Computing and Software Systems

University of Melbourne
Course Plan

Overview

The course is designed for students who wish to study computing in depth. Computer science is the theory and practice of applying computers and software to problem-solving. Its practical applications span all disciplines including science, engineering, business and commerce, creative and performing arts and the humanities. You will learn how … For more content click the Read More button below.
The course is designed for students who wish to study computing in depth. Computer science is the theory and practice of applying computers and software to problem-solving. Its practical applications span all disciplines including science, engineering, business and commerce, creative and performing arts and the humanities. You will learn how to think like a computer scientist about processes and their descriptions. This will enable you to design algorithms (instructions for computers) and data structures (ways to store information). You will also acquire practical programming skills to implement these in efficient software that solves real-world problems. The course provides strong foundations in the theory of computation and its connection to mathematics.

This flexible course offers you a choice of two specialisations, either advanced computer science studies including graphics, intelligent systems and networks, or a specialisation in data science to handle the massive datasets of the information age. Your studies will conclude with a significant project in the area of your specialisation.

If you are an eligible student, you may apply for the industry-based learning (IBL) placement program, in which you undertake a 22-week, full-time industry placement as part of the curriculum. Through the IBL placement program you will apply the computer science skills and knowledge you have gained to real-world problems in a professional organisation.

Structure

The course develops through the themes of computer science foundation study, professional skills study, specialist discipline knowledge, problem-solving and analytical skills study, which come together in applied practice.

Part A. Computer science foundation study

This study will develop your understanding of the role and theoretical basis of computer science and computational methods.

Classes

Total Credit Units : 42 credit points
You must complete ALL of the following:

1. Fundamentals of Algorithms (6 credit points)

   Overview
   This unit introduces you to core problem-solving, analytical skills, and methodologies useful for developing flexible, robust, and maintainable software. In doing this, it covers a range of conceptual levels, from fundamental algorithms and data structures, down to their efficient implementation as well as complexity. Topics include data types, data structures, … For more content click the Read More button below.
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2. Introduction to Programming (6 credit points)

   Overview
   This unit introduces programming fundamentals using the Python language. It will present fundamental programming control structures, built-in and complex datatypes, mechanisms for modularity, and the use of basic libraries. Students will also be introduced to good programming practices and programming in teams.
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3. Introduction to Computer Systems, Network and Security (6 credit points)

   Overview
   The unit introduces students to fundamentals of computer systems, networks and security. It provides basic knowledge of computer organisation and architecture, operating systems, networking architecture, technology and operation. It introduces the

concepts of security goals for protecting common modern computer systems and communication networks from adversaries and the deployment of … For more content click the Read More button below.
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4. Algorithms and Data Structures (6 credit points)

Overview
This unit introduces students to problem solving concepts and techniques fundamental to the science of programming. In doing this it covers problem specification, algorithmic design, analysis and implementation. Detailed topics include analysis of best, average and worst-case time and space complexity; introduction to numerical algorithms; recursion; advanced data structures such … For more content click the Read More button below.
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5. Theory of Computations (6 credit points)

Overview
This unit introduces formal languages, models of computation, and computational complexity. It looks at what computers can and cannot compute. Topics include finite state automata, regular expressions, grammars, pushdown automata, computable functions, Turing machines, polynomial-time reductions, complexity classes P and NP, and NP-completeness. Skills at writing formal proofs will be … For more content click the Read More button below.
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6. Discrete Mathematics for Computer Science (6 credit points)

Overview
This unit introduces fundamental discrete mathematics topics including combinatorics, sets, relations and functions; methods of logic and proof, especially proof by induction; probability

theory, Bayes' theorem; recursion; recurrence relations; trees and other graphs. It establishes the mathematical basis required for studies in Computer Science and Software Engineering.
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7. Continuous Mathematics for Computer Science (6 credit points)

Overview
The unit covers linear algebra (vectors, equations of lines and planes, solutions of simultaneous equations, determinates, Gauss elimination, Gauss-Jordan method), calculus topics (differentiation, parametric differentiation, fundamental theorem of calculus, and numerical integration), an introduction to multivariable calculus (functions of several variables, partial derivatives, tangent planes and directional derivatives), and the … For more content click the Read More button below.
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Part B. Professional skills study

This study develops professional skills by providing an understanding and appreciation of the ethical and professional guidelines applicable to computer science, developing the ability to work as an effective team member, developing the ability to communicate proficiently and appropriately for professional practice, and developing formal project management skills.

Classes

Needed credit points: 6 Credit Points
You must complete one of the following units

1. IT Professional Practice (6 credit points)

   Overview
   This unit provides a practical and theoretical introduction to what it means to be an IT professional, or a professional with IT expertise today. Students will encounter a range of issues relevant to professional practice in the workplace, as well as an understanding of the wider responsibilities that professionals are … For more content click the Read More button below.

This unit provides a practical and theoretical introduction to what it means to be an IT professional, or a professional with IT expertise today. Students will encounter a range of issues relevant to professional practice in the workplace, as well as an understanding of the wider responsibilities that professionals are called upon to uphold in society as they apply their IT expertise. Topics addressed include: the nature of IT as professional expertise; professional communications; situational management; teamwork in professional and organisational settings; problem solving and decision making; applications of professional ethics and relevant legal frameworks. Skills and knowledge will be developed and applied through a range of collaborative, individual and reflective tasks in relevant communication modes and formats.

2. IT Professional Practice and Ethics (6 credit points)

Overview
This unit provides a practical and theoretical foundation in developing the skills required as a Professional IT graduate when entering the workplace. Topics addressed include: professional communication; teamwork; project meetings; professional computing societies code of conduct and ethics; research skills in a professional IT role; ethical reasoning theories; and critical … For more content click the Read More button below.
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Part C. Specialist discipline knowledge

This study will develop your in-depth knowledge of the specific computer science methods of your specialised field within computer science.

Classes

Credit Points : 36 credit points
You must complete one of the following

Advanced Computer Science (36 credit points)

Overview
In this specialisation you will learn advanced aspects of computer science including a detailed study of programming paradigms, especially object-oriented programming and parallel computing. This will be enhanced with experience in constructing, manipulating and analysing

the performance of advanced algorithms and data-structures. Availability Advanced computer science is available in C2001 … For more content click the Read More button below.
In this specialisation you will learn advanced aspects of computer science including a detailed study of programming paradigms, especially object-oriented programming and parallel computing. This will be enhanced with experience in constructing, manipulating and analysing the performance of advanced algorithms and data-structures.

Availability

Advanced computer science is available in C2001 Bachelor of Computer Science at Clayton and Malaysia and in C3001 Bachelor of Computer Science Advanced (Honours) at Clayton as an undergraduate specialisation.

OR

Data Science (36 credit points)

Overview
Data science addresses aspects of how to capture, manage and use the huge volumes of data generated by businesses, organisations and science in the information age. This specialisation spans technical areas such as programming and databases, through modelling, visualisation and analysis, as well as legal and ethical issues. Availability Data … For more content click the Read More button below.
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Availability

Data science is available in C2001 Bachelor of Computer Science at Clayton and Malaysia and in C3001 Bachelor of Computer Science Advanced (Honours) at Clayton as an undergraduate specialisation.

Part D. Problem solving and analytical skills study

This study will develop your ability to apply appropriate methodologies in computer science and develop efficient computational solutions. It develops strong problem-solving skills and the ability to apply analytical thinking.

Part E. Applied practice

The above knowledge and skills are integrated and consolidated in applied practice as demonstrated in a computer or data science project, and in some cases in an industry-based learning placement.

Clayton Options

Computer Science Path (12 Credit Points)

Computer Science Project 1 (6 Credit Points)

Overview
This unit provides practical experience in researching, designing, developing and testing a substantial computer science project. Projects are generally software-based, although sometimes they may involve hardware development or investigation of theory. Projects cover the whole process of software (or hardware) development, from analysis through design to implementation and testing. Comprehensive … For more content click the Read More button below. The unit is the first part of a 12-credit point project sequence; the second part and exit point for the project is FIT3162.
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The unit is the first part of a 12-credit point project sequence; the second part and exit point for the project is FIT3162.

Computer Science Project 2 (6 credit points)

Overview
This unit provides practical experience in researching, designing, developing and testing a non-trivial computer science project. Projects are generally software-based, although sometimes they may involve hardware development or investigation of theory. Projects cover the whole process of software (or hardware) development, from analysis through design to implementation and testing. Comprehensive … For more content click the Read More button below. The unit is the second part of a 12-credit point project sequence; the first part and entry point for the project is FIT3161.

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The unit is the second part of a 12-credit point project sequence; the first part and entry point for the project is FIT3161.

OR

Data Science Option (12 credit points)

Data Science Project 1 (Overview

This unit provides practical experience in researching, designing, developing and evaluating a non-trivial data science project. Projects involve whole or part of the data science process (visualisation, analysis, algorithms, etc.) but can also be software-based, or they may involve investigation of theory. Projects if software-based should cover analysis through design … For more content click the Read More button below.
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Data Science Project 2 (6 credit points)

Overview
This unit provides practical experience in researching, designing, developing and testing a non-trivial data science project. Projects involve whole or part of the data science process (visualisation, analysis, algorithms, etc.) but can also be software-based, or they may involve investigation of theory. Projects if software-based should cover analysis through design … For more content click the Read More button below.
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implementation and testing. Comprehensive written documentation on the project is required. Students are assigned in groups to a project supervisor. There are no lectures in this unit, although students will be expected to attend regular meetings with their project supervisor. The unit is the second part of a 12-credit point project sequence; the first part and entry point for the project is FIT3163.

OR

Industry-based Learning (18 credit points)

This option is available only if you are selected to participate in the IBL placement program. FIT3045 (18 credit points) replaces the capstone project units and the Level 3 elective unit in your specialisation. You must complete one unit over summer semester or overload in one semester by one unit in order to complete the degree within three years.

Overview
Students on placement participate full time in a defined, graduate level role during a 22-week placement period at established partners of the Faculty of IT industry based learning program including major global companies, leading Australian companies and worldwide consultancies. The students on placement apply the knowledge, skills and practices of … For more content click the Read More button below.
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Part F. Free elective study

These elective units will enable you to broaden and deepen your knowledge of computer science, or to select units from across the University in which you are eligible to enrol.

If you are in a double degree courses, some units required for the partner degree are credited as electives towards the computer science degree.

Course progression map

The course progression map (Clayton) (Malaysia) provides guidance on unit enrolment for each semester of study.