Actuaries Institute.

Fellowship Program

Data Science Applications

Subject Syllabus 2026

1. Overview and aim

This subject is a Fellowship applications subject.

The aim of the subject is to teach students how to apply a range of data science skills, such as neural networks, natural language processing, unsupervised learning and optimisation techniques, together with their professional judgement, to solve a variety of complex and challenging business problems. The business problems used as examples in this subject are drawn from a wide range of industries.

2. Student outcomes

After successfully completing this subject, students will be able to:

- assess the impact of complex business environments on all stages of their data science projects;
- perform data science using a variety of tools and techniques to successfully solve realistic business problems; and
- contribute to the successful implementation of data driven change in an organisation.

3. Prerequisites

Students will have studied (but not necessarily passed) all their Foundation and Actuary program subjects before commencing this subject.

The syllabus for the Actuary program subject ‘Data Science Principles’ (DSP) is required knowledge for this subject. Students who have not studied DSP will need to satisfy themselves that they have covered the DSP syllabus items elsewhere.

Students will also have studied (but not necessarily passed) two Fellowship principles-based subjects.

Students require a basic understanding of Python prior to undertaking this subject. The Actuaries Institute will provide students with suggested resources for acquiring this knowledge.

There are no prior work experience requirements for undertaking this subject.

4. Assessment skill level

Assessment of this subject will be split across the following skill levels:

- Simple Application (20%): demonstration of a detailed knowledge and understanding of the topic;
- Application (50%): demonstration of an ability to apply the principles underlying the topic within a given context; and
- Higher Order (30%): demonstration of an ability to perform deeper analysis and assessment of situations, including forming judgements, considering different points of view, comparing and contrasting situations, suggesting possible solutions and actions and making recommendations.

5. Assessment method

The subject is assessed via:

- an assignment worth 50%; and
- a three-hour (plus 15-minute reading time) open-book examination worth 50%.

6. Learning objectives

1 Assess the impact of complex business environments on all stages of a data science project (30%)

1.1 Evaluate the impact domain knowledge has on the success of a data science project

1.1.1 Assess the influence of domain knowledge on all stages of a data science project

1.1.2 Apply appropriate techniques to acquire domain knowledge

1.2 Assess the impact of security and privacy considerations on data science work

1.2.1 Explain the principles that underpin an organisation's data security and privacy processes

1.2.2 Outline the Australian security and privacy laws and regulations that apply to data science work

1.2.3 Contrast the security and privacy rules that relate to data science work in Australia with those that apply in the European Union and the United States of America

1.3 Apply ethical and professional principles to data science work

1.3.1 Evaluate various ethical perspectives that influence data-driven decision-making

1.3.2 Examine an ethical framework that drives a strong data ethics culture

1.3.3 Outline the ethical guidelines that apply to data science work in different jurisdictions

1.3.4 Apply the Actuaries Institute's Code of Conduct to data science projects

1.3.5 Explain the role of the Actuaries Institute's Data Science and AI Practice Committee

1.4 Examine the role of data architecture in a data science project

1.4.1 Evaluate how well data describes business activity

1.4.2 Explain data and database concepts

1.4.3 Distinguish between different data sources and formats

1.4.4 Recommend an effective data workflow

1.4.5 Explain the benefits and challenges of real-time data flows

1.4.6 Contrast cloud databases with internally hosted ones

2 Develop data science solutions to business problems using a variety of tools and techniques (60%)

2.1 Develop solutions to classification problems

2.1.1 Explain what a neural network is

2.1.2 Explain how a neural network can be used as an alternative to GLMs or tree-based models to solve classification problems

2.1.3 Develop solutions to a range of classification problems using GLMs, tree-based models, ensembling and neural networks

2.1.4 Evaluate solutions produced by classification models

2.2 Develop solutions to problems using unsupervised learning

2.2.1 Explain the purpose of dimension reduction

2.2.2 Implement principal component analysis

2.2.3 Recognise alternative dimension reduction techniques

2.2.4 Explain how clustering techniques can be used to gain business insight

2.2.5 Contrast k-means and hierarchical clustering techniques

2.2.6 Perform k-means and hierarchical clustering

2.2.7 Discuss alternative clustering techniques

2.2.8 Evaluate a clustering algorithm using internal, external, and manual validation

2.3 Develop solutions to text analysis problems using natural language processing

2.3.1 Explain what natural language processing models do

2.3.2 Outline the four key tasks of natural language processing

2.3.3 Describe a range of business problems that can be solved with natural language processing

2.3.4 Apply each step in the natural language processing pipeline to solve a variety of business problems

2.3.5 Explain transfer learning with pre-trained models

2.3.6 Evaluate the outcomes of natural language processing models

2.3.7 Explain the challenges that apply when using natural language processing models

2.4 Develop solutions to business optimisation problems

2.4.1 Explain how optimisation algorithms can be used to make decisions when resources are constrained

2.4.2 Develop solutions to optimise business outcomes

3 Implement data driven change in an organisation (10%)

3.1 Evaluate the key drivers of successful model deployment

3.1.1 Assess the impact of domain knowledge on the successful deployment of a model

3.1.2 Identify stakeholders who can influence the success of a model's deployment

3.1.3 Choose a suitable form of model deployment and architecture pattern that meets the needs of users

3.1.4 Implement strategies for gaining stakeholder support for data science projects

3.1.5 Explain the important components of the model deployment process, including deployment issues that relate to customers, management, administration, IT and other areas of a business

3.1.6 Discuss options for testing a model prior to and post deployment

3.1.7 Explain the need to monitor a model's deployment over time

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About the Actuaries Institute and Profession

As the peak professional body for actuaries in Australia, the Actuaries Institute represents the profession to government, business and the community. Our members work in a wide range of fields including insurance, superannuation and retirement incomes, enterprise risk management, data analytics and AI, climate change and sustainability, and government services.

Actuaries use data for good by harnessing the evidence to navigate into the future and make a positive impact. They think deeply about the issue at hand, whether it's advising on commercial strategy, influencing policy, or designing new products. Actuaries are adept at balancing interests of stakeholders, clients and communities. They're called upon to give insight on complex problems and they'll look at the full picture. Actuaries analyse the data and model scenarios to form robust and outcome-centred advice.

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