The Computer Science Undergraduate Scholarship was established in 2000 to identify excellent students and enable them to have direct placement into advanced classes. It is funded by the Faculty of Computing and Mathematical Sciences. The Computer Science Department at the University of Waikato runs an annual Scholarship examination. Up to 10 Scholarships are awarded annually based on the examination results. The examination tests knowledge of computing and skill at programming. It is set at a level roughly equivalent to that of the practical programming tasks and final exam of the first year paper *Introduction to Computer Science*, with the exception that tasks can be performed in a programming language of the candidate’s choice.

1. **Purpose**
   1.1. The Computer Science Undergraduate Scholarship examination serves two purposes. The first is to identify excellent students to whom scholarships can be awarded. The second is to identify students for whom direct placement into advanced classes may be appropriate.

2. **Eligibility**
   2.1. To be eligible, candidates must:
       2.1.1. be intending to enrol full-time in a BCMS(Hons), BSc, BSc(Tech), BE(Hons) or BDes degree, in one of the computing streams, at the University of Waikato;
       2.1.2. meet the entry requirements for their chosen programme of study (for further information, please check the FCMS website or FCMS Handbook);
       2.1.3. currently be in Year 12 or Year 13; and
       2.1.4. be a New Zealand citizen, permanent resident or international student studying at a New Zealand secondary school.

3. **Value**
   3.1. The Scholarships will each have a value of $5,000 and will be paid to the recipients in cash.
   3.2. The Scholarships will be paid in two equal instalments.
       3.2.1. The first instalment will be paid after the withdrawal deadline for A Semester papers, provided the student is enrolled in a full-time programme of study on that date.
3.2.2. The second instalment will be paid after the withdrawal deadline for B Semester papers, provided the student continues to be enrolled full-time and has passed all of their A Semester papers with at least a B grade average.

4. Examination
4.1. The Computer Science Undergraduate Scholarship examination will be held on **25 and 26 October 2019**.
4.2. The examination is made up of two parts:
   4.2.1. a two-hour written examination; and
   4.2.2. a six-hour practical examination.
4.3. The examination will be conducted in, and supervised by, the candidate’s school. In the case where a school is not able to provide an appropriate environment, candidates will be allowed to sit the examination at the University of Waikato, or at some other venue to be arranged. Please contact the Computer Science Department as soon as possible to arrange this.
4.4. Candidates will be required to present proof of identity at the examination.
4.5. If you have any questions, please contact the Computer Science Department:
   Email: cs-scholarships@waikato.ac.nz
   Phone: (07) 838 4021

5. Selection Criteria
5.1. The decisions will be based on the examination results of each candidate participating in the Computer Science Undergraduate Scholarship examination.
5.2. Candidates who show sufficient proficiency in the subject may merit placement in more senior papers, while those who demonstrate a particular aptitude for the subject will be offered a Computer Science Undergraduate Scholarship.

6. Selection Panel
6.1. The Selection Panel will comprise the Dean of the Faculty of Computing and Mathematical Sciences, the Chairperson of the Computer Science Department, and the Faculty’s representative on the Scholarships Committee (or their nominees).
6.2. The Selection Panel’s decisions are final and no correspondence will be entered into following the selection meeting.
7. **Awarding**

7.1. The recipients must meet the Scholarship criteria (see clause 2.1.) by the commencement of A Semester in the year of tenure.

7.2. The offer of a Scholarship must be accepted by the date indicated in the offer letter or the offer will lapse. If a candidate declines a Scholarship, or does not take it up, the Selection Panel may re-offer it to another candidate.

7.3. Candidates may apply to defer the award of the Scholarship for one year. This is usually appropriate for candidates taking the exam in Year 12.

7.4. The Scholarship will have a maximum tenure of one year.

8. **Other Conditions**

8.1. The Scholarship may be held with any other scholarship or award, unless the conditions of the other award preclude this.

8.2. The Scholarships Committee may terminate a Scholarship at any time, and recoup any funds disbursed, if the holder withdraws from the University of Waikato during the tenure of the Scholarship, brings the University into disrepute¹, or is otherwise not complying with the regulations governing the Scholarship. The holder of a Scholarship will have the right to appeal to the Scholarships Executive against any decision to terminate the award.

8.3. By accepting a Scholarship, the recipient agrees to participate in any publicity concerning the Scholarship arranged by the University of Waikato.

8.4. International scholars must comply with the conditions of their Immigration New Zealand (INZ) Student Permit.

8.5. The Scholarships Committee may, from time to time, vary these regulations.

¹ See [Code of Student Conduct](#).
Examination Syllabus

*Aims and Objectives*

The aims of the Scholarship are to enable high school students to:

- Develop an understanding of the nature and principles of computing
- Develop an understanding of methods of analysing problems and practice the application of such methods

Before taking the Scholarship examination, students should be able to:

- Understand, apply and use appropriate terminology, concepts, processes and techniques of computing
- Use the basic features of a spreadsheet application
- Construct a computer program in a high level language to explore and solve a specific problem

*Outline of Examination Syllabus*

Students should have a working knowledge of the following areas:

1. **Programming topics**
   - Control structures
     - Sequence
     - Iteration
     - Choice
     - Nested structures
   - Control statements
     - If-then-else
     - While or repeat-until
     - Switch (or case)
   - Data types
     - Integer
     - Real (or Float)
     - Character
     - Boolean
   - Data structures
     - Arrays (one and two dimensional)
     - Strings (or character arrays)
   - Data operations
     - Variable assignment
     - Arithmetic expressions & operator precedence
o Boolean expressions

• Input/output
  o Input operations: reading from keyboard or text files
  o Output formatting: to screen or writing to text files
  o Printable and non-printable characters

• Programming structures
  o Procedures
  o Functions
  o Value parameters
  o Built-in functions and library routines

• Algorithms and problem solving
  o See the attached sample examinations from past years

2. Computer Science topics

• Base conversion
  o Conversion of positive integers between bases binary, octal decimal.

• Binary numbers and arithmetic
  o Addition and multiplication of numbers in unsigned format. Subtraction using two’s complement representation.

• Type representation
  o Students should know how characters might be represented using (for example) ASCII and UNICODE.
  o Representation of signed integers and fixed point numbers in two’s complement.
  o Floating point numbers using two’s complement notation only (8-bit fractional two’s complement for mantissa, signed integer for exponent).
  o Awareness of errors associated with accuracy and loss of precision—underflow, truncation, and overflow.
  o Normalization of floating point numbers is not required.

• Languages
  o Compilers and interpreters for high level languages.

• Computer architecture
  o Features of commonly used input, output and backing store devices.
  o Structure of a processor (ALU, CPU—internal details and registers not required).
Function of RAM, ROM, cache memory, and disk.

The following terms should be understood:
- Virtual memory
- Primary and secondary memory
- Bit (b), byte (B), frequency (hz) and their modifiers (k, M, G, T)
- Serial and direct access
- Computer systems

Students should understand that an operating system is a collection of programs performing:
- Communication with peripherals
- Coordination of processes (including programs)
- Memory management
- File handling
- Accounting
- Security
- Data management
- Error handling

Students should understand the need for systems software to provide:
- Utilities such as archiving (and compression), de-fragmentation, file maintenance
- A user interface

Data representation and graphics
- The relationship between numbers of colours and numbers of bits should be known; eg, 24 bits allows 224 or (approximately) 16 million colours.
- The relationship between resolution and file size should be understood
- Students should appreciate that different resolutions are appropriate for particular devices.

Applications skills

3. Spreadsheet usage
- Cell formats
- Formulae
- Simple graph plotting
- Conditional expressions

Programming languages
The Department uses the C# language for first year programming courses. Candidates for the Scholarship are free to use any of the following languages:

- BASIC, including Visual Basic
- C, C++, C#
- Pascal, Delphi
- Java

For examination questions candidates will only be required to use text-based input and output. Candidates who wish to program in other languages must seek written approval from the Department of Computer Science before applying for the Scholarship examination.

**Resources**

The textbook used in the first year Computer Science programming courses is:

- Douglas Bell and Mike Parr: *C# for Students*, Addison/Wesley, 2004

However, any instructional text on programming should be satisfactory.