Next Generation Higher National Unit Specification

Applied Artificial Intelligence (SCQF level 8)

Unit code: J7DJ 48

SCQF level: 8 (24 SCQF credit points)

Valid from: session 2023–24

Prototype unit specification for use in pilot delivery only (version 1.0) June 2023

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

Unit purpose

This specialist unit introduces learners to applications of artificial intelligence (AI). It provides a foundation for more technical units relating to machine learning and data science, but is useful for any learner with an interest in science, technology, engineering and mathematics (STEM).

Learners do not require previous knowledge of AI, although they must have a good conceptual knowledge of computational methods. This can be demonstrated by completing Computer Science at SCQF level 7 or 8.

The unit introduces the concepts behind intelligent systems, including machine learning and neural network learning. It covers the algorithmic basis for machine learning, with learners using software tools to derive learning from data using both standard machine learning approaches and deep learning (neural networks). The unit also introduces a range of types of AI, such as generative AI, and their applications in the real world. Learners also explore the legal, ethical and social implications of these applications of AI.

On completion of the unit, learners can progress to more technical units in machine learning or artificial intelligence at SCQF level 8 and higher.

Unit outcomes

Learners who complete this unit can:

1   describe types of AI and their applications
2   describe ethical and legal implications for the use of AI
3   explain fundamental principles of machine learning
4   explain fundamental principles of deep learning
5   explain features of computer vision workloads
6   explain features of natural language processing workloads
7   explain features of Large Language Models and generative AI
8   select and apply AI services to a given brief

Evidence requirements

Learners must provide product and knowledge evidence.

The product evidence must demonstrate that learners can:

♦   interpret at least one AI scenario or brief
♦   correctly select and use AI services or tools
♦   interpret the results

Knowledge evidence must demonstrate that learners have sufficient knowledge and understanding for all statements in the 'Knowledge and skills' section.

Learners' evidence must be produced without assistance. The evidence can be produced over an extended period under lightly-controlled conditions. Learners should have access to learning materials.

You can sample the knowledge evidence when testing is used, but you must include one or more questions that cover:

♦   comparison of rule-based and learning-based approaches
♦   knowledge representation, including decision trees and truth tables
♦   time and space complexity
♦   machine learning process and workflow
♦   algorithmic and data bias
♦   supervised, unsupervised and reinforcement learning
♦   at least one method from machine learning
♦   model validation and goodness of fit
♦   artificial neural networks and convolutional neural networks
♦   Large Language Models
♦   benefits, risks and limitations of AI

Learners must produce evidence under test conditions in terms of supervision, location, timing and access to reference materials.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes:

Knowledge	Skills
Learners should understand: ♦ the definitions of AI, machine learning and deep learning (neural network learning) ♦ rule-based and learning-based approaches ♦ artificial narrow, general and superintelligence ♦ learning and neuroscience ♦ knowledge representation, including decision trees and truth tables ♦ machine learning models ♦ artificial neural networks ♦ completeness and optimisation ♦ tree and graph searches in AI ♦ time complexity ♦ space complexity ♦ machine learning process, including training and test data ♦ algorithmic and data bias ♦ supervised, unsupervised and reinforcement learning ♦ classification, regression and clustering problems ♦ model validation and goodness of fit ♦ machine learning software tools ♦ convolutional neural networks (CNNs) ♦ tokenisation in Natural Language Processing (NLP) ♦ fundamentals of Large Language Models ♦ prompt engineering, zero-shot and few-shot prompts ♦ how AI is applied in business, education, engineering, science, health and communications	Learners can: ♦ select a model for a given problem ♦ select and use software for machine learning ♦ create training data and test data ♦ use machine learning to develop and validate a model to a problem ♦ implement a neural network (deep learning) to solve a problem ♦ interpret the output from a neural network optimisation ♦ write prompts to solve a problem using a generative AI model

Knowledge	Skills
Learners should understand: ♦ the limitations of AI ♦ the benefits and risks of AI ♦ the legal, social and ethical implications of AI	

Meta-skills

Throughout this unit, learners develop meta-skills to enhance their employability in the computing sector.

Self-management

This meta-skill includes:

♦ focusing: interpreting an AI scenario or brief
♦ integrity: correctly selecting and using AI services or tools
♦ adapting: selecting and using AI services appropriately, to a given brief
♦ initiative: a readiness to get started and to investigate how AI is used in different settings

Social intelligence

This meta-skill includes:

♦ communicating: conveying AI information to different audiences
♦ collaborating: working in groups to problem solve and create a unified solution

Innovation

This meta-skill includes:

♦ sense-making: appreciating the benefits and risks of AI
♦ critical thinking: interpreting the results of using AI services and tools

Literacies

Throughout this unit, learners have opportunities to develop their literacy skills.

Numeracy

Learners develop numeracy skills by exploring problem-solving approaches, including statistical methods, and the roots of AI in mathematics and other disciplines.

Communication

Learners develop communication skills by working with others in teams and creating a unified solution from their individual efforts. They also present their results.

Digital

Learners develop digital skills and computer literacy by using machine learning software applications and cloud services to produce digital evidence.

Delivery of unit

We recommend that you teach the knowledge outcomes in sequence. You can deliver the practical outcome at any time, although we recommend that this outcome is started after the basic theory is covered, early in the unit. While the exact time allocated is at your centre's discretion, the notional design length is 120 hours.

We suggest the following distribution of time:

Outcome 1 — describe types of AI and their applications
    (5 hours)
Outcome 2 — describe ethical and legal implications for the use of AI
    (5 hours)
Outcome 3 — Explain fundamental principles of machine learning
    (15 hours)
Outcome 4 — Explain fundamental principles of deep learning
    (15 hours)
Outcome 5 — Explain features of computer vision workloads
    (15 hours)
Outcome 6 — Explain features of natural language processing workloads
    (20 hours)
Outcome 7 — Explain features of Large Language Models
    (20 hours)
Outcome 8 — Select and apply AI services to a given brief
    (25 hours)

Professional recognition

The unit does not provide professional recognition.

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

You can tailor content to specific learner contexts. As a minimum, we strongly recommend that you give an overview of the importance of AI, including:

♦ ethical and socially responsible AI

♦ contemporary and historical theoretical evolutions

♦ cleaning and preparing data

♦ optimisation

♦ evolutionary and genetic algorithms

♦ comparing supervised, unsupervised and reinforcement learning approaches

♦ image and text classification

♦ artificial neural networks and new evolutions, such as CNNs

♦ Large Language Models and generative AI

Not all of these areas are necessarily assessed.

In all contexts, you should emphasise the benefit of using a recognised methodology to calculate the values associated with machine learning. Learners must appreciate the value of AI for its practical applications and societal benefits.

Approaches to assessment

You can assess learners in a variety of ways. A traditional approach to assessment would involve the use of testing, for knowledge evidence, and a practical assignment, for product evidence. The test would comprise a number of extended-response questions sampling from outcomes 1, 2, 3, 4, 5, 6 and 7. The test would be carried out in controlled conditions in terms of location, timing and supervision. The 'Evidence requirements' define the mandatory items that must be included in every test. The practical assignment could require learners to select and apply a machine learning model to a data problem.

An alternative approach to assessment is for learners to maintain a portfolio of work. If you use this approach, learners must evidence all the defined knowledge and skills statements. They produce the portfolio throughout the unit, adding their best work as-and-when they produce it. This can be done under lightly-controlled conditions, in which case you must ensure authentication.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page: www.sqa.org.uk/assessmentarrangements.

Information for learners

Applied Artificial Intelligence (SCQF level 8)

This information explains:

♦ what the unit is about

♦ what you should know or be able to do before you start

♦ what you need to do during the unit

♦ opportunities for further learning and employment

Unit information

This specialist unit introduces you to the principles and applications of artificial intelligence (AI). It provides a foundation for more technical units relating to machine learning and data science. You do not need any previous knowledge of AI, but you should have a good conceptual knowledge of computing, as well as a grasp of matrix operations in mathematics. You can demonstrate this by completing Computer Science at SCQF level 7 or 8.

The unit introduces you to the principles behind intelligent systems, including machine learning and neural network learning. The algorithmic basis for machine learning is covered, and you use software tools to derive learning from data, using both standard machine learning approaches and deep learning (neural networks). The unit also elaborates on the various types of AI and a range of their applications in the real world. The unit also explores the legal, ethical and social implications of these applications of AI.

When you complete the unit, you can:

♦ describe types of AI and their applications

♦ describe ethical and legal implications for the use of AI

♦ explain fundamental principles of machine learning

♦ explain fundamental principles of deep learning

♦ explain features of computer vision workloads

♦ explain features of natural language processing workloads

♦ explain features of Large Language Models, such as ChatGPT

♦ select and apply AI services to a given brief

You are likely to be assessed by a holistic approach, consisting of a single assessment. You must meet all knowledge and skills outcomes and produce your evidence individually and without assistance.

Your product evidence of correctly selecting and using AI services to a given brief could form the basis for the holistic assessment.

Any areas that have not been covered in the given brief can be assessed by extended-response questions. In this case, you must demonstrate understanding of all knowledge statements and provide product evidence for all the skills listed.

Your evidence may be produced over an extended period of time in lightly-controlled conditions. You have access to learning materials. Authentication may be required to validate the integrity of your submission.

Throughout the unit, you develop meta-skills covering self-management, social intelligence and innovation.

When you finish the unit, you may progress to more advanced or more technical units in AI and machine learning, at SCQF level 8 or higher.

Administrative information

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Superclass: CB

History of changes

Version	Description of change	Date

Note: please check [SQA's website](#) to ensure you are using the most up-to-date version of this document.

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