

Guide to the NCSS Challenge 2011

The NCSS Challenge is a five week competition that teaches participants how to program. The Challenge is designed to give high school students an opportunity to learn and experience computer programming for themselves.

The Challenge has four different streams to cater for students of different abilities, experience and interest. Material is provided online and backed up with forum access to high quality tutorial support provided by students and staff from University of Sydney and NICTA.

Quick Facts

- **Aim:** The Challenge is a fun competition in which students can learn to program and then test their skills with some fun (and challenging) questions
- **Dates:** 5 weeks from Monday 1 August to Monday 5 September 2011. Registration opens on 17 June 2011.
- **What do I get?** Students are provided with weekly notes and questions along with online access to a tutorial team for providing help and answering questions
- **Registration:** Students can either register themselves and participate from home outside school hours or schools can register students as a group and support participation from school as a classroom activity (once registered students have 24-hour access to the site from any Internet connected computer)
- **Difficulty:** The competition starts at a quite easy level in Week 1, and moves through to more challenging questions by Week 5. Although the hardest questions are tough enough to test the best programmers, we make sure there are some questions each week that everyone can do.
- **Levels:** There are four streams catering to students of varying ability and interest: Beginners, Intermediate, Advanced and Embedded
- **Eligibility:** Any high school student in Australia can enter (see the information on each stream in this document to help you choose the stream that is right for you or your student)
- **Cost:** The cost is \$20 (which includes GST) per student per stream. Students enrolled in the Embedded Stream will also need to purchase a board (\$85 which includes GST).
- **Teachers:** Teachers can register free if a student from their school registers
- **Register online** at challenge.ncss.edu.au
- **Please note:** Once you have registered it is not possible for us to offer you a refund, so please read this brochure carefully and contact us if you have any questions before registration

More Information

What do I get when I register?

Each student or teacher who registers for the Challenge gets:

- The opportunity to participate in the 5-week NCSS Challenge, with a set of 5-10 fun questions each week.
- A full set of notes (downloadable as a PDF) for each week of the Challenge, that you can use to study in your own time.
- Fully worked solutions and commentary, released at the end of each week.
- Online tutorial support (via online forums) from highly qualified students and staff from University of Sydney and NICTA

If you participate over the full 5 weeks of the Challenge you will receive a certificate from The University of Sydney showing your level of achievement or participation.

We encourage teachers to use the notes and questions as a learning exercise in their classroom, and are happy to provide more information about this.

How does the Challenge Run?

The notes and Challenge questions for the week are released at 9am each Monday morning for the five weeks of the Challenge. Students have until midnight the following Sunday to submit their answers to collect marks. Answers can be submitted later but, as the solutions will then be online, no marks can be allocated for late submissions. Marks are not allocated in the first week to give students a chance to gain familiarity with the system.

To answer a Challenge question the student needs to write a computer program and ensure it works correctly. Once satisfied they submit the source code to their program to the online marking system which runs a series of tests to determine if the program is correct. If the program fails testing then feedback is provided as to why it failed and the student has the option of re-submitting. Multiple attempts to each question are allowed but after 5 attempts the amount of marks allocated to a finally successful submission diminishes.

Students in the *Beginners*, *Intermediate* and *Advanced* streams are shown how to download and install Python on their own computer. Students then are able to write, run and debug Python programs locally before submitting the source code for marking.

Students in the *Embedded* stream are shown how to install the Arduino software on their own computer and how to use it to write, run and debug programs which are uploaded and run on a microcontroller board. This "NICTA ed1" is essential to this stream and can be purchased from the Challenge web site as part of enrolment. We use the same board each year so if your school or friend has one from last year you can use it. Like the Python based streams the students in the *Embedded* stream have to submit source code to answer each of the questions.

The Challenge web site hosts online forums for the students to ask questions and communicate with others doing the Challenge. As some students may feel intimidated by open forums the site also has closed forums where students can address questions directly to our experienced team of tutors.

Support is provided for students to answer questions each week to reinforce learning. Support can be of the form of answering general questions on the programming concepts or providing feedback on source code submitted to the marking system. The *Advanced* stream will

emphasis the competitive aspect of the Challenge by providing minimal support for a small number of questions each week. In all cases students are encouraged in the first instance to work out solutions themselves and help is in the form of guidance to see how a problem may be solved.

The marks of the top students for each of the three age groups of students (Years 7-8, 9-10 and 11-12) are displayed on the web site for all participants of that course to see.

Registration and refund policy

Note that once you have registered it is not possible for us to offer you a refund, so please read this brochure carefully and contact us if you have any questions before registration.

What level should I enrol in?

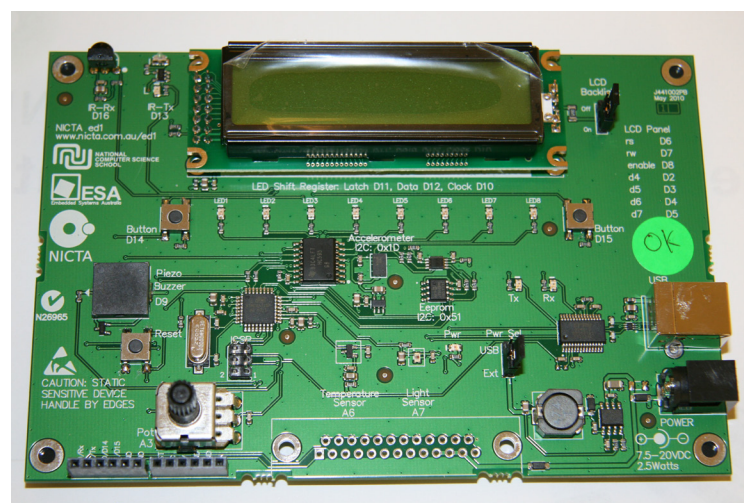
In 2011 there are 4 different streams available in the Challenge. We have included a brief description and examples from each, so you can judge what level is most suitable for you. After the first week of the Challenge you can change streams if the one you enrolled in isn't suitable.

A small number of students (mainly those who have enjoyed the Challenge previously) choose to enrol in multiple streams. For some this will be a large workload and we generally encourage students to attempt just one stream at a time. In any event the no refund policy will apply.

Year 12 students may enrol but we realise that the timing of the Challenge may conflict with preparation, or participation, in end of school exams. Some Year 12 students choose to enrol but do not complete the full five weeks. If in doubt we suggest students concentrate on their exams in Year 12 and, ideally, participate in the Challenge in earlier years.

How do the Python Streams in 2011 Relate to the Streams in 2010

The *Beginners* stream in 2011 is a new course pitched at a more introductory level than in previous years. The *Intermediate* stream in 2011 is similar to the *Beginners* stream in previous years.



Stream 1: *Beginners*

The *Beginners* stream is designed for students with no prior experience at programming. It starts at the very beginning, and includes extra questions each week that cover the basic concepts.

This level is most suited to students in years 7 to 10.

Topics Covered:

- The concept of programming
- Variables and user input and output
- Python data structures for strings and lists
- String manipulation
- Python control structures: for loops, while loops, if statements

Sample Question: Week 1 *Beginners*

Hello to you, too

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Write a program that asks the user's name, then prints:

```
Hello, <name>!
```

For example:

```
Enter your name: Tara
Hello, Tara!
```



Hint

Make sure you give `raw_input` the same prompt message that is used in the example interaction above.

Stream 2: *Intermediate*

The *Intermediate* stream is designed for students who either have completed the *Beginners* stream in a previous year, have some other prior experience at programming, or who are naturally quite capable students who can start with material more advanced than the *Beginners* stream. Advanced maths and science students in years 10 and above may also want to enter this level. If you are enrolling a class you may find you have one or two students who would benefit from starting here.

Topics Covered:

- The concept of programming
- Variables and user input
- String manipulation
- Python control structures: for loops, while loops, if statements
- Python data structures: lists, dictionaries
- Functions

Sample Question: Week 1 *Intermediate*

Soctopus Prediction

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Paul the Octopus achieved international renown during the course of the 2010 FIFA World Cup for correctly predicting the winner in all of Germany's seven matches. Although the owners of his aquarium claim he has retired from making public predictions, we have it on good authority that Paul is going to perform one last series of predictions.

Paul has agreed to predict the winners of the 2011 FIFA Women's World Cup, and your task is to write a Python program to help him. Paul has decided that the winner will be the team with the longest name, and there will be a draw if the two teams have the same number of characters in their names (including spaces).

Your program should ask for two team names using the prompts **Team 1:** and **Team 2:** (don't forget the space at the end of the prompt).

The output should be either the name of the winning team, or **Draw** in the case of a draw. For example, Paul predicts that **New Zealand** will beat **Germany**:

```
Team 1: Germany
Team 2: New Zealand
New Zealand
```

and that **Japan** will tie with **Spain**:

```
Team 1: Japan
Team 2: Spain
Draw
```

Stream 3: *Advanced*

The *Advanced* stream is designed for students who have completed the *Intermediate* stream in a previous year and want more advanced material or who have significant programming experience. While some capable students can start the Challenge at the *Intermediate* stream level those students who are new to the Challenge should not take this as their first course unless they really have significant programming experience.

This level is most suited to students in years 10 to 12, or extremely talented junior students.

Topics Covered:

- All topics listed in the *Beginners* and *Intermediate* streams, plus:
- Advanced functions and recursion
- Reading from and writing to files
- Regular expressions
- Object oriented programming
- Exception handling

Sample Question: Week 1 *Advanced*

Word Calculator

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After an unfortunate incident with a glass of cordial and the top third of my laptop's keyboard, my numbers and special character keys aren't working anymore. It's particularly unhelpful that my maths assignment is due tomorrow. If you could help me out, I need to be able to do calculations typed out in words.

The types of calculations will be simple – two single digit numbers (in words) with either **plus**, **minus**, **times** or **/** in between them (thank goodness the **/** character is not up with the numbers!). You just need to print out the numerical answer. Here are some example uses of your program:

```
Enter calculation: one plus two
3
```

```
Enter calculation: five minus eight
-3
```

```
Enter calculation: six / four
1.5
```

```
Enter calculation: six / three
2
```

As you can see, you'll have to deal with negative answers, and if the division doesn't produce a whole number, you'll need to print out the decimal part too. There also won't be any division by zero cases.

There will only be single spaces between the words in the inputs, and there won't be any malformed inputs, except that sometimes my caps lock key gets stuck...

Stream 4: *Embedded*

The *Embedded* stream is for students with a particular interest in programming devices for interacting with the physical world (such as robotics). Unlike the other streams it requires programming in C to create programs that upload and run on a micro-controller board that will be sent out to your home or school for you to work with. The course uses the popular Arduino Programming Language (based on C) and is designed to encourage post-Challenge experimentation with Arduino based devices.

The course assumes no prior knowledge of C programming but it is not a gentle introduction to programming like the *Beginners* Stream. Students with no programming experience would benefit from completing the *Beginners* Stream and perhaps even the *Intermediate* Stream to learn some programming concepts before attempting the *Embedded* Stream. Capable students or those with prior programming experience should be okay with the *Embedded* Stream.

More information on the NICTA ed1 board used in this stream can be found at www.nicta.com.au/ed1

Topics Covered:

- Installing and running Arduino software
- Structure of an Arduino program
- Basic syntax of C programming
- Control structures such as for, while, if
- Interaction with digital logic devices such as LEDs, buttons, LCD panel, accelerometer
- Access to analogue inputs using an analog to digital converter

Sample Question: Week 1 *Embedded*

Hello World

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Copy the sketch below and save with the name `hello_world`.

```
/*
 * using the serial port to print "Hello World"
 */

void setup(void)
{
  Serial.begin(9600);

  Serial.println("Hello World");
}

void loop(void)
{
}
```

Edit the output text so instead of "Hello World" the program prints out "Hi, how are you?".

Hints: * Remember to select the "Serial Monitor" button on the top of the Arduino IDE to view serial output from the board * The pull down menu must be set at "9600 baud" for you to see the output correctly * To run the program again you can press the reset button on the Arduino board

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