

(<http://csmatters.org/pd-new>) P - 09

0bP - 0b1001

Optional

Extending Python: Programming Challenges



Unit Programming

Revision Date: Mar 01, 2018

Duration: 75 50-minute sessions

Lesson Summary

Summary: A variety of programming challenges and their uses will be presented. Teachers will then have time to work either collaboratively or individually on some challenges.

Objectives:

- Teachers will be introduced to programming challenges as a way to practice coding in a language and keep active with languages that they do not use regularly.
- Teachers will learn about resources for practicing coding and doing programming challenges.

Outcomes:

Total: 75 minutes

1. Introduction (10 min)
2. Programming Challenges (65 min)

Learning Objectives

Key Concepts

There are many resources online for practicing coding and algorithm skills

Teacher Resources

Student computer usage for this lesson is: **required**

PROG09_Extending Python: Programming Challenges Folder (<https://drive.google.com/open?id=0B1v7pcLSD-B5U0FPVnF1SDNBYkU>)

Lesson Plan

TOTAL: 75 minutes

Introduction (10 minutes)

The instructor can use the Programming Challenges document to guide this lesson.

Programming challenges can be a fun exercise to practice coding in a language. Many professionals use them to keep active with languages they don't use regularly, while others use them as a competition to prove their skill. The most important part of programming challenges for students is not the programming. We want to show that programming is a means to an end. When the students see a problem, they should think about how they would solve it (maybe writing some tests on pen and paper!) and then think about how to translate this into code. Programming challenges are great for cooperative work, have myriad possible solutions of varying complexity, and are simple to verify.

FizzBuzz

Write a program that prints the numbers from 1 to 100. But for multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".

Plan a solution together. Brainstorm different approaches to the problem, ways to facilitate student discovery, and the pros and cons of various solutions. Explore pseudocode and flow diagrams to demonstrate possible solutions. Code a solution together.

Programming Challenge (65 minutes)

Teachers will then be introduced to CodinGame, a fun website that has many unique algorithm challenges over different difficulty levels. A list of useful challenges is provided in the Programming Challenges document, as well as additional resources that the teachers may be interested in trying or using. Teachers will explore resources individually or in pairs or groups.

<http://codingame.com> (<http://codingame.com>)

CodinGame is a website that provides many algorithm challenges that mimic real world situations (with fun twists and visualizations). Coding challenges can be done in any language including Python 3.

Pros:

- Includes many unique challenges over different difficulty levels.
- Can check code in real time with numerous built-in test cases.
- Can track score and continue beyond class.
- Solutions are not provided on website until after solving.
- Helpful community to assist with questions.
- Fun experience.

Cons:

- Requires Internet access and 3rd party website.
- Challenges may have solutions available elsewhere on site.
- Must use onsite IDE, and no offline option (unless built by hand).
- Some challenges get very hard.

Useful challenges: (solution code provided in the teacher resources for `ascii.py`, `defib.py`, `descent.py`, `fizzbuzz.py`, `onboarding.py`, `skynet.py`, `spoon.py`)

- *Tutorial: Onboarding* -- Get general understanding of IDE and website
- *Beginner: The Descent* -- Simple demonstration of searching
 - *Beginner: Temperatures* for more advanced version
- *Beginner: ASCII Art* -- String manipulation; storing data in lists
- *Beginner: Defibrillators* -- Applying mathematical function on open data
- *Medium: There is No Spoon Episode 1* -- Graphs and detecting nodes with matrix
- *Medium: Skynet Revolution Episode 1* -- Graph theory and Dijkstra's algorithm
- *Hard: Skynet Revolution Episode 2* for much more advanced version

Other Resources

- <http://www.practicepython.org/> (<http://www.practicepython.org/>) - beginner Python exercises just waiting to be solved. Each exercise comes with a small discussion of a topic and a link to a solution.
- <http://www.w3resource.com/python-exercises/> (<http://www.w3resource.com/python-exercises/>) Python Exercises by W3 resource
- <https://coderbyte.com/challenges> (<https://coderbyte.com/challenges>) Coding challenges and algorithms. Choose to do 10 for free.
- LeetCode OJ (<https://leetcode.com/problemset/algorithms/>) -- Clean site with simple algorithm problems (many require free account)
- Sphere Online Judge (<http://www.spoj.com/problems/classical/>) -- Plain text problems that can be sorted by difficulty
- Code Chef (<https://www.codechef.com/problems/school>) -- Another challenge website with multiple categories of difficulty
- HackerRank (<https://www.hackerrank.com/>) -- Competition site; requires registration, but offers school partnerships, <https://www.hackerrank.com/domains/python/py-introduction> (<https://www.hackerrank.com/domains/python/py-introduction>) many practice problems starting with very easy ones.
- Google Code Jam (<https://code.google.com/codejam/contests.html>) -- Very challenging problems released by Google for several years
- Project Euler (<https://projecteuler.net/archives>) -- Challenge math-based problems that require programming

Options for Differentiated Instruction

The teachers can use paired programming to work on their programming challenges.

Teachers can select challenges at multiple levels to use with students in class with different skill levels.



(<http://www.umbc.edu/>)



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(<http://www.nsf.gov/>)

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