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

Video 1
Units 3 and 4
Algorithmics (HESS) (2023–2026)

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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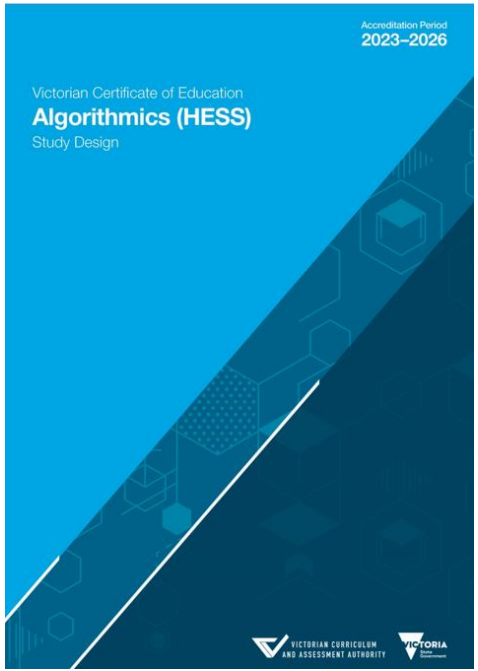
Purpose of this presentation

This presentation will cover:

- Changes to Algorithmics (HESS)
- Unit 3: Algorithmic problem solving
  - Outcomes 1–3
- Unit 4: Principles of Algorithmics
  - Outcomes 1–3
- Examination specifications
- Advice for teachers

Changes to Algorithmics (HESS)



- This is the Draft VCE Algorithmics (HESS) Study Design.
- There have been some minor changes to most outcomes and significant changes to Unit 4 Outcome 3 and school-based assessment.
- School-based Assessment now involves a combination of SACs (Unit 3 Outcomes 1 and 2 as well as Unit 4 Outcome 3) and a SAT (Unit 3 Outcome 3 as well as Unit 4 Outcomes 1 and 2).
- An all new Advice for teachers is being developed to support the study in 2023.
- An all new Administrative information for School-based Assessment will be published at the start of 2023.

Unit 3: Algorithmic problem solving

Unit 3 Area of Study 1

Data modelling with abstract data types

In this area of study, students develop and apply knowledge and skills in data abstraction. Students consider the structure of information through a study of the definition and properties of abstract data types (ADTs). They select appropriate ADTs and use them to model salient aspects of real-world problems. Students study a variety of collection-based data types, with a particular focus on the graph ADT, which encapsulates a set of nodes along with their interconnections. Students explore how graph ADTs can be applied to network problems, such as social or transport network problems, and planning problems.

Unit 3 Outcome 1

On completion of this unit the student should be able to define and explain the representation of information using abstract data types, and devise formal representations for modelling various kinds of real-world information problems using appropriate abstract data types.

Contribution to final assessment (SAC)

Outcome 1	Marks allocated	Assessment task
Define and explain the representation of information using abstract data types, and devise formal representations for modelling various kinds of real-world information problems using appropriate abstract data types.	50	In response to given stimulus material, create one or more designs of a data model using abstract data types to capture the salient aspects of a real-world information problem.

School-assessed Coursework for Unit 3 Outcome 1 will contribute 6 per cent to the study score.

Unit 3 Area of Study 2

Algorithm design

In this area of study, students learn how to formalise processes as algorithms and to execute them automatically. They use the language of algorithms to describe general approaches to problem-solving and to give precise descriptions of how specific problems can be solved. Students learn how to decompose problems into smaller parts that can be solved independently. This forms the basis of modularisation. Students explore a variety of problem-solving strategies and algorithm design patterns. Students explore example applications of these design patterns and learn about their implications for efficiently solving problems. They learn about recursion as a method for constructing solutions to problems by drawing on solutions to smaller instances of the same problem.

Students are required to implement algorithms as computer programs. The programming language used must explicitly support the ADTs listed in the key knowledge in Area of Study 1 either directly or by using a library.

Unit 3 Outcome 2

On completion of this unit the student should be able to define and explain algorithmic design principles, design algorithms to solve information problems using basic algorithm design patterns, and implement the algorithms.

Contribution to final assessment (SAC)

Outcome 2	Marks allocated	Assessment task
Define and explain algorithmic design principles, design algorithms to solve information problems using basic algorithm design patterns, and implement the algorithms.	50	In response to given stimulus material: • create one or more designs of algorithms that apply algorithm design patterns or select appropriate graph algorithms to solve information problems • implement an algorithm.

School-assessed Coursework for Unit 3 Outcome 2 will contribute 6 per cent to the study score.

Unit 3 Area of Study 3

Applied algorithms

In this area of study, students combine their knowledge of data modelling and algorithm design to solve real-world problems. Students consider a variety of algorithms and ADTs before selecting a suitable combination. They justify their chosen combination of algorithms and data types relative to other possible choices. Typically the fitness of a chosen combination could be measured in terms of the selection of salient features to achieve an appropriate level of abstraction and the quality of result produced by the algorithm.

Unit 3 Outcome 3

On completion of this unit the student should be able to design suitable solutions for real-world problems that require the integration of algorithms and data types, including the communication of solutions and their justification.

Contribution to final assessment (SAT)

Unit 3 Outcome 3	Assessment task
Design suitable solutions for real-world problems that require the integration of algorithms and data types, including the communication of solutions and their justification.	The design of a data model and algorithm combination to solve a real-world/applied problem, including: • a specification of the problem • a consideration of multiple solution options • the selection of a suitable, coherent, clear and fit-for-purpose solution

School-assessed Task – Part 1 for Unit 3 Outcome 3 will contribute 8 per cent to the study score.

Unit 4: Principles of algorithmics

Unit 4 Area of Study 1

Formal algorithm analysis

In this area of study, students investigate the efficiency of algorithms using mathematical techniques. Students learn how some computable problems require such a large amount of resources that in practice it is not possible to solve these exactly for realistic problem sizes. Students examine specific, widely occurring instances of such problems and the reasons why these problems cannot be solved. Students analyse time complexity formally and informally, while they study space complexity as a general concept. Students are not expected to derive the space complexity of algorithms.

Unit 4 Outcome 1

On completion of this unit the student should be able to establish the efficiency of simple algorithms and explain soft limits of computability.

Contribution to final assessment (SAT)

Unit 4 Outcome 1	Assessment task
Establish the efficiency of simple algorithms and explain soft limits of computability.	A formal time complexity analysis of the designed algorithm for the applied problem and an explanation of the consequences of these results on the algorithm’s real-world application.

School-assessed Task – Part 2 for Unit 4 Outcome 1 will contribute 6 per cent to the study score.

Unit 4 Area of Study 2

Advanced algorithm design

In this area of study, students examine more advanced algorithm design patterns. Students learn how to select algorithmic approaches from a wider range of options, depending on the structure of the problem that is being addressed. They investigate how some problems are solvable in principle while being intractable in practice. They explore examples of such problems with real-world relevance and learn how such problems can be tackled by computing near-optimal solutions.

Unit 4 Outcome 2

On completion of this unit the student should be able to solve a variety of information problems using algorithm design patterns and explain how heuristics can address the intractability of problems.

Contribution to final assessment (SAT)

Unit 4 Outcome 2	Assessment task
Solve a variety of information problems using algorithm design patterns and explain how heuristics can address the intractability of problems.	A design of an improved data model and algorithm combination to solve the applied problem, including: • the selection of an efficient, coherent and fit-for-purpose solution • a time complexity analysis • a comparison to the original solution.

School-assessed Task – Part 3 for Unit 4 Outcome 2 will contribute 6 per cent to the study score.

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

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.

Contribution to final assessment (SAC)

Outcome 3	Marks allocated	Assessment task
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.

School-assessed Coursework for Unit 4 Outcome 3 will contribute 8 per cent to the study score.

Examination specifications

Examination specifications

Overall conditions

The examination will be sat at a time and date to be set annually by the Victorian Curriculum and Assessment Authority (VCAA).

VCAA examination rules will apply.

Details of these rules are published annually in the VCE and VCAL Administrative Handbook.

There will be 15 minutes reading time and 2 hours writing time.

The examination will be marked by a panel appointed by the VCAA.

The examination will contribute 60 per cent to the study score.

Examination specifications

Content

The VCE Algorithmics (HESS) Study Design 2023–2026 is the document for the development of the examination.

All outcomes in Units 3 and 4 will be examined.

All of the key knowledge and skills that underpin the outcomes in Units 3 and 4 are examinable.

Examination specifications

Format

The examination will be in the form of a question and answer book.

The examination will consist of two sections.

Section A will consist of 20 multiple-choice questions worth 1 mark each and will be worth a total of 20 marks.

Section B will consist of short-answer and extended-answer questions, including questions with multiple parts.

The number of questions may vary from year to year.

Section B will be worth a total of 80 marks.

The examination may include questions that refer to visual and/or written material, including scenarios.

All questions will be compulsory.

The total marks for the examination will be 100.

Answers to Section A are to be recorded on the answer sheet provided for multiple-choice questions.

Answers to Section B are to be recorded in the spaces provided in the question and answer book.

Advice for teachers

Advice for teachers

- Overview of Unit 3: Algorithmic problem solving
- Teaching and learning activities
- Detailed examples
- Sample approaches to developing an assessment task
  - Unit 3 Outcome 1
  - Unit 3 Outcome 2
- School-assessed Task
  - Unit 3 Outcome 3
- Performance descriptors
  - Unit 3 Outcome 1
  - Unit 3 Outcome 2
- Unit 3 Sample weekly planner

- Overview of Unit 4: Principles of algorithmics
- Teaching and learning activities
- Detailed examples
- Sample approaches to developing an assessment task
  - Unit 4 Outcome 3
- School-assessed Task
  - Unit 4 Outcome 1
  - Unit 4 Outcome 2
- Performance descriptors
  - Unit 4 Outcome 3
- Unit 4 Sample weekly planner

Contact

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