adversely affected due to serious and unavoidable circumstances outside of your control (e.g. severe illness or unavoidable obligation), you may be able to apply for special consideration (SPC).

Applications for Special Consideration will be submitted via the SPC online tool normally no later than 5.00pm on the third working day after the submission/sitting date for the relevant assessment component.

### **Accessibility needs**

Sometimes students with a disability, a mental health or medical condition or significant carer responsibilities require reasonable adjustments to enable full access to and participation in education. Your needs can be addressed by Swinburne's AccessAbility Services by negotiating and distributing an 'Education Access Plan'. The plan makes recommendations to University teaching and examination staff. You must notify AccessAbility Services of your disability or condition within one week after the commencement of your unit to allow the University to make reasonable adjustments.

### **Review of marks**

An independent marker reviews all fail grades for major assessment tasks. In addition, a review of assessment is undertaken if your final result is between 45 and 49 or within 2 marks of any grade threshold.

If you are not satisfied with the result of an assessment, you can ask the Unit Convenor to review the result. Your request must be made in writing within 10 working days of receiving the result. The Unit Convenor will review your result to determine if your result is appropriate.

If you are dissatisfied with the outcomes of the review, you can lodge a formal complaint.

### **Feedback, complaints and suggestions**

In the first instance, discuss any issues with your Unit Convenor. If you are dissatisfied with the outcome of the discussion or would prefer not to deal with your Unit Convenor, then you can complete a feedback form. See

<https://www.swinburne.edu.au/corporate/feedback/>

### **Advocacy**

Should you require assistance with any academic issues, University statutes, regulations, policies and procedures, you are advised to seek advice from Academic Department and Student HQ.