A Path from Math to Computer Science

The CENTRE for EDUCATION in MATHEMATICS and COMPUTING

Visit **cemc.uwaterloo.ca** for more information

Do you have interested mathematics students wanting to extend their knowledge in a new direction?

Do they find problem solving interesting, and enjoy learning new things?

Together, mathematics and computer science are a powerful way to solve important real-world problems!

Beaver Computing Challenge (BCC)

Introduces computer science to students. Designed to get students with little or no previous experience excited about computing.

CS Circles

Free website of structured lessons that teaches computer programming to students with no prior experience.

Canadian Computing Competition (CCC)

Opportunity for students to test their ability in designing, understanding and implementing algorithms. An online grader provides free access to practice and previous contests.

A

B

C

Solving real-world problems with computer science

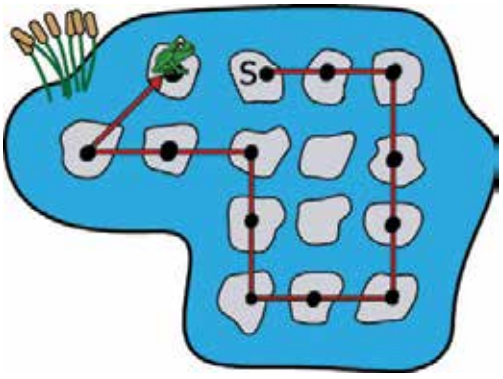
UNIVERSITY OF WATERLOO | The CENTRE for EDUCATION in MATHEMATICS and COMPUTING

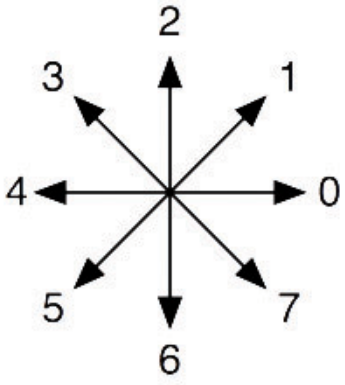
Beaver Computing Challenge (BCC)

- 45 minute online multiple-choice contest
- engaging problems involving logic and algorithmic thinking
- for students with no Computer Science experience
- open to students in Grades 5 to 10
- offered in November
- held in schools and supervised by teachers

Sample Question

A frog gets exercise by jumping around a pond. It jumps from lily pad to lily pad in the sequence shown in the picture below. It starts at the lily pad labelled S. It ends on the lily pad as shown (i.e., the frog shown has finished jumping). Each black dot marks a lily pad on which the frog has landed. The legend below labels each of the 8 possible directions of a jump with an integer from 0 to 7.





Which sequence describes the frog's path?

- 4, 1, 0, 0, 0, 6, 6, 4, 4, 2, 2, 1
- 0, 0, 6, 6, 6, 4, 4, 2, 2, 4, 4, 1
- 0, 0, 6, 6, 6, 0, 0, 2, 2, 2, 2, 4, 4, 4
- 6, 6, 4, 4, 4, 2, 4, 1, 1, 1

Testimonials for CS circles

CS Circles

- free website to learn Python programming
- no prior programming experience necessary
- only a web browser and internet connection required
- interactive self-paced online lessons
- all structured exercises use the Python programming language
- hints and help are provided
- ability for teachers to act as a "guru" to assist a class

Sample Exercise – Code Scramble

Here is a code scramble, where you must drag and drop the lines to rearrange them into a correct program.

Scramble Exercise: **Sort of Strangeness**

Arrange the code so that it prints the three numbers x, y and z **sorted** in increasing order, so that the smallest is printed first, then the middle one, and then the largest one.

Drag and drop with your mouse to rearrange the lines.

```
print(max(x, y, z))
print(min(x, y, z))
print(x+y+z-min(x, y, z)-max(x, y, z))
```

Run program

This is by far the most beautiful, effective and elegant solution to teaching basic programming using Python. Thanks to ALL of you for this.

Thank you very much. I am really enjoying this set of tutorials... This set of tutorials is really great. In spite of having no computer science background and never learning a computer language before, I am learning this very fast... I just wanted you to know how well this is working for me.

– cscircles.cemc.uwaterloo.ca

Canadian Computing Competition (CCC)

- programming contest run since 1996
- online grader for training and competition
- tests algorithmic thinking and implementation
- can begin practicing early with real-time feedback
- Pascal, C/C++, Python, Java are permitted
- offered for high school students at Junior and Senior levels
- top performers invited to the Canadian Computing Olympiad at UWaterloo

Sample Junior Problem – Speed fines are not fine!

Many communities now have radar signs that tell drivers what their speed is, in the hope that they will slow down. Write a program that takes the speed limit and recorded speed of a car as input. It must output a message indicating the fine (if any) according to the following table:

KM/H OVER THE LIMIT	FINE
1 to 20	$100
21 to 30	$270
31 or above	$500

Sample Senior Problem – Absolutely Acidic

You are gathering readings of acidity level in a very long river in order to determine the health of the river. You have placed a large number of sensors in the river, and each sensor gives an integer reading. Write a program to determine the frequency of each reading, and the absolute difference between the two most frequent readings.