VCE Algorithmics (HESS) 2023-2026 Implementation on-demand video

Video 5
Background to the Unit 4 Outcome 3 SAC

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY
VICTORIA State Government

Acknowledgement of Country

The VCAA respectfully acknowledges the Traditional Owners of Country throughout Victoria and pays respect to the ongoing living cultures of First Peoples.

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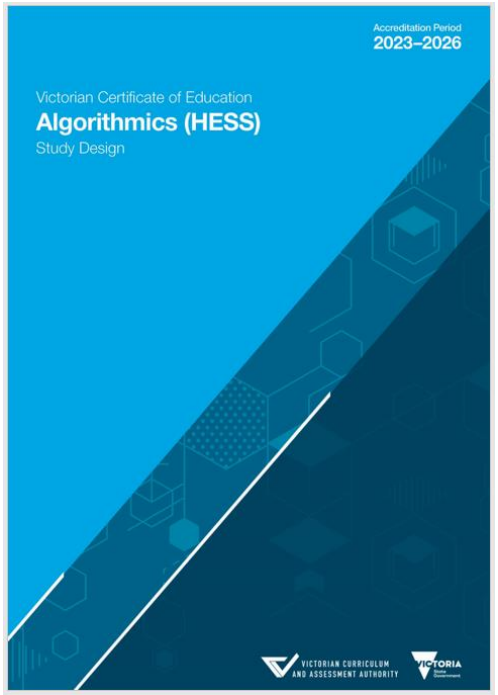
Purpose of this presentation

This presentation will cover:

- The study design
- Area of Study statement
- Outcome statement
- The assessment task
- Key knowledge
- Key skills
- Performance descriptors
- Advice for teachers

Resources



- This is the new study design.
- It will be accredited for 2023–2026.
- This is available on the Algorithmics (HESS) study page right now.
- Unit 4 Outcome 3 is now a School-assessed Coursework (SAC) task.

Unit 4 Area of Study 3

Computer science: past and present

In this area of study, students examine the emergence of computer science as a field and the philosophical and technical ideas that support the emergence of modern artificial intelligence (AI). They explore how the quest to develop methods for mathematical proof led to the proof that there exist problems that may not be computed automatically. Students investigate how machine learning algorithms learn from data and engage with several conceptions of artificial intelligence and whether it is possible. They examine and discuss some of the ethical issues posed by the application of data-driven algorithms. Students are not required to produce proofs or formal explanations concerning undecidability.

Unit 4 Outcome 3 – The outcome

On completion of this unit the student should be able to explain the historical context for the emergence of computer science as a field and discuss modern machine learning techniques and the philosophical issues they raise.

Unit 4 Outcome 3 – The assessment task

Contribution to final assessment

School-assessed Coursework for Unit 4 will contribute 8 per cent to the study score.

Outcomes	Marks allocated	Assessment tasks
Outcome 3 Explain the historical context for the emergence of computer science as a field and discuss modern machine learning techniques and the philosophical issues they raise.	50	Select at least one task from the following: • a response to a case study or stimulus material • a written report • an annotated visual report • an oral report • structured questions.
Total marks	50	

Key knowledge

- the historical connections between the foundational crisis of mathematics in the early 20th century and the origin of computer science, including Hilbert and Ackermann's Entscheidungsproblem and its resolution by Church and Turing
- characteristics of a Turing machine
- the concept of decidability and the Halting Problem as an example of an undecidable problem
- implications of undecidability for the limits of computation
- philosophical conceptions of artificial intelligence, including the Turing Test, weak AI and strong AI
- Searle's Chinese Room Argument, including standard responses both for and against
- the concept of training algorithms using data
- the concepts of model overfitting and underfitting
- support vector machines (SVM) as margin-maximising linear classifiers, including:
  - the geometric interpretation of applying SVM binary classification to one- or two-dimensional data
  - the creation of a second feature from one-dimensional data to allow linear classification
- neural networks, including:
  - the structure of multi-layer perceptron neural networks
  - the evaluation of outputs using forward propagation
  - training neural networks by using iterative improvement of the edge weights to reduce the output error
  - the factors leading to a resurgence in neural networks in the late 20th century
- ethical issues related to artificial intelligence and data-driven algorithms, including transparency, accountability, bias and machine ethics

Key skills

- explain the historical context for the emergence of computer science as a field
- describe the general structure of a Turing machine
- demonstrate the existence of hard limits of computability using the Halting Problem
- describe and compare the Turing Test, strong AI and weak AI as conceptions of artificial intelligence
- describe the Chinese Room Argument and mount an argument for or against it
- explain, at a high level, how data-driven algorithms can learn from data
- explain the optimisation objectives for training SVM and neural network binary classifiers
- explain how higher dimensional data can be created to allow for linear classification
- describe the structure of a multi-layer perceptron neural network
- evaluate the output of a small multi-layer perceptron neural network using forward propagation
- explain the consequences of model overfitting or underfitting
- explain and discuss ethical issues related to artificial intelligence and data-driven algorithms

VCAA Performance descriptors

ALGORITHMICS (HESS) UNIT 4 OUTCOME 3 SCHOOL-ASSESSED COURSEWORK					
Performance descriptors					
	DESCRIPTOR: typical performance in each range				
	Very low	**Low**	**Medium**	**High**	**Very high**
Unit 4 ***Outcome 3*** **On completion of this unit the student should be able to explain the historical context for the emergence of computer science as a field and discuss modern machine learning techniques and the philosophical issues they raise.**	Very limited description of the historical connections between the foundational crisis in mathematics and the origin of computer science.	Some explanation of the historical connections between the foundational crisis in mathematics and the origin of computer science.	Satisfactory explanation of the historical connections between the foundational crisis in mathematics and the origin of computer science.	Detailed explanation of the historical connections between the foundational crisis in mathematics and the origin of computer science.	Thorough explanation of the historical connections between the foundational crisis in mathematics and the origin of computer science.
	Very limited description of the concept of undecidability and its implications for the limits of computation.	Some explanation of the concept of undecidability and its implications for the limits of computation.	Satisfactory explanation of the concept of undecidability and its implications for the limits of computation.	Detailed explanation of the concept of undecidability and its implications for the limits of computation.	Thorough explanation of the concept of undecidability and its implications for the limits of computation.
	Very limited description of philosophical conceptions of artificial intelligence and the Chinese Room Argument.	Some explanation of philosophical conceptions of artificial intelligence and the Chinese Room Argument.	Satisfactory explanation of philosophical conceptions of artificial intelligence and the Chinese Room Argument with some analysis of these ideas.	Detailed explanation of philosophical conceptions of artificial intelligence and the Chinese Room Argument with a clear analysis of these ideas.	Thorough explanation of philosophical conceptions of artificial intelligence and the Chinese Room Argument with a sophisticated analysis of these ideas.
	Very limited description of data-driven algorithms, including support vector machines and neural networks.	Some explanation of data-driven algorithms, including support vector machines and neural networks.	Satisfactory explanation of data-driven algorithms, including support vector machines and neural networks.	Detailed explanation of data-driven algorithms, including support vector machines and neural networks.	Thorough explanation of data-driven algorithms, including support vector machines and neural networks.
	Very limited description of ethical issues related to artificial intelligence and data-driven algorithms.	Some explanation of ethical issues related to artificial intelligence and data-driven algorithms.	Some analysis of ethical issues related to artificial intelligence and data-driven algorithms with a limited synthesis of how these can result from the training of algorithms using data.	Clear analysis of ethical issues related to artificial intelligence and data-driven algorithms with some synthesis of how these can result from the training of algorithms using data.	Sophisticated analysis of ethical issues related to artificial intelligence and data-driven algorithms with a detailed synthesis of how these can result from the training of algorithms using data.

Advice for teachers

- Overview of Unit 4: Principles of algorithmics
- Unit 4 Outcome 3
  - Teaching and learning activities
  - Detailed examples
  - Sample approaches to developing an assessment task
  - Performance descriptors
- Unit 4 Sample weekly planner

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