# *Computer Science Scholarship Examination*
# *Student Registration Form*

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The Computer Science Department at the University of Waikato runs an annual scholarship exam. Each year, up to 10 scholarships have been given to the best performing students.

The Scholarship will have a value of up to $5,000 and will be credited to the tuition fees account of the successful applicants. It will not be refundable to recipients who withdraw from their degree (BSc, BE, or BCMS.), and can be held concurrently with other scholarships It will be the responsibility of the student to pay the balance of their fees.

This year the exam will be held on the 30th September and the 1st October.

If you or your students have any questions, or require an information pack, please do not hesitate to contact the Department:

**Email:** scholarships@cs.waikato.ac.nz

**Phone:** (07) 838-4021

**Website:** http://www.cs.waikato.ac.nz/admissions/scholarships.html

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# Examination Information

The purpose of the University of Waikato Computer Science Scholarship Examination is to determine whether new students have sufficient proficiency in the subject to merit placement in the more senior papers. In addition, students demonstrating a particular aptitude for the subject will be offered **$5,000 which will be credited directly to the fees accounts of successful students.**

The scholarship examination is roughly the equivalent to the practical programming tasks and final exam of the first year paper Introduction to Computer Science 1 at Waikato University, which gives students a basic level of competence in computer programming and computing concepts.

Detailed below and in the attached document titled Syllabus is all of the information you need to know about the Scholarship Examination process.

### *Awards*

- On the basis of examination results, up to **ten fees scholarships** will be offered. These scholarships will cover the full fees payable for the first year of study towards a BCMS, BSc, BE or BCGD degree (in one of the computing streams) at Waikato University. They shall not be tenable for any other degree or at any other university.
- Note that if a student is awarded both a Computer Science Examination fees scholarship and a Waikato University School Leavers Scholarship, then the School Leavers Scholarship can be carried forward to the student's second year—that is, the student will receive fees scholarships for two years of study (provided that the student receives passing grades for all enrolled courses in the first year of study).
- At the discretion of the Chairperson of the Computer Science Department, students who obtain a high pass mark in the scholarship exam will be offered a more advanced programme of study at Waikato University.

### *Eligibility*

- All scholarship candidates must be New Zealand Residents (proof of citizenship or permanent residence may be required before the candidate is allowed to sit the examination).
- Any student awarded a University of Waikato Computer Science Scholarship must meet the entry requirements for the degree they choose to do. For more information please see the School website or handbook.
- The scholarship examination is open to Year 12 and Year 13 students only.

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### *Examination*

- The University of Waikato Computer Science Scholarship Examination is made up of two parts: a two-hour written examination and a six-hour practical examination. Both parts are usually on 2 days in October of each year.
- The examination will be conducted in and supervised by the candidate's school so that the candidate will be working in a familiar hardware and software environment. In any case where a school is not able to provide an appropriate environment, candidates will be allowed to sit the examination at Waikato University, or at some other venue to be arranged. Please contact our department as soon as possible to arrange this.
- Candidates will be required to present proof of identity at the examination.
- Examination papers will be posted to the University of Waikato Department Of Computer Science within 24 hours of the exam taking place, for assessment.

### *Reference Material*

- The examination syllabus is included in this pack, and covers all of the information students will need to know to effectively prepare for the examination. This information has been made available to all schools with students participating in the UWCS Scholarship Examination. The syllabus is also obtainable directly from the University of Waikato Department of Computer Science by phoning +64 7838 4021 or via e-mail to scholarships@cs.waikato.ac.nz Further information can also be obtained from the website at: http://www.cs.waikato.ac.nz/admissions/scholarships.html

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# 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
  - Boolean expressions
- Input/output
  - Input operations: reading from keyboard or text files
  - Output formatting: to screen or writing to text files
  - Printable and non-printable characters
- Programming structures
  - Procedures
  - Functions
  - Value parameters
  - Built-in functions and library routines
- Algorithms and problem solving
  - See the attached sample examinations from past years

2. **Computer science topics**
   - Base conversion
     - Conversion of positive integers between bases binary, octal decimal.
   - Binary numbers and arithmetic
     - Addition and multiplication of numbers in unsigned format. Subtraction using two's complement representation.
   - Type representation
     - Students should know how characters might be represented using (for example) ASCII and UNICODE.
     - Representation of signed integers and fixed point numbers in two's complement.
     - Floating point numbers using two's complement notation only (8-bit fractional two's complement for mantissa, signed integer for exponent).
     - Awareness of errors associated with accuracy and loss of precision—underflow, truncation, and overflow.
     - Normalization of floating point numbers is not required.
   - Languages
     - Compilers and interpreters for high level languages.

- Computer architecture
    - Features of commonly used input, output and backing store devices.
    - Structure of a processor (ALU, CPU—internal details and registers not required).
    - Function of RAM, ROM, cache memory, 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 $2^{24}$ 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

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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.