Accreditation Period
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Victorian Certificate of Education

COMPUTING

STUDY DESIGN

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VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

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Contents

Important information 5

Introduction 6
- Scope of study 6
- Rationale 6
- Aims 6
- Structure 7
- Entry 7
- Duration 7
- Changes to the study design 7
- Monitoring for quality 7
- Safety and wellbeing 8
- Use of digital resources 8
- Employability skills 8
- Legislative compliance 8

Assessment and reporting 9
- Satisfactory completion 9
- Levels of achievement 9

Key concepts 10

Glossary 11

Units 1–4: Problem-solving methodology 14

Unit 1: Computing 17
- Area of Study 1 17
- Area of Study 2 19
- Area of Study 3 20
- Assessment 21

Unit 2: Computing 23
- Area of Study 1 23
- Area of Study 2 24
- Area of Study 3 25
- Assessment 27

Unit 3: Informatics 28
- Area of Study 1 28
- Area of Study 2 30
- School-based assessment 32
- External assessment 33

Unit 4: Informatics 34
- Area of Study 1 34
- Area of Study 2 35
- School-based assessment 37
- External assessment 38

Unit 3: Software development **40**
Area of Study 1 40
Area of Study 2 41
School-based assessment 43
External assessment 44

Unit 4: Software development **45**
Area of Study 1 45
Area of Study 2 46
School-based assessment 48
External assessment 49

Important information

Accreditation period

Units 1–4: 1 January 2016 – 31 December 2019

Implementation of this study commences in January 2016.

Sources of information

The *VCAA Bulletin* is the only official source of changes to regulations and accredited studies. The *VCAA Bulletin* also regularly includes advice on VCE studies. It is the responsibility of each VCE teacher to refer to each issue of the *VCAA Bulletin*. The *VCAA Bulletin* is available as an e-newsletter via free subscription on the VCAA's website at: www.vcaa.vic.edu.au.

To assist teachers in developing courses, the VCAA publishes online the *Advice for teachers*, which includes teaching and learning activities for Units 1–4, and advice on assessment tasks and performance level descriptors for School-assessed Coursework in Units 3 and 4.

The current *VCE and VCAL Administrative Handbook* contains essential information on assessment processes and other procedures.

VCE providers

Throughout this study design the term 'school' is intended to include both schools and other VCE providers.

Copyright

Introduction

Scope of study

VCE Computing focuses on the application of a problem-solving methodology, and strategies and techniques for managing information systems in a range of contexts, to create digital solutions that meet specific needs. The study examines the attributes of each component of an information system including people, processes, data and digital systems (hardware, software, networks), and how their interrelationships affect the types and quality of digital solutions.

VCE Computing is underpinned by four key concepts: approaches to problem solving, data and information, digital systems and interactions and impact. Together these form the conceptual framework of the study and the organising elements for its key knowledge.

An important component of the study is the opportunity for students to develop social capital, that is, the shared understanding in social networks that enable cooperation and a cooperative approach to problem solving.

VCE Computing provides students with opportunities to acquire and apply knowledge and skills to use digital systems efficiently and effectively when creating digital solutions both individually and as part of a network. Students investigate legal requirements and ethical responsibilities that individuals and organisations have with respect to the security and integrity of data. Through a structured approach to problem solving, incorporating computational, design and systems thinking, students are equipped to orient themselves towards the future, with an awareness of the technical and societal implications of digital systems.

Rationale

The ubiquity and rapid pace of developments in digital systems, and the increasing availability of digitised data and information are having major influences on many aspects of society and the economy. This study equips students with the knowledge and skills to be discerning users of digital systems, data and information and creators of digital solutions. They are equipped to apply new ways of thinking as well as technical and social protocols when developing intellectual and social capital.

VCE Computing supports students to participate in a globalised society and economy as they learn how to exploit the capabilities of digital systems and manage risks when communicating and collaborating with others locally and globally. The study provides students with practical opportunities to create digital solutions for real-world problems in a range of settings, developing an essential tool set for current and future learning, work and social endeavours.

VCE Computing provides a pathway to further studies in areas such as computer science, information systems, business, systems engineering, robotics, linguistics, logistics, database management and software development, and to careers in digital-technologies based areas such as information architecture, web design, business analysis and project management.

Aims

This study enables students to:

- apply skills, techniques, processes and a methodology to create digital solutions that meet a range of needs and conditions
- understand how data can be represented in digital systems and structured and manipulated to become part of a digital solution

- become independent and discerning users of digital systems, able to critically appraise the opportunities and appropriateness of different digital systems in a range of settings
- understand the components of information systems and the architecture of the associated digital systems
- understand how digital systems, processes, legislation and personal behaviours can affect the integrity and security of data and information
- apply computational, design and systems thinking skills when creating digital solutions.

Structure

The study is made up of six units:

Unit 1: Computing

Unit 2: Computing

Unit 3: Informatics

Unit 4: Informatics

Unit 3: Software development

Unit 4: Software development

Note: students may elect to undertake one or both of these Units 3 and 4 sequences.

Each unit deals with specific content contained in areas of study and is designed to enable students to achieve a set of outcomes for that unit. Each outcome is described in terms of key knowledge and key skills.

A glossary defining terms used across Units 1 to 4 in the VCE Computing Study Design is included on pages 11–13.

Entry

There are no prerequisites for entry to Units 1, 2 and 3. However, it is assumed that students enrolling in VCE Informatics have sound design thinking skills and students enrolling in VCE Software development have sound computational thinking skills. Students must undertake Unit 3 prior to undertaking Unit 4. Units 1 to 4 are designed to a standard equivalent to the final two years of secondary education. All VCE studies are benchmarked against comparable national and international curriculum.

Duration

Each unit involves at least 50 hours of scheduled classroom instruction over the duration of a semester.

Changes to the study design

During its period of accreditation minor changes to the study will be announced in the *VCAA Bulletin*. The *VCAA Bulletin* is the only source of changes to regulations and accredited studies. It is the responsibility of each VCE teacher to monitor changes and advice about VCE studies published in the *VCAA Bulletin*.

Monitoring for quality

As part of ongoing monitoring and quality assurance, the VCAA will periodically undertake an audit of VCE Computing to ensure the study is being taught and assessed as accredited. The details of the audit procedures and requirements are published annually in the *VCE and VCAL Administrative Handbook*. Schools will be notified if they are required to submit material to be audited.

Safety and wellbeing

It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study. For this study this includes an ergonomically sound work environment.

Use of digital resources

Depending on the unit students need access to the following resources to be able to demonstrate the outcomes:

- appropriate computers, tablets and handheld computing devices
- printers
- internet
- web
- a range of software tools including:
  - database management software to format, store, edit and retrieve data
  - spreadsheet or statistical software to format, store, edit and retrieve data
  - software to edit, retrieve, insert, delete data such as text, sound, static and moving images to create multimodal information
  - drawing and graphics software, data visualisation software, visualising thinking software to create graphical output
  - tools to create programs that provide programming and/or scripting environments including editing, compiling, executing, debugging/testing
- other input and output devices; for example, scanner, stylus, digital camera, gaming console, smart phone.

Employability skills

This study offers a number of opportunities for students to develop employability skills. The *Advice for teachers* provides examples of how students can develop employability skills during learning activities and assessment tasks.

Legislative compliance

When collecting and using information, the provisions of privacy and copyright legislation such as the Victorian *Privacy and Data Protection Act 2014* and *Health Records Act 2001*, and the federal *Privacy Act 1988* including the *Privacy Amendment (Enhancing Privacy Protection) Act 2012* and *Copyright Act 1968*, must be met.

Assessment and reporting

Satisfactory completion

The award of satisfactory completion for a unit is based on the teacher's decision that the student has demonstrated achievement of the set of outcomes specified for the unit. Demonstration of achievement of outcomes and satisfactory completion of a unit are determined by evidence gained through the assessment of a range of learning activities and tasks.

Teachers must develop courses that provide appropriate opportunities for students to demonstrate satisfactory achievement of outcomes.

The decision about satisfactory completion of a unit is distinct from the assessment of levels of achievement. Schools will report a student's result for each unit to the VCAA as S (Satisfactory) or N (Not Satisfactory).

Levels of achievement

Units 1 and 2

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the VCAA. Schools may choose to report levels of achievement using grades, descriptive statements or other indicators.

Units 3 and 4

The VCAA specifies the assessment procedures for students undertaking scored assessment in Units 3 and 4. Designated assessment tasks are provided in the details for each unit in the VCE study designs.

The student's level of achievement in Units 3 and 4 will be determined by School-assessed Coursework (SACs) and/or School-assessed Tasks (SATs) as specified in the VCE study designs, and external assessment.

The VCAA will report the student's level of achievement on each assessment component as a grade from A+ to E or UG (ungraded). To receive a study score the student must achieve two or more graded assessments and receive S for both Units 3 and 4. The study score is reported on a scale of 0–50; it is a measure of how well the student performed in relation to all others who took the study. Teachers should refer to the current *VCE and VCAL Administrative Handbook* for details on graded assessment and calculation of the study score. Percentage contributions to the study score in VCE Computing are as follows:

- Unit 3 School-assessed Coursework: 10 per cent
- Unit 4 School-assessed Coursework: 10 per cent
- School-assessed Task: 30 per cent
- End-of-year examination: 50 per cent.

Details of the assessment program are described in the sections on Units 3 and 4 in this study design.

Authentication

Work related to the outcomes of each unit will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student's own. Teachers need to refer to the current *VCE and VCAL Administrative Handbook* for authentication procedures.

Key concepts

Four key concepts underpin VCE Computing: data and information, digital systems, approaches to problem solving, and interactions and impacts. These concepts are themes used as a way to understand and organise Computing content. They provide a conceptual framework for teaching and learning programs and establish a way of thinking about problems, opportunities and digital systems. They also assist students in recognising these concepts after they have encountered several examples in action.

The four key concepts are broadly defined as:

Approaches to problem solving focuses on ways of creating solutions and thinking about problems, opportunities and needs. A detailed approach to problem solving is explained in the stages and activities of the problem-solving methodology on pages 14 and 16. Overall approaches to problem solving involve computational, design and systems thinking (see glossary on pages 11–13).

Data and information focuses on the nature of data and how data and information can be acquired, structured, represented and interpreted to extract meaning. This process of preparing data and information appropriately is the precursor to creating solutions that meet intended needs.

Digital systems focuses on the functions and technical underpinnings of hardware and software components as well as networks (wireless, wired and mobile) and the internet, including protocols and styles of modern application architecture such as rich client, mobile and internet. This concept also addresses ways in which hardware and software are used to manage and control access to data and its transfer between digital systems. Digital systems form one of the components of an information system along with people, data and processes.

Interactions and impact focuses on the relationships within and between information systems and the effects of these in achieving economic and social goals. Relationships are considered from three perspectives: how people interact with other people when using digital systems for communication and collaboration; how people interact with, or respond to, different types of digital systems; and how information systems interact with other information systems. This concept also considers the impact of these relationships on meeting current and future needs of individuals, organisations and society, including the ownership and privacy of data and information, and personal safety.

Within an area of study, the key knowledge is organised under the headings of relevant concepts; however, not all concepts may be addressed in any one area of study.

Glossary

For the purposes of this study design and associated assessment the following definitions will apply.

Term	Definition
Application architecture	Application architecture is the process of identifying the components, and their interrelationships, of a structured (software) solution that meets all of the technical and operational requirements, while optimising common quality attributes such as performance, security and manageability. There are styles of application architecture such as client-server, peer-to-peer, rich client and service oriented.
Computational thinking	Computational thinking is a process of recognising aspects of computation in the world and being able to think logically, algorithmically, recursively and abstractly. It is about systematic problem solving in light of the capabilities of digital systems. It typically involves thinking abstractly, defining problems through decomposition, documenting steps and decisions through algorithms, transforming algorithms through the use of programming languages and software that supports automation, and evaluating the resulting digital solutions.
Data types	Data types are the particular forms that an item of data can take including numeric, character and Boolean, and are characterised by the kind of operations that can be performed on it. Depending on the software being used, these fundamental types can be divided into more specific types, for example integer and floating point are numeric types. More sophisticated types can be derived from them, for example a string of characters or a date type and their names may vary, such as text data type versus string data type.
Design brief	A design brief is a statement that contains an outline of a situation, context, problem, need or an opportunity, and constraints or conditions under which a solution must be developed. It is sometimes important to create a solution that not only meets the current needs but has the capacity to meet future or changing needs. It provides a basis from which students can apply some or all of the stages of the problem-solving methodology when creating digital solutions.
Design principles	Design principles are accepted characteristics that contribute to the functionality and appearance of solutions. In this study the principles related to functionality are useability, including robustness, flexibility and ease of use, and accessibility, including navigation and error tolerance. Design principles related to appearance are alignment, repetition, contrast, space and balance.
Design thinking	Design thinking is a way of thinking critically and creatively to generate innovative ideas, evaluate them and precisely define the preferred solution so it can be created using a digital system. It involves a strong understanding of the needs of users and of ways of creating solutions that are more efficient or effective than existing ones. When designing, students use both convergent and divergent thinking skills: divergent thinking supports creativity and the generation of a range of ideas, and convergent thinking supports the selection of a preferred solution and the preparation of accurate and logical plans and instructions to digitally create the solution.

Term	Definition
Efficiency	Efficiency is a measure of how much time, cost and effort is applied to achieve intended results. Measures of efficiency in a solution could include the speed of processing, its functionality and the cost of file manipulation. Measures of efficiency in a network include its productivity, processing time, operational costs and level of automation.
Effectiveness	Effectiveness is a measure of how well a solution, an information management strategy or a network work and whether each achieves its intended results. Measures of effectiveness in a solution include completeness, readability, attractiveness, clarity, accuracy, accessibility, timeliness, communication of message, relevance and useability. Measures of effectiveness of an information management strategy include integrity of data, security, ease of retrieval and currency of files. Measures of effective networks include reliability and maintainability.
Information architecture	Information architecture is the ways in which content (information and objects) is grouped, labelled and located in online solutions. This includes the structuring or grouping of sets of information and determining navigation pathways. Effective and efficient information architecture enables users to intuitively and confidently locate information they require. Key principles that govern information architecture include disclosure, classifications, navigation, growth, choices.
Information system	An information system is the combination of digital hardware and software components (digital systems), data, processes and people that interact to create, control and communicate ideas and digital solutions.
Legal requirements	There are legal requirements with which individuals and organisations are expected to comply, with respect to the ownership and privacy of information, and freedom of expression. For the purposes of this study the key provisions of the following acts are relevant: *Privacy Act 1988*, including *Privacy Amendment (Enhancing Privacy Protect) Act 2012*, *Privacy and Data Protection Act 2014*, *Health Records Act 2001*, *Copyright Act 1968*, *Charter of Human Rights and Responsibilities Act 2006* (VIC) (sections 13, 14 and 15), and the *Spam Act 2003* (Part 1.3, Simplified outline).
Normalisation	Normalisation is the process of ensuring that a database conforms to a set of normal forms. Its primary purpose is to remove redundancies that create threats to data integrity such as update anomalies. It also plays a role in making querying more efficient. The first three normal forms should be realised: First normal form (1NF): Where a table has no repeating groups, that is, no single row has a column containing more than one value or more than one column with the same kind of value, for example telephone1 and telephone2. Second normal form (2NF): Where a table is in 1NF and any column that is not part of the primary key is dependent on the whole primary key. Third normal form (3NF): Where a table is in 2NF and any column that is not part of the primary key is dependent only on the primary key and no other column. A table's primary key is the smallest set of columns needed to uniquely identify a row in the table.
Physical security controls	Physical security controls are the equipment and procedures used to assist in the protection of information systems and the files created, communicated and stored by individuals and organisations. Equipment controls include zoned security strategies, barrier techniques and biometrics. Physical procedures include backing up, shredding confidential documents and checking authorisation credentials. Also see Software security controls.

Term	Definition
Security threats	Security threats are the actions, devices and events that threaten the integrity and security of data and information stored within, and communicated between, information systems. The threats can be accidental, such as losing a portable storage device containing files; deliberate, such as malware, phishing; and events-based such as a power surge.
Software requirements specification	Software requirements specification is a comprehensive description of the intended purpose and environment for purpose-designed software solutions. It documents the key activities associated with the analysing stage of the problem-solving methodology. Software requirements specifications (SRS) fulfil the purposes of breaking down a problem into component parts, providing input to the design stage and serving as a reference point for further stages of the problem-solving methodology.
Software security controls	Software security controls are the software and procedures used to assist in the protection of information systems and the files created, communicated and stored by individuals and organisations. These include user names and passwords, access logs and audit trails, access restrictions, encryption, firewalls and system protection, and security protocols such as Transport Layer Security (TLS) and Secure Sockets Layer (SSL).
Solution (digital)	A digital solution is the method of creating required digital output through the application of digital systems and processes that transforms data and information. Depending on the chosen context, the output of a solution may take forms such as an information product like a website, instructions to control a game, an abstract piece of art or a soundscape. Solutions can be interactive or non-interactive, online (internet connected) or not, multimodal or not. An example of an interactive online solution is a website where users can input variable data. An example of a non-interactive, non-internet connected solution is an infographic stored on a hard drive. An example of a multimodal solution is a website that combines multiple types of data, for example text, sound and images to communicate an idea and information.
Systems thinking	Systems thinking is a way of thinking that takes a holistic approach to identifying and solving problems. It involves analysing the interactions and interrelationships between individual information system components (data, processes, people and digital systems), to identify how they influence the functioning of the entire system. Systems thinking also involves understanding the interdependence between information systems and how a change or output from one system can affect another, and how this affects larger systems such as the economy and society.
Types of data	Types of data are general categories of data including text, number, sound and image (still and moving).
User experience	User experience are those aspects that affect how an end-user interacts with digital systems such as visual, interface and navigation design, user needs, functional and content requirements, and ergonomics.
User flow diagrams	User flow diagrams are diagrammatic representations of the path a user travels through when using an online interactive solution to complete a task or transaction, such as making a reservation or purchasing a product. It is a diagram showing a user's journey to complete a task. User flow diagrams incorporate user interfaces and show the multiple entry points to interactive online solutions, for example, paid advertisements, social media and search engines may direct a user to a location in the solution other than the home page.

Units 1–4: Problem-solving methodology

Integral to the VCE Computing Study Design is a methodology for systematically creating solutions to problems, needs and opportunities. As applied in this study design the methodology comprises four stages: analysis, design, development and evaluation. For each of these stages there is a typical set of activities, as shown in Figure 1. Specific details of the scope of the problem-solving methodology are provided in the introduction to relevant areas of study. Note: when creating solutions, this methodology can be applied as a single stage-by-stage problem-solving process or to each iteration of an agile problem-solving process.

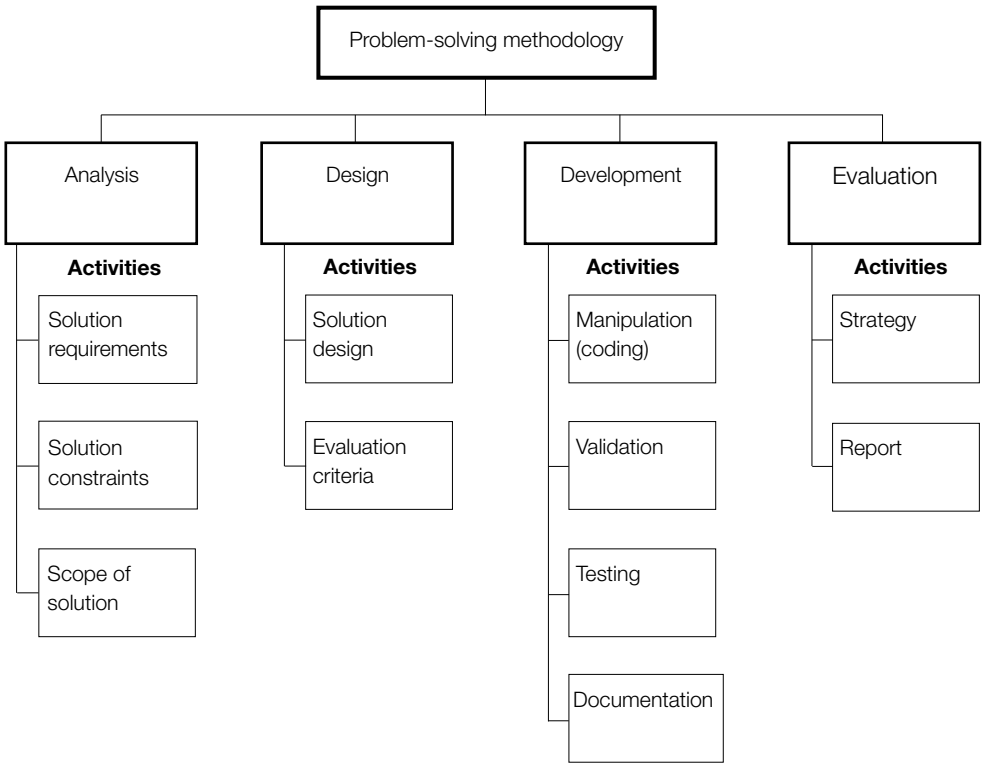

Figure 1: A problem-solving methodology for creating digital solutions

Analysis typically answers the 'what questions' – what is needed to solve a problem, given particular circumstances? It involves:

- Determining the solution requirements. What output is the solution to provide? What data is needed to produce the output? What functions must the solution provide? These requirements can be classified as being functional, that is, what the solution is required to do, and non-functional, which describes the attributes the solution should possess including useability, reliability, portability, robustness, maintainability. Tools to assist in determining the solution requirements include context diagrams, data flow diagrams and use cases.
- Identifying the constraints on the solution. What conditions need to be considered when designing a solution? Typical constraints include economic, such as cost and time; technical, such as speed of processing, capacity, availability of equipment, compatibility and security; social, such as level of expertise of users; legal, such as ownership and privacy of data requirements; and useability, such as usefulness and ease of use of solutions.
- Determining the scope of the solution. The scope states the boundaries or parameters of the solution. It identifies the area of interest or what aspects of the problem will and will not be addressed by the solution.

Design typically answers the 'how questions' – how will the solution requirements be achieved? It involves:

- Planning how the solution will function and its appearance. The solution design typically involves identifying what specific data is required and how the data will be named, structured, validated and manipulated. Typical design tools for this purpose include data dictionaries and data structure diagrams, input-process-output (IPO) charts, flowcharts, pseudocode, object descriptions. Solution design also involves, where appropriate, showing how the various components of a solution relate to one another, for example web pages, style sheets, scripts; queries, forms, reports; modules, procedures, methods, functions. Typical design tools used to show relationships include storyboards, site maps, entity-relationship diagrams, data flow diagrams, structure charts, hierarchy charts, and context diagrams.

  Planning the solution also involves determining its appearance, including, where appropriate, the user interface. This typically involves identifying the position and size of text, images and graphics, font types, colours and text enhancements. Design tools used for this purpose include layout diagrams, annotated diagrams/mock ups.
- Determining the evaluation criteria. What measures will be used to judge whether or not the solution meets the requirements? These criteria should arise from the solution requirements identified in the analysis stage.

Development typically asks the questions of how do we realise or transform solution instructions into a working solution through the use of digital systems. It involves:

- Electronically 'building' or creating the solution following initial designs. It may, however, warrant modifying initial designs in order to create a working solution.
- Validation to check for the reasonableness of data being input. Validation can be both manual and electronic. Proofreading is a manual technique and it occurs when a human scans the data for errors. Electronic validation occurs when the validation process is built into the solution. Its effectiveness is determined through the testing activity.
- Testing whether the solution does what it was intended to do. This activity typically involves:
  - establishing what tests will be conducted
  - determining what test data will be used
  - determining expected results
  - conducting the test
  - recording the actual results
  - correcting any identified errors.
- Writing internal and user documentation, including within the user interface, to support the functioning and use of the solution.

Evaluation typically answers the question: 'How well did the solution meet its stated requirements'? It involves:

- Determining a strategy for finding out the extent to which the solution meets the required needs of the user. Typically this occurs after the solution has been developed. Usually an evaluation strategy would include specifying a timeline, outlining what data will be collected and by what methods and techniques, and how the data relates to the criteria that were generated in the design stage.
- Reporting on the extent to which the solution meets the requirements of the user. This usually takes place after the solution has been used by the user/client and is based on the criteria generated in the design stage.

Unit 1: Computing

In this unit students focus on how data, information and networked digital systems can be used to meet a range of users' current and future needs. In Area of Study 1 students collect primary data when investigating an issue, practice or event and create a digital solution that graphically presents the findings of the investigation. In Area of Study 2 students examine the technical underpinnings of wireless and mobile networks, and security controls to protect stored and transmitted data, to design a network solution that meets an identified need or opportunity. They predict the impact on users if the network solution were implemented. In Area of Study 3 students acquire and apply their knowledge of information architecture and user interfaces, together with web authoring skills, when creating a website to present different viewpoints on a contemporary issue.

When creating solutions students need to apply relevant stages of the problem-solving methodology as well as computational, design and systems thinking skills.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	Any software tool to create a graphic solution
Area of Study 3	Web authoring software, visualising thinking tool/s, tool for planning a project

The following table indicates the software tool that students are required to use, but not required to study, in this unit.

Area of Study 2	A graphic tool to represent a network solution

Area of Study 1

Data and graphic solutions

In this area of study students conduct an investigation into an issue, practice or event and through the systematic collection, interpretation and manipulation of primary data they create a graphic solution, such as an infographic, that represents their findings. Examples of investigations include the social networking habits of people of different age groups, the heritage of a class of students to three generations and music preferences by genre and favourite artists within each. Graphic solutions could include charts, flowcharts, diagrams, images, hierarchies, animations, maps and timelines.

Students develop and apply a detailed understanding of data, including its types, characteristics, sources and methods of acquisition. Relevant primary data is collected and then evaluated to determine its suitability for manipulation. When acquiring this data, students consider risks associated with using data owned by other people or organisations, and apply strategies and techniques for acknowledging legal requirements and ethical responsibilities.

Students apply computational thinking skills when extracting meaning from data and apply design thinking knowledge and skills to create graphic information for the purpose of informing, educating or persuading an audience. No restrictions are placed on the software tool used to create these solutions.

Outcome 1

On completion of this unit the student should be able to acquire, secure and interpret data, and design and develop a graphic solution that communicates the findings of an investigation.

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

Key knowledge

Data and information

- types and purposes of qualitative and quantitative data
- sources of, and methods and techniques for, acquiring and referencing primary data and information
- factors affecting the quality of data and information such as relevance, accuracy, bias and reliability
- techniques for authorising the collection and use of data and information such as using consent forms
- techniques for protecting the privacy of the providers of data and information such as de-identifying personal data

Digital systems

- physical and software controls used to protect the security of stored data such as backing up, usernames and passwords, systems protection software and encryption

Interactions and impact

- Australian Privacy Principles relating to the acquisition, management and communication of data and information, including non-identification of individuals (principle 2), information only being held for its primary purpose (principle 6)
- ethical dilemmas arising from data acquisition strategies

Approaches to problem solving

- types of graphic solutions suitable for educating, persuading and informing audiences
- design tools for representing the functionality and appearance of graphic solutions such as input-process-output charts (functionality) and annotated diagrams/mock ups (appearance)
- formats and conventions suitable for graphic solutions such as titles, text styles, shapes, lines and arrows, sources of data and legend, colours and contrasts
- software functions and techniques for efficiently and effectively manipulating data to develop graphic solutions, and for validating data
- techniques for testing graphic solutions.

Key skills

- frame an investigation inquiry
- identify, legally and ethically acquire, and reference data and information from primary sources
- devise and implement controls and techniques to minimise risks to the security and privacy of data and information
- interpret selected data, identifying relationships and patterns
- select and apply appropriate design tools to represent the functionality and appearance of graphic solutions for particular purposes
- use software, and select and apply functions, formats, conventions, data validation and testing techniques to efficiently manipulate data and create graphic solutions.

Area of Study 2

Networks

In this area of study students investigate how networks with wireless capability allow data and information to be exchanged locally and within the global environment. Students examine the hardware and software components and procedures required to connect and maintain a wireless network. They focus on ways in which the security of exchanged and stored data and information can be compromised in wireless networks, in order to understand ways of controlling the networked devices they use. Students apply this technical knowledge to create the design for a network with wireless capability that meets a need or opportunity, identifying its components and how data and information are transmitted. Students use a software tool to depict the components of their network and its interactions.

When designing network solutions, students apply systems thinking by considering how users will interact with the network and the potential effects of the network on users and their data and information.

Outcome 2

On completion of this unit the student should be able to design a network with wireless capability that meets an identified need or opportunity, explain its configuration and predict risks and benefits for intended users.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Digital systems

- applications and capabilities of Local Area Networks (LANs) and Wide Area Networks (WANs)
- functions and characteristics of key hardware and software components of networks required for communicating and storing data and information
- purposes of network protocols
- strengths and limitations of wireless communications technology, measured in terms of data transfer rate, data storage options, cost, security and reliability
- types, capabilities and limitations of mobile devices connected to networks
- security threats to data and information communicated and stored within networks
- technical underpinnings of malware that intentionally threaten the security of networks

Interactions and impact

- ways in which people, processes, digital systems and data combine to form networked information systems
- legal requirements and ethical responsibilities of network professionals and users of networks with respect to social protocols and the ownership of data and information
- risks and benefits of using networks in a global environment.

Key skills

- describe the capabilities of different networks and wireless communications technology
- compare the capabilities of a range of network components to support the communication and storage of data and information
- apply design thinking skills when configuring a network solution with wireless capability, taking into account how data and information are transmitted and secured
- apply systems thinking skills to predict risks and benefits of the implementation of a new or modified network solution with wireless capability for the users.

Area of Study 3

Collaboration and communication

In this area of study students examine how the use of particular information systems within specified contexts can cause tensions and conflicts between different stakeholders. Students develop the ability to critically appraise how information systems are used and how individuals can be empowered to shape their use.

Working in virtual (local, national, international) or face-to-face teams, students use web authoring software to create a website, designed for viewing on a mobile device, which presents an overview of an issue associated with one field. When designing their website students apply their knowledge of information architecture such as structuring sets of information to facilitate navigation and allowing users choices about levels of detail. They evaluate the merits of storing their website and its content in the cloud or on a private server.

Project plans are prepared to support an organised approach to problem solving. Students use software to record tasks to be completed and team member responsibilities and schedules. Students record and monitor progress of the website development. Students do not have to use dedicated project management software.

On their website students present the viewpoints of different stakeholders, drawing on evidence acquired from primary and/or secondary sources. They publish the team's opinions about the issue and propose actions that can be taken to shape how information systems are used, for example, using social media to encourage actions or inviting comments in a forum. Students use visualising thinking tools to analyse content, online collaborative tools to support sharing of ideas, and techniques to assist in forming team opinions. They use other appropriate software to manipulate acquired data such as image, numeric, text and sound editing tools, and web authoring tools to communicate viewpoints.

Outcome 3

On completion of this unit the student should be able to design and develop a website collaboratively with others that presents an analysis of a contemporary issue and the team's point of view on the issue.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.

Key knowledge

Interactions and impact

- applications of information systems in a range of settings
- a detailed study in a particular field such as entertainment, agriculture, finance, sport, health, that focuses on:
  - the nature of a contemporary issue associated with the use of information systems
  - legal, social, environmental or ethical reasons for a contentious issue
  - types and capabilities of digital systems associated with the field and issue
  - key stakeholders such as individuals, organisations and governments, and their responsibilities
  - positive and negative opinions of each stakeholder about the issue
- ways in which end-users can express opinions on websites about how information systems are used for particular purposes such as writing a review in a text box and a rating system

Data and information

- sources of, and methods and techniques for, acquiring and referencing primary data and secondary data and information
- factors affecting the integrity of data, such as correctness, reasonableness and accuracy

Digital systems

- advantages and disadvantages of using cloud solutions, and using cloud computing for storing, communicating and disposing of data and information
- impact of growth of mobile devices on website design

Approaches to problem solving

- visualising thinking tools and techniques for supporting reasoning and decision making when analysing issues and ethical dilemmas
- key principles of information architecture
- characteristics of effective user interfaces for mobile devices, for example useability, accessibility, tolerance, visibility, legibility, consistency, affordance
- design principles that influence the appearance of websites
- design tools and techniques for representing websites
- formats and conventions suitable for websites
- software functions and techniques for manipulating and validating data, and testing websites
- tools and techniques for coordinating the tasks, people, digital systems resources and time required to create solutions.

Key skills

- select and apply appropriate methods and techniques to acquire and reference data and information
- use digital systems to document and monitor project plans when creating team solutions
- analyse the causes and effects of issues using visualising thinking tools
- synthesise viewpoints to formulate a team's point of view
- evaluate cloud computing as a data storage solution
- select and use digital system components appropriate to a team's needs
- select appropriate design tools and represent the appearance and functionality of solutions, taking into account user interactions
- recommend online techniques for encouraging end-users' support of published viewpoints
- use web authoring software and select and apply functions and techniques to manipulate data and create solutions.

Assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks that provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study, including the key knowledge and key skills listed for the outcomes, should be used for course design and the development of learning activities and assessment tasks. Assessment must be a part of the regular teaching and learning program and should be completed mainly in class and within a limited timeframe.

All assessments at Units 1 and 2 are school-based. Procedures for assessment of levels of achievement in Units 1 and 2 are a matter for school decision.

For this unit students are required to demonstrate three outcomes. As a set these outcomes encompass the areas of study in the unit.

Suitable tasks for assessment in this unit may be selected from the following:

- using digital systems and techniques, create a solution in response to a need
- visual presentations
- oral presentations
- written reports.

Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand.

Unit 2: Computing

In this unit students focus on data and how the application of computational, design and systems thinking skills support the creation of solutions that automate the processing of data. In Area of Study 1 students develop their computational thinking skills when using a programming or scripting language to create solutions. They engage in the design and development stages of the problem-solving methodology. In Area of Study 2 students develop a sound understanding of data and how a range of software tools can be used to extract data from large repositories and manipulate it to create visualisations that are clear, usable and attractive, and reduce the complexity of data. In Area of Study 3 students apply all stages of the problem-solving methodology to create a solution using database management software and explain how they are personally affected by their interactions with a database system.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	A programming or scripting language that can support object-oriented programming
Area of Study 2	One data manipulation tool and one visualisation tool, for example a programming language, database software, spreadsheet software, data visualisation software
Area of Study 3	Database management software

Area of Study 1

Programming

In this area of study students focus on using a programming or scripting language that can support object-oriented programming to create working software modules. These languages provide users with greater flexibility than application software, as specific sets of instructions can be implemented to create solutions that are purpose-designed. Flexibility exists regarding the specific language studied. Depending on its nature the language could also be used in Area of Study 2.

Students develop skills in interpreting teacher-provided solution requirements and in designing working modules. They apply methods and techniques for completing a series of small discrete tasks or working modules that use features of a programming or scripting language, including predefined classes. They apply knowledge and skills associated with the design and development stages of the problem-solving methodology. Details of this methodology are on pages 14–16. Students also apply computational and design thinking skills when preparing design specifications and transforming them into working modules through the use of programming or scripting languages.

Outcome 1

On completion of this unit the student should be able to design working modules in response to solution requirements, and use a programming or scripting language to develop the modules.

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

Key knowledge

Data and information

- characteristics of data types and methods of representing and storing text, sound and images

Digital systems

- functions and capabilities of key hardware and software components of digital systems required for processing, storing and communicating data and information

Approaches to problem solving

- functional requirements of solutions
- methods for creating algorithms such as identifying the required output, the input needed to produce the output, and the processing steps necessary to achieve the transformation from a design to a solution
- suitable methods of representing solution designs such as data dictionaries, data structure diagrams, object descriptions and pseudocode
- characteristics of effective user interfaces, for example useability, accessibility, structure, visibility, legibility, consistency, tolerance, affordance
- techniques for manipulating data and information
- naming conventions for files and objects
- testing and debugging techniques, including construction of test data.

Key skills

- interpret solution requirements
- select and use appropriate methods for expressing solution designs, including user interfaces
- apply techniques for manipulating data and information using a programming or scripting language
- devise meaningful naming conventions for files and objects
- apply testing techniques using appropriate test data.

Area of Study 2

Data analysis and visualisation

In this area of study students learn to use software tools to access, select and, where appropriate, manipulate authentic data from large data repositories, and to present the key aspects of the data in an appropriate visual form. Once the data has been isolated and checked for its integrity, students create data visualisations that assist in reducing the complexity of data by using designs that illustrate patterns, connections and structure. These visualisations should minimise the effort required by readers to interpret complex data and they need to be clear, usable and relevant. Some data visualisation tools allow presentations to be dynamic and/or interactive. Appropriate visualisation forms include graphs, charts, spatial relationships, maps, histograms and network diagrams (nodes and edges).

Sources of large data repositories include the Bureau of Meteorology, World Development Indicators, Australian Bureau of Statistics, United Nations, CSIRO, OECD. Appropriate tools to extract or structure data and create visualisations include a programming language, database software, spreadsheet software and data visualisation software. It is important that students engage in a two-step approach when creating visualisations: acquiring and preparing data (step one) and manipulating data into a visual form (step two). In response to teacher-provided design briefs, students apply all stages of the problem-solving methodology.

Outcome 2

On completion of this unit the student should be able to apply the problem-solving methodology and use appropriate software tools to extract relevant data and create a data visualisation that meets a specified user's needs.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Data and information

- sources of authentic data in large repositories
- factors influencing the integrity of data, for example accuracy, timeliness, authenticity, relevance
- characteristics of data types and data structures relevant to selected software tools

Approaches to problem solving

- types and purposes of data visualisations
- problem-solving activities related to analysing needs: functional and non-functional requirements and constraints
- characteristics of file formats and their suitability to be converted to other formats
- design tools for representing data visualisations
- formats and conventions applied to visualisations to improve their effectiveness for intended users
- functions of appropriate software tools to extract targeted data and to manipulate data when developing visualisations
- criteria and techniques for evaluating visualisations.

Key skills

- analyse needs to define specific requirements
- identify and extract, using software functions, relevant data from appropriate data sources
- prepare data structures relevant to the software tools
- interpret selected data, identifying relationships and patterns
- select and apply appropriate tools to represent the design of selected visualisations
- use appropriate software and select and apply functions, formats and conventions to manipulate the extracted data to create data visualisations
- select appropriate techniques and apply criteria to determine the extent to which data visualisations meet users' needs.

Area of Study 3

Data management

In this area of study students are introduced to the structure of databases and their applicability in a range of settings. Databases underpin many applications such as borrowing and booking systems, medical records and social media websites. Students develop an understanding of the purposes of databases by exploring the data and information they supply to and receive from systems such as banking, membership, online purchasing and voting systems. They apply systems thinking skills when considering the effects of their interactions with information systems that use databases.

Students develop and apply knowledge and skills in determining data types required to solve specific problems, and in organising and storing data. They examine the flexibility of databases by constructing query searches and sorts, and apply design principles that contribute to effective and efficient data collections tools, input forms and reports. Where appropriate, students apply mathematical calculations to the data and may create macros to automate

repetitive tasks. Students devise a need or opportunity for a solution and collect relevant data for manipulation by database management software. This facilitates a deeper understanding of the benefits and risks associated with using database solutions. Students apply all stages of the problem-solving methodology.

Outcome 3

On completion of this unit the student should be able to apply the problem-solving methodology to create a solution using database management software, and explain the personal benefits and risks of interacting with a database.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.

Key knowledge

Data and information

- data sources and methods of data acquisition
- characteristics of effective data collection tools and user interfaces for the purposes of entering data efficiently
- characteristics of data types

Digital systems

- capabilities and limitations of database management software to manipulate data
- roles, functions and characteristics of hardware components used to input, store, communicate and output data and information
- accidental and deliberate security threats to data and information stored within databases
- physical and software controls suitable for protecting the security of stored and transmitted data

Approaches to problem solving

- the structure of a database, including fields, records and tables
- design tools for representing input forms to capture data and reports to meet specific needs
- design tools for representing the structure of databases
- techniques for manipulating and validating data
- formats and conventions applied to create effective solutions

Interactions and impact

- applications of database systems in a range of settings
- personal benefits and risks arising from the use of databases.

Key skills

- analyse needs or opportunities for database management solutions
- use appropriate techniques to describe data types and database structures
- identify and collect data from appropriate sources, using data collection tools that facilitate efficient data entry
- apply suitable functions to validate and manipulate data efficiently
- construct queries to locate data that matches specific criteria
- apply formats and conventions to create effective forms and reports
- evaluate the value of using a database system in fulfilling a personal need.

Assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks that provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study, including the key knowledge and key skills listed for the outcomes, should be used for course design and the development of learning activities and assessment tasks. Assessment must be a part of the regular teaching and learning program and should be completed mainly in class and within a limited timeframe.

All assessments at Units 1 and 2 are school-based. Procedures for assessment of levels of achievement in Units 1 and 2 are a matter for school decision.

For this unit students are required to demonstrate three outcomes. As a set these outcomes encompass the areas of study in the unit.

Suitable tasks for assessment in this unit may be selected from the following:

- using digital systems and techniques, create a solution in response to a need or opportunity
- visual presentations
- oral presentations
- written reports.

Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand.

Unit 3: Informatics

In Informatics Units 3 and 4 students focus on data, information and information systems. In Unit 3 students consider data and how it is acquired, managed, manipulated and interpreted to meet a range of needs. In Area of Study 1 students investigate the way organisations acquire data using interactive online solutions, such as websites and applications (apps), and consider how users interact with these solutions when conducting online transactions. They examine how relational database management systems (RDBMS) store and manipulate data typically acquired this way. Students use software to create user flow diagrams that depict how users interact with online solutions, and acquire and apply knowledge and skills in the use of an RDBMS to create a solution.

Students develop an understanding of the power and risks of using complex data as a basis for decision making. In Area of Study 2 students complete the first part of a project. They frame a hypothesis and then select, acquire and organise data from multiple data sets to confirm or refute this hypothesis. This data is manipulated using tools such as spreadsheets or databases to help analyse and interpret it so that students can form a conclusion regarding their hypothesis. Students take an organised approach to problem solving by preparing project plans and monitoring the progress of the project. The second part of the project is completed in Unit 4.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	A relational database management system (RDBMS) Drawing or graphics software

A list of minimum software capabilities or equivalents suitable for drawing and graphics software and a relational database management system will be published annually by the VCAA in the *VCAA Bulletin*.

The following table indicates the software tools that students are required to use, but not required to study, in this unit.

Area of Study 2	Appropriate tool for documenting project plans Software tools to capture, store, prepare and manipulate data

Area of Study 1

Organisations and data management

In this area of study students investigate why organisations acquire data online for transaction processing and how they structure their data-gathering processes to support these transactions. Students also develop and apply skills in using a relational database management system (RDBMS) to manipulate data typically sourced through interactive online solutions, such as websites and applications (apps). Students examine how value can be added to this data through the careful structuring of data and the application of functions, such as queries, searches and reports, that identify patterns and relationships between data sets.

Students investigate interactive online solutions to ascertain the types of data being acquired, how it is obtained and protected and how transactions are completed. They design a user flow diagram that traces different ways in which users interact with online solutions when initiating and completing transactions, acknowledging that there can be multiple entry points and multiple interactions. Students diagrammatically represent the user interface of the page on which the user commences an online transaction.

Students examine how organisations fulfil their legal requirements to protect the rights of those who provide data and why organisations want the data organised in particular ways. Students consider the fundamentals of an RDBMS; that is, fields and data types, data structures and the relationships between data sets. Students learn to describe data types and data structures, and apply functions, techniques, formats and conventions to store, validate and manipulate data, and to present suitable solutions.

When tracing user interactions and developing a solution, students respond to two teacher-provided design briefs: one relates to how users interact with an online solution when conducting a transaction; the other provides details of why an RDBMS solution is needed, and includes data. The contexts of the briefs can be the same or different.

In this area of study there is an emphasis on the design and development stages of the problem-solving methodology. Details of the methodology are located on pages 14–16. Students also apply design and systems thinking skills when problem solving.

Outcome 1

On completion of this unit the student should be able to design a solution, develop it using a relational database management system, and diagrammatically represent how users interact with an online solution when supplying data for a transaction.

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

Key knowledge

Data and information

- techniques used by organisations to acquire data through their interactive online solutions and reasons for their choice
- techniques for efficient and effective data collection
- characteristics of data types

Digital systems

- physical and software security controls used by organisations to protect their data

Approaches to problem solving

- purposes and structure of an RDBMS, including comparison with flat file databases
- naming conventions to support efficient use and maintenance of an RDBMS
- a methodology for creating an RDBMS structure: identifying entities, defining tables and fields to represent entities; defining relationships by identifying primary key and foreign key fields; defining data types and field sizes; normalisation to third level
- design tools for describing data types and the value of entity relationship (ER) diagrams for representing the structure of an RDBMS
- design principles that influence the functionality and appearance of solutions
- design tools for representing solutions
- functions and techniques within an RDBMS to efficiently and effectively validate and manipulate data
- functions and techniques to retrieve required information through searching, sorting, filtering and querying data sets
- methods and techniques for testing that solutions perform as intended

Interactions and impact

- reasons why organisations acquire data using online facilities, including 24-hour customer access, improved efficiencies through direct data entry by customers, improvements in effectiveness, and access to global markets, marketing opportunities and ongoing services
- reasons why users supply data for online transactions, including convenience, variety of choice, reducing costs
- techniques used by organisations to protect the rights of individuals and organisations who supply data, including security protocols and stating privacy, shipping and returns policies
- user flow diagrams that depict different ways in which users interact with online solutions.

Key skills

- select and apply design tools and techniques for describing data types and representing the structure and functionality of solutions
- use RDBMS functions and techniques to construct a relational database to manipulate and validate data
- apply functions and techniques to construct queries that efficiently retrieve required information
- select and apply testing methods and techniques to confirm whether the solutions operate as intended
- use software tools to represent the user interface of the page on which online transactions begin, including data protection, where appropriate
- use software tools to represent the interactions between users and online solutions (user flow diagrams)
- annotate user flow diagrams to identify where and why data protection is used.

Area of Study 2

Data analytics: drawing conclusions

In this area of study students focus on data analytics, in particular selecting, referencing, organising, manipulating and interpreting relevant data to draw valid conclusions about a hypothesis. Students initially frame a hypothesis within a chosen field such as entertainment, sport, science/medicine, business and education, and undertake an analysis to determine the multiple data sets needed to support their claim, the scope of the hypothesis and any constraints. The hypothesis could reflect an existing or emerging trend such as confirming or predicting a changing pattern in food culture in a defined precinct due to demographic shifts. Students complete this as the first part of a project; the other part is undertaken in Unit 4, Outcome 1.

Students prepare their acquired data for manipulation through integrity checks and, where appropriate, codify data and information. Students manipulate this data to support interpretation and apply computational thinking skills to extract meaning from the data in order to express a conclusion to their hypothesis.

Details regarding the complexity of data sets, such as variety of types of data, number and variety of data sets and the state of the data (fully digitised or physical) will be published annually by the VCAA in the *VCAA Bulletin*.

Students devise a file management plan and prepare a project plan for the execution of the problem-solving methodology. This includes both parts of the project, from the framing of the hypothesis, the analysis and the conclusion (Unit 3, Outcome 2), through to the design, development and evaluation of the multimodal online solution showing the correctness (or otherwise) of the hypothesis (Unit 4, Outcome 1). Students determine the milestones of their project.

Outcome 2

On completion of this unit the student should be able to use a range of appropriate techniques and processes to acquire, prepare, manipulate and interpret complex data to confirm or refute a hypothesis, and formulate a project plan to manage progress.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Data and information

- primary and secondary data sources (digital and non digital) and methods of data acquisition, including observation, interview and querying of resources
- suitability of quantitative and qualitative data for manipulation including comparisons (quantitative) and policy formation (qualitative)
- data types and data structures relevant to selected software tools
- one of the following methods for referencing primary and secondary sources: Harvard, American Psychological Association (latest edition), Chicago, Institute of Electrical and Electronics Engineers (IEEE)
- criteria to check the integrity of data including timeliness, authenticity, relevance, accuracy
- techniques for coding qualitative data to support manipulation

Interactions and impact

- key legal requirements for storage and communication of data and information, including privacy, intellectual property and human rights requirements

Approaches to problem solving

- features of a reasonable hypothesis including a specific statement identifying a prediction and the variables
- solution specifications: requirements, including data to support the prediction of the hypothesis, constraints and scope
- project management concepts and processes, including milestones and dependencies (concepts), task identification, sequencing, time allocation, resources and documentation using Gantt charts (processes)
- file naming conventions to support efficient use of software tools
- software functions to organise, manipulate and store data
- techniques for identifying patterns and relationships between data

Digital systems

- roles, functions and characteristics of digital system components used to input, store, communicate and output data and information
- physical and software security controls suitable for protecting stored and communicated data.

Key skills

- frame a hypothesis that can be tested
- determine the specifications of the solution
- acquire complex data sets and use a standard referencing system to acknowledge intellectual property
- apply techniques that discriminate data on the basis of its integrity
- select and apply methods to secure stored and communicated data and information
- organise, manipulate and interpret selected data, identifying relationships and patterns to develop a conclusion
- devise and apply a file management plan
- prepare project plans using software
- select and use digital system components appropriate to project needs.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 3 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table.

Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 3 **Outcome 1** Design a solution, develop it using a relational database management system, and diagrammatically represent how users interact with an online solution when supplying data for a transaction.	**90** **10**	In response to a design brief that includes an analysis of a need or an opportunity and a data set: • the design and development of a relational database management system solution. **AND** In response to a design brief that includes a description of the online transaction requirements of an organisation and its data protection techniques: • an annotated, diagrammatic representation of a user's interactions with an online solution when conducting a transaction and the user interface for the page that initiates the transaction.
Total marks	**100**	

*School-assessed Coursework for Unit 3 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided on page 38 of this study design.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 50 per cent.

Unit 4: Informatics

In this unit students focus on strategies and techniques for manipulating, managing and securing data and information to meet a range of needs. In Area of Study 1 students draw on the analysis and conclusion of their hypothesis determined in Unit 3, Outcome 2, and then design, develop and evaluate a multimodal, online solution that effectively communicates the conclusion and findings. The evaluation focuses on the effectiveness of the solution in communicating the conclusion and the reasonableness of the findings. Students use their project plan to monitor their progress and assess the effectiveness of their plan and adjustments in managing the project.

In Area of Study 2, students explore how different organisations manage the storage and disposal of data and information to minimise threats to the integrity and security of data and information and to optimise the handling of information.

Software tools

The following table indicates the software tool that students are required to both study and use in this unit.

Area of Study 1	Software tools to manipulate data for creating a multimodal online solution

A list of minimum software capabilities or equivalents suitable for creating multimodal online solutions will be published annually by the VCAA in the *VCAA Bulletin*.

The following table indicates the software tool that students are required to use, but not required to study, in this unit.

Area of Study 1	Appropriate tool for documenting project plans

Area of Study 1

Data analytics: presenting the findings

In this area of study students draw on the conclusion they formed to their hypothesis in Unit 3, Outcome 2, and design and develop a multimodal online solution that communicates and substantiates this conclusion. Students evaluate the effectiveness of the solution in communicating the conclusion.

Effective designs and clarity of messages are key features of solutions designed to communicate conclusions and findings arising from complex data sets. In this area of study students design a multimodal online solution with an educational purpose that is intended for a world-wide audience. When designing the solution, students generate two or three alternative design ideas and develop and apply criteria to select the design idea that will be fully detailed and transformed into a solution. Students use software tools and functions that support the types of data being manipulated to transform the design into a solution.

Students also use their set of criteria to evaluate the effectiveness of their solution in presenting the conclusion and findings. During these problem-solving methodology stages students use their project plan to monitor and record progress and assess the effectiveness of this strategy in managing the project.

Outcome 1

On completion of this unit the student should be able to design, develop and evaluate a multimodal online solution that confirms or refutes a hypothesis, and assess the effectiveness of the project plan in managing progress.

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

Key knowledge

Approaches to problem solving

- characteristics of information for educating world-wide audiences, including gender and culture inclusiveness, commonality of language, age appropriateness
- techniques for generating design ideas
- criteria for evaluating alternative design ideas and the effectiveness of solutions
- characteristics of effective multimodal online solutions
- formats and conventions appropriate to multimodal online solutions
- design principles that influence the functionality and appearance of multimodal online solutions
- design tools for representing a solution's appearance and functionality, including relationships, where appropriate
- functions, techniques and procedures for efficiently and effectively manipulating data using software tools
- manual and electronic validation techniques
- functions, techniques and procedures for managing files
- techniques for testing that solutions do what is intended
- techniques for documenting the progress of projects, including annotations, logs and adjustments to tasks and timeframes
- strategies for evaluating the effectiveness of solutions and assessing project plans.

Key skills

- generate alternative design ideas
- select preferred design ideas, based on student-developed criteria
- select and apply design tools to represent the functionality and appearance of solutions
- select and apply software functions, methods, formats, conventions, techniques and design principles to develop multimodal online solutions that operate as intended
- monitor and adjust project plans where appropriate
- apply criteria to evaluate the effectiveness of multimodal online solutions in communicating conclusions to hypotheses
- assess the effectiveness of project plans in managing work practices.

Area of Study 2

Information management

This area of study focuses on information management and its importance to organisations. Students develop knowledge about the components of an information system and the role of these components in managing information. They investigate how different organisations store and dispose of their data and information. Students examine the threats to this data and information, whether accidental, deliberate or technical, and consider the potential consequences to organisations of ineffective information management strategies.

Students recommend information management strategies to protect the integrity and security of data and information, taking into account key legal requirements of organisations and any ethical dilemmas faced by organisations and individuals regarding security of information.

Outcome 2

On completion of this unit the student should be able to compare and contrast the effectiveness of information management strategies used by two organisations to manage the storage and disposal of data and information, and recommend improvements to their current practices.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Interactions and impact

- reasons why data and information are important to organisations, including meeting the goals and objectives of both organisations and information systems
- reasons why information management strategies are important to organisations, including maximising opportunities, minimising risks and fulfilling legal requirements
- key legislation that affects how organisations control the storage and disposal of their data and information: the *Privacy Act 1988*, the *Privacy and Data Protection Act 2014,* and the *Health Records Act 2001*
- ethical dilemmas arising from information management practices
- strategies for resolving legal and ethical tensions between stakeholders arising from information management practices
- reasons for preparing disaster recovery plans, and their scope, including evacuation, backing up, restoration and test plans
- possible consequences for organisations that fail to follow or violate security measures
- criteria for evaluating the effectiveness of information management strategies

Digital systems

- role of people, processes and digital systems in the management of data and information
- types and causes of accidental, deliberate and events-based threats to the integrity and security of data and information
- physical and software security controls for preventing unauthorised access to data and information and for minimising the loss of data accessed by authorised and unauthorised users
- the advantages and disadvantages of using networks and cloud computing for storing and disposing of data and information.

Key skills

- explain the current information management strategies used by organisations to monitor and control their data and information
- identify similarities and differences between the information management strategies of organisations
- propose and apply criteria to evaluate the effectiveness of information management strategies
- discuss possible consequences of ineffective information management strategies
- recommend information management strategies to improve current practices.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 4 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table.

Contribution to final assessment

School-assessed Coursework for Unit 4 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 4 **Outcome 2** Compare and contrast the effectiveness of information management strategies used by two organisations to manage the storage and disposal of data and information, and recommend improvements to their current practices.	**100**	A written report **OR** An annotated visual report.
Total marks	**100**	

*School-assessed Coursework for Unit 4 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided in the following table.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

Outcomes	Assessment tasks
Unit 3 **Outcome 2** Use a range of appropriate techniques and processes to acquire, prepare, manipulate and interpret complex data to confirm or refute a hypothesis, and formulate a project plan to manage progress.	A short report that sets out a statement of a student-generated hypothesis, the conclusion that has been drawn and an outline of the findings supporting the conclusion **AND** A collection of data sets, and information derived from them, that allows a conclusion to be drawn about the hypothesis and evidence of: • the specifications for creating the information • acknowledgment of intellectual property • the validation and manipulation processes and techniques used • the methods used to secure stored and communicated data and information **AND** A project plan (Gantt charts) indicating times, resources and tasks.
Unit 4 **Outcome 1** Design, develop and evaluate a multimodal online solution that confirms or refutes a hypothesis, and assess the effectiveness of the project plan in managing progress.	A folio of two or three alternative design ideas and the detailed design specifications of the preferred design **AND** A multimodal online solution that communicates the confirmation or refutation of a hypothesis as detailed in Unit 3 **AND** • an evaluation of the effectiveness of the solution • an assessment of the effectiveness of the project plan (Gantt chart) in monitoring project progress in one of the following: • a written report • an annotated visual plan.

*School-assessed Task for Units 3 and 4 contributes 30 per cent.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination.

Contribution to final assessment

The examination will contribute 50 per cent.

End-of-year examination

Description

The examination will be set by a panel appointed by the VCAA. All the key knowledge and key skills that underpin the outcomes in Units 3 and 4 are examinable.

Conditions

The examination will be completed under the following conditions:

- Duration: two hours.
- Date: end-of-year, on a date to be published annually by the VCAA.
- VCAA examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.
- The examination will be marked by assessors appointed by the VCAA.

Further advice

The VCAA publishes specifications for all VCE examinations on the VCAA website. Examination specifications include details about the sections of the examination, their weighting, the question format/s and any other essential information. The specifications are published in the first year of implementation of the revised Units 3 and 4 sequence together with any sample material.

Unit 3: Software development

In Software development Units 3 and 4 students focus on the application of a problem-solving methodology and underlying skills to create purpose-designed solutions using a programming language. In Unit 3 students develop a detailed understanding of the analysis, design and development stages of the problem-solving methodology and use a programming language to create working software modules. Details of these approaches to problem solving are on pages 14–16.

In Area of Study 1 students respond to given software designs and develop a set of working modules through the use of a programming language. Students examine a range of software design representations and interpret these when applying specific functions of a programming language to create working modules. In Area of Study 2 students analyse a need or opportunity, plan and design a solution and develop computational, design and systems thinking skills. This forms the first part of a project that is completed in Unit 4.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	An appropriate programming language
Area of Study 2	Unified modelling language to create use cases

A list of suitable programming requirements will be published annually by the VCAA in the *VCAA Bulletin*. Schools select a language that fulfils these programming requirements.

The following table indicates the software tool that students are required to use, but not required to study, in this unit.

Area of Study 2	Appropriate tool for documenting project plans

Area of Study 1

Programming practice

In this area of study students focus on the design and development stages of the problem-solving methodology and computational thinking skills. Students examine the features and purposes of different design tools so they can accurately interpret the requirements for working software modules. Students interpret given designs and create working modules using a programming language, undertaking the problem-solving activities of coding, testing and documenting (development stage). Students use a programming language that meets the programming requirements published annually by the VCAA in the *VCAA Bulletin*.

The working modules do not have to be complete solutions and can focus on limited features of the programming language; however, students are expected to fully develop the working modules in accordance with the given designs. Each module should allow the testing of the program logic in readiness for creating a complete solution in Unit 4. Testing techniques are applied to ensure modules operate as intended and students learn to write internal documentation in the code that they develop.

Outcome 1

On completion of this unit the student should be able to interpret designs and apply a range of functions and techniques using a programming language to develop working modules.

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

Key knowledge

Data and information

- characteristics of data types
- types of data structures, including one-dimensional arrays (single data type, integer index) and records (varying data types, field index)

Approaches to problem solving

- methods of representing designs, including data dictionaries, object descriptions, mock-ups and pseudocode
- formatting and structural characteristics of input and output, including XML file formats
- a programming language as a method for developing working modules that meet specific needs
- processing features of a programming language, including instructions, procedures, methods, functions and control structures
- techniques for linear and binary searching
- techniques for checking that modules meet design specifications, including trace tables and test data
- purposes and characteristics of internal documentation, including comments and meaningful names.

Key skills

- interpret designs to develop working modules that meet these requirements
- use a range of data types and structures
- use appropriate processing features of a programming language
- select and use appropriate techniques to test the functionality of modules
- document the functioning of modules through the use of internal documentation.

Area of Study 2

Analysis and design

In this area of study students construct the framework for the creation of a software solution that meets a need or opportunity determined by individual students. This is the first part of a project, with the second part undertaken in Unit 4, Outcome 1.

In this area of study students analyse a real-world need or opportunity identified by them. The analysis is stated in terms of solution requirements, constraints and scope (analysis stage of problem-solving methodology) and presented as a software requirements specification.

There are two steps to designing. Initially, through the application of design and systems thinking skills, students generate two or three different design ideas for creating their solution. These are briefly stated and could include annotations to indicate key functions and layouts. The next step involves developing and applying evaluation criteria to select the preferred design idea. This is then fully detailed, addressing both the functionality and user interface of the solution. The evaluation criteria will be used in Unit 4 to evaluate the quality of this solution.

Students prepare a project plan, taking into account all stages of the problem-solving methodology covered in this outcome and in Unit 4, Outcome 1. Students do not have to use dedicated project-management software. Students determine the milestones of their project.

Outcome 2

On completion of this unit the student should be able to analyse and document a need or opportunity, generate alternative design ideas, represent the preferred solution design and formulate a project plan for creating the solution.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Data and information

- techniques for collecting data to determine needs and requirements, including interviews, surveys and observation

Approaches to problem solving

- features of functional and non-functional requirements
- constraints that influence solutions, including economic, legal, social, technical and useability factors
- factors that determine the scope of solutions
- features and purposes of software requirements specifications
- techniques for generating design ideas
- criteria for evaluating alternative design ideas and the efficiency and effectiveness of solutions
- tools and techniques for depicting the interfaces between solutions, users and networks, including use case diagrams created using Unified Modelling Language
- features of context diagrams and data flow diagrams
- methods of expressing software designs using data dictionaries, object descriptions, mock-ups and pseudocode
- factors influencing the design of solutions, including useability, affordability, security, interoperability and marketability
- characteristics of user experiences, including efficient and effective user interfaces
- naming conventions for solution elements
- project management concepts and processes, including milestones and dependencies (concepts), and task identification, sequencing, time allocation, resources and documentation using Gantt charts (processes)

Digital systems

- security considerations influencing the design of solutions, including data protection and authentication
- styles of modern application architecture, including mobile, rich client, peer-to-peer and internet applications

Interactions and impact

- types of goals and objectives of organisations and information systems
- key legal requirements relating to the ownership and privacy of data and information.

Key skills

- propose a range of methods to collect data for analysis
- apply analysis tools and techniques to determine solution requirements, constraints, including vulnerability to security threats, and scope
- identify appropriate styles of modern application architecture
- document the analysis as a software requirements specification
- generate alternative design ideas
- select preferred designs based on student-generated criteria and express the solution designs using appropriate design methods and techniques
- prepare project plans using software.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 3 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table.

Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 3 **Outcome 1** Interpret design requirements and apply a range of functions and techniques using a programming language to develop working modules.	**100**	In response to teacher-provided designs, create working modules to meet specific needs.
Total marks	**100**	

*School-assessed Coursework for Unit 3 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided on page 49 of this study design.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 50 per cent.

Unit 4: Software development

In this unit students focus on how the information needs of individuals and organisations are met through the creation of software solutions used in a networked environment. They continue to study the programming language used in Unit 3.

In Area of Study 1 students further their computational thinking skills by transforming their detailed design prepared in Unit 3 into a software solution. They evaluate the efficiency and effectiveness of the solution in meeting needs or opportunities. They also assess the effectiveness of the project plan in monitoring project progress. In Area of Study 2 students apply systems thinking skills when explaining the relationship between two information systems that share data and how that dependency affects the performance of the systems.

Software tools

The following table indicates the software tools that students are required to both study and use in this unit.

Area of Study 1	An appropriate programming language

The following table indicates the software tool that students are required to use, but not required to study, in this unit.

Area of Study 1	Appropriate tool for documenting project plans

A list of suitable programming requirements will be published annually by the VCAA in the *VCAA Bulletin*.

Area of Study 1

Software solutions

In this area of study students further develop their computational thinking skills by using the programming language studied in Unit 3 to transform the design they prepared in Unit 3, Outcome 2 into a software solution that meets specific needs or opportunities.

Students prepare a useability test that addresses the core features of their solution. The test must be undertaken by at least two other 'users' and the results recorded. Students can make any necessary adjustments to their solution based on these results.

During the project students apply techniques to record their progress on their plan, such as showing actual versus expected durations, achievement of milestones, modifications to the plan to show adjustments and annotations to explain these modifications. Students evaluate the quality of their solution using criteria developed in Unit 3 and they assess the effectiveness of their project plan in managing their project.

Outcome 1

On completion of this unit the student should be able to apply stages of the problem-solving methodology to create a solution using a programming language that fulfils identified requirements and assess the effectiveness of the project plan in monitoring progress.

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

Key knowledge

Data and information

- ways in which file size, storage medium and organisation of files affect access of data
- uses of data structures to organise and manipulate data, including associative arrays (or dictionaries or hash tables)

Digital systems

- procedures and techniques for handling and managing files, including security, archiving, backing up and disposing of files

Approaches to problem solving

- processing features of a programming language, including instructions, procedures, methods, functions and control structures
- algorithms for sorting, including selection sort and quick sort and their suitability for a given purpose, measured in terms of algorithm complexity and sort time
- characteristics of efficient and effective solutions
- techniques for checking that coded solutions meet design specifications, including construction of test data
- validation techniques, including existence checking, range checking and type checking
- techniques for testing the useability of solutions and forms of documenting test results
- techniques for recording the progress of projects, including annotations, adjustments to tasks and timeframes, and logs
- factors that influence the effectiveness of project plans
- strategies for evaluating the efficiency and effectiveness of solutions and project plans.

Key skills

- organise and manage data and files
- code solutions and write internal documentation
- select and apply testing techniques to confirm that solutions operate as intended, and make necessary modifications
- prepare and conduct useability tests using appropriate techniques, capture results, and make any necessary modifications to solutions
- monitor and adjust project plans, where appropriate, and assess their usefulness in managing projects
- evaluate the efficiency and effectiveness of solutions based on the criteria stated in the design.

Area of Study 2

Interactions and impact

In a globalised economy and society, organisations are increasingly dependent on data supplied by other organisations. The integrity of the supplied data can affect the ability of an information system to achieve objectives. In this area of study students focus on the interactions between information systems that share data and how the performance of one of these systems is dependent on the integrity of the data. For example, timely and accurate weather reports generated by one information system can be used by an airline's information system to reschedule flights, reducing risks to commuters.

Students apply systems thinking skills when examining information systems that share data. They develop knowledge of factors that influence the integrity of data and consider processes used within information systems to manage the storage, communication and disposal of data. Students investigate the capabilities of information systems operating in a networked environment and how these systems can be secured to enhance the integrity of data. They examine the importance of applying technical protocols when interacting with information systems and the consequences of violating these protocols.

Outcome 2

On completion of this unit the student should be able to analyse and explain the dependencies between two information systems and evaluate the controls in place in one information system to protect the integrity of its source data.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.

Key knowledge

Interactions and impact

- reasons why individuals and organisations use information systems
- goals and objectives of information systems
- types of interactions (inputs and outputs) generated by information systems
- characteristics of data that has integrity, including accuracy, timeliness, reasonableness, authenticity, correctness
- key legislation that affects how organisations control the storage, communication and disposal of their data and information: the *Privacy Act 1988*, the *Privacy and Data Protection Act 2014*, the *Copyright Act 1968*, the *Spam Act 2003* and the *Charter of Human Rights and Responsibilities Act 2012*
- data management practices that cause conflict between information systems, including data mining
- advantages and disadvantages for stakeholders affected by the operation of information systems
- the impact of diminished data integrity on dependent systems

Digital systems

- the technical underpinnings of intranets, the internet and virtual private networks
- characteristics of wired and wireless networks
- types and causes of accidental, deliberate and events-based threats to the integrity and security of data and information shared between information systems
- the physical and software controls used by organisations to secure the storage and communication of data in a networked environment
- the role of hardware, software and technical protocols in managing, controlling and securing data shared between information systems
- tools and techniques for tracing transactions between users of information systems.

Key skills

- identify data dependencies between information systems
- identify ways in which the integrity of data supplied by information systems can be monitored and controlled when it becomes the inputs to other information systems
- explain ways in which organisations can protect the security of data and information stored and shared in a networked environment
- evaluate the extent to which information system objectives are met through the acquisition of data supplied by another information system in a networked environment.

School-based assessment

Satisfactory completion

The award of satisfactory completion for a unit is based on whether the student has demonstrated the set of outcomes specified for the unit. Teachers should use a variety of learning activities and assessment tasks to provide a range of opportunities for students to demonstrate the key knowledge and key skills in the outcomes.

The areas of study and key knowledge and key skills listed for the outcomes should be used for course design and the development of learning activities and assessment tasks.

Assessment of levels of achievement

The student's level of achievement in Unit 4 will be determined by School-assessed Coursework and a School-assessed Task.

School-assessed Coursework

School-assessed Coursework tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe.

Where teachers provide a range of options for the same School-assessed Coursework task, they should ensure that the options are of comparable scope and demand.

The types and range of forms of School-assessed Coursework for the outcomes are prescribed within the study design. The VCAA publishes *Advice for teachers* for this study, which includes advice on the design of assessment tasks and the assessment of student work for a level of achievement.

Teachers will provide to the VCAA a numerical score representing an assessment of the student's level of achievement. The score must be based on the teacher's assessment of the performance of each student on the tasks set out in the following table

Contribution to final assessment

School-assessed Coursework for Unit 4 will contribute 10 per cent to the study score.

Outcomes	Marks allocated*	Assessment tasks
Unit 4 **Outcome 2** Analyse and explain the dependencies between two information systems and evaluate the controls in place in one information system to protect the integrity of its source data.	**100**	In response to a case study, one of the following: • a written report • an annotated visual report.
Total marks	**100**	

*School-assessed Coursework for Unit 4 contributes 10 per cent.

School-assessed Task

The student's level of achievement in Outcome 2 in Unit 3 and Outcome 1 in Unit 4 will be assessed through a School-assessed Task. Details of the School-assessed Task for Units 3 and 4 are provided in the following table.

Contribution to final assessment

The School-assessed Task will contribute 30 per cent to the study score.

Outcomes	Assessment tasks
Unit 3 **Outcome 2** Analyse and document a need or opportunity, generate alternative design ideas, represent the preferred solution design and formulate a project plan for creating the solution.	An analysis that defines the requirements, constraints and scope of a solution in the form of a software requirements specification **AND** A folio of two to three alternative design ideas and the detailed design specifications of the preferred design **AND** A project plan (Gantt chart) indicating times, resources and tasks.
Unit 4 **Outcome 1** Apply stages of the problem-solving methodology to create a solution using a programming language that fulfils identified requirements and assess the effectiveness of the project plan in monitoring progress.	A software solution that meets the software requirements specification and the results of the useability test **AND** An assessment of the extent to which the project plan (Gantt chart) assisted in monitoring project progress in one of the following: • a written report • an annotated visual plan.

*School-assessed Task for Units 3 and 4 contributes 30 per cent.

External assessment

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination.

Contribution to final assessment

The examination will contribute 50 per cent.

End-of-year examination

Description

The examination will be set by a panel appointed by the VCAA. All the key knowledge and key skills that underpin the outcomes in Units 3 and 4 are examinable.

Conditions

The examination will be completed under the following conditions:

- Duration: two hours.
- Date: end-of-year, on a date to be published annually by the VCAA.
- VCAA examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.
- The examination will be marked by assessors appointed by the VCAA.

Further advice

The VCAA publishes specifications for all VCE examinations on the VCAA website. Examination specifications include details about the sections of the examination, their weighting, the question format/s and any other essential information. The specifications are published in the first year of implementation of the revised Units 3 and 4 sequence together with any sample material.