AVIA2601 Aviation Operations Research - 2024

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General Course Information

Course Code : AVIA2601
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Aviation
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course will focus on modelling and data analytics in aviation and will explore these ideas from the viewpoint of practices in the aviation industry. Data analytics and Python programming skills are included to provide students with problem-solving skills in data preparation, data

exploration and data modelling. Students are provided with computer programming training in the Python language. Tutorial sessions are an essential and significant part of this course. Major aviation models are introduced including regression models, clustering models and classification models. Assessments are based on aviation data projects to bring the relevance of model building and machine-learning practices to aviation data.

Course Aims

The overall aim of this course is to enable students to develop and gain further understanding of aviation data analytics through the investigation of mathematical models and machine learning techniques with a direct emphasis of their application to real-world situations in the field of aviation operations and planning. This course is aimed to equip students with graduate attributes to analyse and evaluate contemporary issues in aviation business situations and propose appropriate solutions based on scientific, theoretical and operational knowledge.

Relationship to Other Courses

This is an elective course. Before electing this course, students should have completed MATH1031 and MATH1041. This course is followed by another data analytics course, AVIA3610 which focuses on deep machine learning.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply Python programming language proficiently to process data and conduct data exploration tasks.
CLO2 : Implement data visualisation techniques and apply these to aviation data exploration.
CLO3 : Recall data modelling skills and statistical learning algorithms to build data models.
CLO4 : Develop mathematical models to investigate business challenges and create effective solutions.

Course Learning Outcomes	Assessment Item
CLO1 : Apply Python programming language proficiently to process data and conduct data exploration tasks.	• Data Project 1 – Data Exploration and Visualisation
CLO2 : Implement data visualisation techniques and apply these to aviation data exploration.	• Data Project 2 – Data Modelling • Data Project 1 – Data Exploration and Visualisation
CLO3 : Recall data modelling skills and statistical learning algorithms to build data models.	• Data Project 2 – Data Modelling • Data Project 1 – Data Exploration and Visualisation
CLO4 : Develop mathematical models to investigate business challenges and create effective solutions.	• Data Project 3 – Fleet Assignment Optimisation in Aviation

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

Teaching comprises lectures, hands-on tutorials, and data projects. All should be seen as interactive, providing opportunities to ask questions, to discuss issues and interact with fellow students and lecture/tutor in the class. Lab training (hands-on tutorials) is an integral part of this course and is also an essential part of learning. This gives students plenty hands-on experiences on solving aviation problems. This course aims to provide a learning and teaching environment where students are actively engaged in the learning process as part of a community of learners. The course aims to be interesting, challenging, but manageable while enjoyable. Learning activities are linked to problem solving and knowledge acquirement in the aviation context. Student diversity in terms of experiences and learning styles is valued and reflected in teaching

strategies. Student assessments are designed to reflect the course learning outcomes (CLOs).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Data Project 1 – Data Exploration and Visualisation Assessment Format: Individual	30%	Start Date: Week 1 Due Date: Week 5: 11 March - 17 March
Data Project 2 – Data Modelling Assessment Format: Individual	30%	Start Date: Week 4 Due Date: Week 7: 25 March - 31 March
Data Project 3 – Fleet Assignment Optimisation in Aviation Assessment Format: Individual	40%	Start Date: Week 7 Due Date: Week 11: 22 April - 28 April

Assessment Details

Data Project 1 – Data Exploration and Visualisation

Assessment Overview

For this assessment, you will be given two datasets which contain flight delay records. You will need to assume the role of data analyst, and provide insights and advice related to the available data for the improvement of flight scheduling policies and operations in the airline industry. Questions will be provided for you to answer as part of your response.

Data Project 1 is due in Week 5. Details of the assignment will be released in Week 1 of the course.

You are being assessed on your ability to:

- address the compulsory tasks listed for the assessment

- explore the data further and make meaningful analysis or modelling based on the available data.

- comprehensively compare various factors to contribute to insights e.g., cross-season, cross-airline.

You will be provided with written feedback and marks within 10 working days after your assignment submission.

Course Learning Outcomes

- CLO1 : Apply Python programming language proficiently to process data and conduct data

exploration tasks.
- CLO2 : Implement data visualisation techniques and apply these to aviation data exploration.
- CLO3 : Recall data modelling skills and statistical learning algorithms to build data models.

Data Project 2 – Data Modelling

Assessment Overview

In Data Project 2 – Data Modelling, you are required to conduct furtherdata exploration from Data Project 1 through the use of visualisation. This includes creating visuals of different charts to improve your data exploration in Data Project 1 and improve your insights. Questions will be provided for you to answer as part of your response.

Data Project 2 is due in Week 7. Details of the assignment will be released in Week 4 of the course.

You are being assessed on your ability to:

- comply with the assessment instructions.
- address the compulsory tasks listed for the assessment.
- explore the data further and make meaningful analysis or modelling based on the available data.
- comprehensively compare various factors to contribute to insights e.g., cross-season, cross-airline.

You will be provided with written feedback and marks within 10 working days after your assignment submission.

Course Learning Outcomes
- CLO2 : Implement data visualisation techniques and apply these to aviation data exploration.
- CLO3 : Recall data modelling skills and statistical learning algorithms to build data models.

Data Project 3 – Fleet Assignment Optimisation in Aviation

Assessment Overview

For Data Project 3, there are two tasks: Task 1 – Schedule Generation and Task 2 – Fleet Assignment Optimisation. Assignment information will be released in Week 7 of the course.

Task 1 – Schedule Generation

For Task 1, you are to create a timetable based on a base city and fleets of which you are provided. You are to create this timetable in alignment with a set of parameters provided to you.

Task 1 will form the foundation for Task 2 and must be completed with serious intent.

Task 2 – Fleet Assignment Optimisation Model

After completing Task 1, you will be required to perform fleet assignment optimisation by using the Fleet Assignment Model (FAM). You will be provided with demand figures.

You will be assessed on how well you can demonstrate how you improve your schedule and use FAM to improve aircraft utilisation. As part of this assessment, you are encouraged to discuss your model building process and challenges you face during the process, and exercise critical thinking and problem-solving skills to address the problem

Submission:
The assignment is due in the UNSW study period (week following Week 10 of the course). You are required to submit codes and the summary report generated in Tasks 1 and 2 of this assessment, in alignment with the assignment guidelines.

You will receive feedback and your mark within 10 working days after the submission deadline.

Course Learning Outcomes

- CLO4 : Develop mathematical models to investigate business challenges and create effective solutions.

General Assessment Information

UNSW Aviation's decision for Short Extension Policy

The School of Aviation has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. After careful consideration of our course offerings and our current structure, we have determined that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. **Consequently, the School of Aviation has decided to not adopt the Short Extension provision for all its courses and has reassured that flexibility is integrated into our assessment deadlines.** The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Blended	Topic: Course Introduction & Welcome L1-Data and Model Building, T1-Python Programming Basics Activity: Lecture Data sourcing Tutorial
Week 2 : 19 February - 25 February	Blended	Topic : L2-Supervised Learning Models-1 T2-Pandas and NumPy for Python Activity: Lecture Tutorial
Week 3 : 26 February - 3 March	Blended	Topic : L2-Supervised Learning Models-2 T3-Data preparation, Processing and Visualisation in Python-1 Activity: Lecture Tutorial Project consultation
Week 4 : 4 March - 10 March	Blended	Topic : L3-Unsupervised Learning Models T3-Data preparation, Processing and Visualisation in Python- 2 Activity: Lecture Tutorial Project consultation
Week 5 : 11 March - 17 March	Blended	Topic: L3-Unsupervised Learning Models T4-Regression, Clustering and Classification Model Tutorial Activity: Lecture Tutorial Project consultation
Week 6 : 18 March - 24 March	Other	Flexibility week
Week 7 : 25 March - 31 March	Blended	Topic: L4-Optimisation and CPLEX Library- 1 T5- CPLEX Tutorial- 1 Activity : Lecture Tutorial Project consultation
Week 8 : 1 April - 7 April	Blended	Topic : L4-Optimisation and CPLEX Library- 2 T5- CPLEX Tutorial- 2 Activity: Lecture Tutorial
Week 9 : 8 April - 14 April	Blended	Topic : L5- Optimisation in Aviation- Fleet Assignment & Aircraft Configuration Activity: Lecture, Tutorial
Week 10 : 15 April - 21 April	Blended	Data Project Consultation

Attendance Requirements

Please note that lecture recordings are not available for this course. Students are strongly encouraged to attend all classes and contact the Course Authority to make alternative arrangements for classes missed.

General Schedule Information

UNSW Aviation's decision to not release Lecture Recordings:

The School of Aviation prides itself on offering education that supports students in their personalised learning journey. This involves providing opportunities for students to engage with academics and key aviation experts to identify and address learning gaps, develop core skills and knowledge, and foster an environment of collaboration and meaningful discussion with the UNSW Aviation community. To support this vision, UNSW Aviation has decided to require students to attend all synchronous lectures (in-person or online) and not release class recordings to the student cohort. If students cannot attend a class and require learning support due to unforeseen circumstances, they should contact their Course Coordinator or Program Coordinator to discuss options for support and making up for missed class time.

Course Resources

Prescribed Resources

Essential:

1. Lubanovic, B 2014, Introducing Python. O'Reilly Media, Sebastopol, CA.

Print: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781492051367, Digital: https://unswbookshop.vitalsource.com/products/-v9781492051329.

2. Tomasz Drabas, 2016. Practical data analysis cookbook. Birmingham, UK, Packt Publishing.

Print: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781783551668, Digital: https://unswbookshop.vitalsource.com/products/-v9781783558513.

3. VanderPlas, J., 2016. Python data science handbook: Essential tools for working with data. O'Reilly Media, Inc. Print: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781098121228, Digital: https://unswbookshop.vitalsource.com/products/-v9781098121181, Web: https://jakevdp.github.io/PythonDataScienceHandbook/index.html.

Further Reading:

4. Abdelghany, A., & Abdelghany, K. (2010). *Modeling Applications in the Airline Industry* (1st ed.). Routledge. https://doi.org/10.4324/9781315595818. Print: https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780754678748, Digital: https://unswbookshop.vitalsource.com/products/-v9781317094890. **4.**

5. Severance, CR 2009, *Python for everybody: exploring data using Python 3*, Charles Severance.

6. James, G., Witten, D., Hastie, T. and Tibshirani, R., 2013. *An introduction to statistical learning*. New York: springer. (https://www.statlearning.com/)

These texts can be borrowed from UNSW Library in hard copy and/or soft copy forms (e.g. e-books). Some are "freely" accessible on the Internet. It is essential that students have a copy of these texts as the teaching of this course closely follows the structure and contents of the prescribed texts. E-books are available for download for UNSW students via the Library portal, so please visit UNSW Library and download a copy of e-book before starting this course.

Some texts can also be purchased from UNSW Bookshop: https://www.bookshop.unsw.edu.au,

where these texts are usually in stock and readily available. Books are also available for purchase online via major platforms. Other texts and journal papers that may be of assistance are provided on Moodle via UNSW Library. The use of library resources is essential for your study in this course.

Recommended Resources

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.*1* At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- • The *Current Students* site https://student.unsw.edu.au/plagiarism, and
- • The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

Course Evaluation and Development

The myExperience Survey aims to boost student feedback which creates a culture of continuous improvement by identifying, responding to, and acting on student feedback.

The course survey will open towards the end of Term. Students are encouraged to participate in the survey via Moodle, myUNSW, or through the direct myExperience link.

Please provide constructive feedback and focus on your learning experience in relation to the course material. While the survey is confidential, it is not anonymous. Comments that breach the Student Code of Conduct, that are hurtful, racist, sexist or ill natured, may lead to disciplinary action.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Cheng-Lung Wu					No	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the [UNSW Student Code of Conduct Website](#).

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can

be located at:

- The [Current Students site](#),
- The [ELISE training site](#), and
- The [Use of AI for assessments](#) site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination

or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

School Contact Information

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