VCE Algorithmics (HESS) 2023
Unit 3 School-based Assessment

Video 3
Planning the
Unit 3 Outcome 1 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.

VCE Algorithmics (HESS) 2023
Unit 3 School-based Assessment

Video 3
Planning the
Unit 3 Outcome 1 SAC

Phil Feain
Digital Technologies Curriculum Manager
VCAA

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

VICTORIA State Government

Purpose of this session

- to build the capacity of teachers to develop compliant, rigorous and engaging VCE assessment tasks in line with the VCE assessment principles
- provide an overview of how to plan for the Unit 3 Outcome 1 School-assessed Coursework (SAC) task.

Outline of the presentation

This presentation will cover:

- Unit 3 Outcome 1
- Key knowledge
- Key skills
- The assessment task
- Planning the task

Unit 3 Outcome 1

Unit 3 Outcome 1 – The outcome

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.

Key knowledge

- the motivation for using ADTs
- signature specifications of ADTs using operator names, argument types and result types
- specification and uses of the following ADTs:
  - set, list, array, dictionary (associative array)
  - stack, queue, priority queue
  - graphs, including undirected and directed graphs and unweighted and weighted graphs
- features of graphs, including paths, weighted path lengths, cycles and subgraphs
- categories of graphs, including complete graphs, connected graphs, directed acyclic graphs and trees, and their properties
- modularisation and abstraction of information representation with ADTs
- the structure of decision trees and state graphs

Key skills

- explain the role of ADTs for data modelling
- read and write ADT signature specifications
- use ADTs in accordance with their specifications
- identify and describe properties of graphs
- apply ADTs to model real-world problems by selecting an appropriate ADT and justifying its suitability
- model basic network and planning problems with graphs, including the use of decision trees and state graphs

Unit 3 Outcome 1 – The assessment task

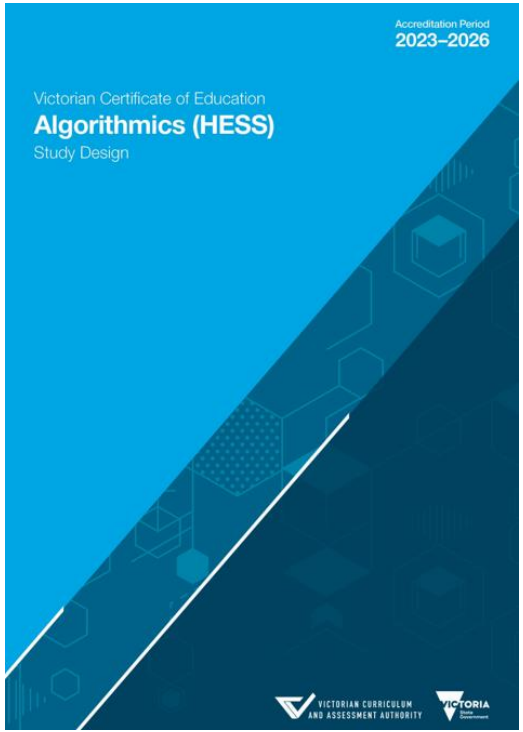
Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 12 per cent to the study score.

Outcomes	Marks allocated	Assessment tasks
Outcome 1 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.
Outcome 2 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.
Total marks	**100**	

Planning the Unit 3 Outcome 1 SAC task using VCAA resources

Unit 3 Outcome 1 Resources



Unit 3 Sample approaches to developing an assessment task

Area of Study 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.

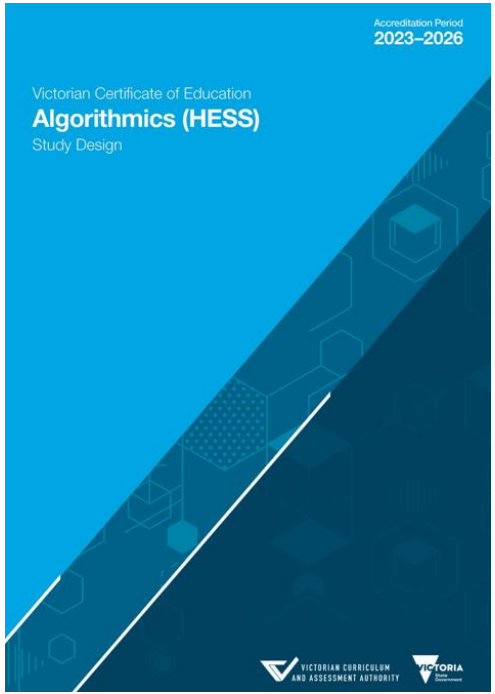
- ▸ Step 1: Requirements of the outcome
- ▸ Step 2: Determining teaching and learning activities
- ▸ Step 3: Designing the assessment task
- ▸ Step 4: Conditions of the assessment task
- ▸ Step 5: Marking the assessment task

ALGORITHMICS (HESS) UNIT 3 OUTCOME 1
SCHOOL-ASSESSED COURSEWORK

Performance descriptors

	DESCRIPTOR: typical performance in each range				
	Very low	**Low**	**Medium**	**High**	**Very high**
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.**	Identifies some motivations for the abstraction of data.	Discusses how an ADT property could be used to model an aspect of a particular problem. Little discrimination is demonstrated when identifying features of the problem.	Explains the role of ADTs for data modelling.	Describes in detail the suitability of appropriate ADTs for creating a model in a given problem context.	Compares and justifies the selection of appropriate ADTs for creating a model and outlines limitations of different representations.
	Uses limited metalanguage when describing ADTs.	Executes a sequence of ADT operations to a given ADT instance.	Reads, writes and uses ADTs.	Writes complete signature specifications for several ADTs, fully in appropriate metalanguage.	Specifies a non-trivial new operation for one of the standard ADTs to meet requirements that cannot be satisfied by the standard definition.
	Limited use of terminology in describing graph properties.	Confirms or rejects the properties of a graph given as a diagram.	Identifies and describes the properties of graphs.	Analyses the interconnections between the properties of graphs using correct terminology.	Analyses the properties satisfied by a given graph and derives another graph property using as evidence the existing specified properties of graphs.
	Identifies an example problem attribute that could be modelled by a graph node or edge.	Discusses some aspects of a problem, including planning problems from a given data model instance.	Applies ADTs to real-world problems. The full range of problem instances can be represented.	Models and fully represents a specific problem instance as a data model using a combination of ADT representations.	Models fully a specific problem instance as a data model with a combination of ADTs, and appropriately justifies the assigned priority of several aspects of the problem to the specific context of the problem.

Algorithmics (HESS) Study Design



Unit 3: Algorithmic problem-solving

This unit focuses on how algorithms are used for solving complex problems. Algorithms are systematic problem-solving procedures that exist independently of computers. The study of algorithms lies at the heart of computer science and provides the formal foundation for computer programming. Algorithmic problem-solving is a technique that can be applied very broadly in addressing a wide range of complex practical problems.

In Area of Study 1, students develop and apply a range of knowledge and skills to model real-world information problems. In Area of Study 2, students learn how to design algorithms following a variety of simple algorithm design patterns and learn graph algorithms. The programming requirements for Area of Study 2 will be published annually by the VCAA in the *VCAA Bulletin*. In Area of Study 3, students apply the understanding developed in Areas of Study 1 and 2 to design a solution for a real-world problem that includes both a data representation and algorithm design. Area of Study 3 forms the first part of the School-assessed Task that is completed in Unit 4.

Students are not required to know about the implementation of abstract data types (ADTs), as the main focus of this study is on algorithmic thinking using ADTs rather than on the details of how ADTs are implemented.

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.

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.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.

Key knowledge

- the motivation for using ADTs
- signature specifications of ADTs using operator names, argument types and result types
- specification and uses of the following ADTs:
  - set, list, array, dictionary (associative array)
  - stack, queue, priority queue
  - graphs, including undirected and directed graphs and unweighted and weighted graphs
- features of graphs, including paths, weighted path lengths, cycles and subgraphs
- categories of graphs, including complete graphs, connected graphs, directed acyclic graphs and trees, and their properties
- modularisation and abstraction of information representation with ADTs
- the structure of decision trees and state graphs

Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 12 per cent to the study score.

Outcomes	Marks allocated	Assessment tasks
Outcome 1 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.
Outcome 2 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.
Total marks	**100**	

School-assessed Task

The student's level of achievement in Unit 3 Outcome 3, Unit 4 Outcome 1 and Unit 4 Outcome 2 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided on page 18 of this study design.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 60 per cent to the study score.

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY
VICTORIA State Government

Sample approaches to developing an assessment task

Unit 3 Sample approaches to developing an assessment task

Area of Study 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.

- ▸ Step 1: Requirements of the outcome
- ▸ Step 2: Determining teaching and learning activities
- ▸ Step 3: Designing the assessment task
- ▸ Step 4: Conditions of the assessment task
- ▸ Step 5: Marking the assessment task

Performance descriptors

ALGORITHMICS (HESS) UNIT 3 OUTCOME 1 SCHOOL-ASSESSED COURSEWORK					
Performance descriptors					
	DESCRIPTOR: typical performance in each range				
	Very low	**Low**	**Medium**	**High**	**Very high**
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.**	Identifies some motivations for the abstraction of data.	Discusses how an ADT property could be used to model an aspect of a particular problem. Little discrimination is demonstrated when identifying features of the problem.	Explains the role of ADTs for data modelling.	Describes in detail the suitability of appropriate ADTs for creating a model in a given problem context.	Compares and justifies the selection of appropriate ADTs for creating a model and outlines limitations of different representations.
	Uses limited metalanguage when describing ADTs.	Executes a sequence of ADT operations to a given ADT instance.	Reads, writes and uses ADTs.	Writes complete signature specifications for several ADTs, fully in appropriate metalanguage.	Specifies a non-trivial new operation for one of the standard ADTs to meet requirements that cannot be satisfied by the standard definition.
	Limited use of terminology in describing graph properties.	Confirms or rejects the properties of a graph given as a diagram.	Identifies and describes the properties of graphs.	Analyses the interconnections between the properties of graphs using correct terminology.	Analyses the properties satisfied by a given graph and derives another graph property using as evidence the existing specified properties of graphs.
	Identifies an example problem attribute that could be modelled by a graph node or edge.	Discusses some aspects of a problem, including planning problems from a given data model instance.	Applies ADTs to real-world problems. The full range of problem instances can be represented.	Models and fully represents a specific problem instance as a data model using a combination of ADT representations.	Models fully a specific problem instance as a data model with a combination of ADTs, and appropriately justifies the assigned priority of several aspects of the problem to the specific context of the problem.
	Scaffolding is required to create a basic model.	Some aspects of the problem are modelled.	Models basic network and planning problems with graphs.	Models and fully represents planning problems using the graph ADT in combination with other ADTs where appropriate.	Models fully and justifies the priorities used in the representation of the planning problem using graph and other ADTs.

Review of presentation

This presentation covered:

- Unit 3 Outcome 1
- Key knowledge
- Key skills
- The assessment task
- Planning the task.

Contact

- **Phil Feain – Digital Technologies Curriculum Manager (VCAA)**
- **Ph: (03) 9059 5146**
- **Philip.Feain@education.vic.gov.au**

Authorised and published by the
Victorian Curriculum and Assessment Authority