CMPU 101 § 52

Problem-Solving and Abstraction

Spring 2023

VASSAR COLLEGE

A·D·1861

Hello, computer

Hello, computer
I QUIT SMOKING

We use computers every day as electronic *black boxes* that do amazing things by

collecting,

storing,

retrieving, and

transforming *data*.

Computers only do very basic things.

- Numerical calculations:
  - Add
  - Subtract
  - …
- Symbolic manipulations
  - Compare two numbers
  - Substitute one string of letters and numbers for another
  - …

But when trillions of these simple operations are arranged in the right order, amazing computations can be carried out:

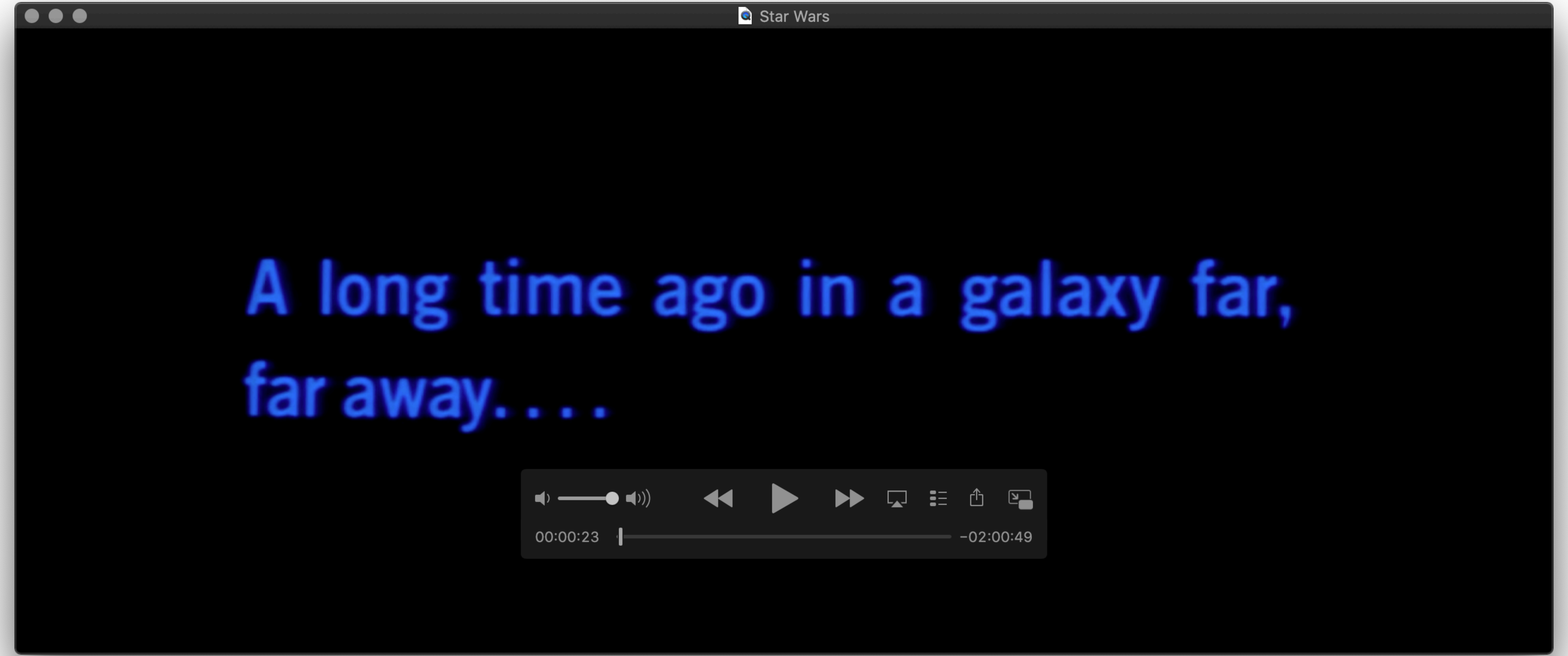
forecasting tomorrow’s weather

deciding where to drill for oil

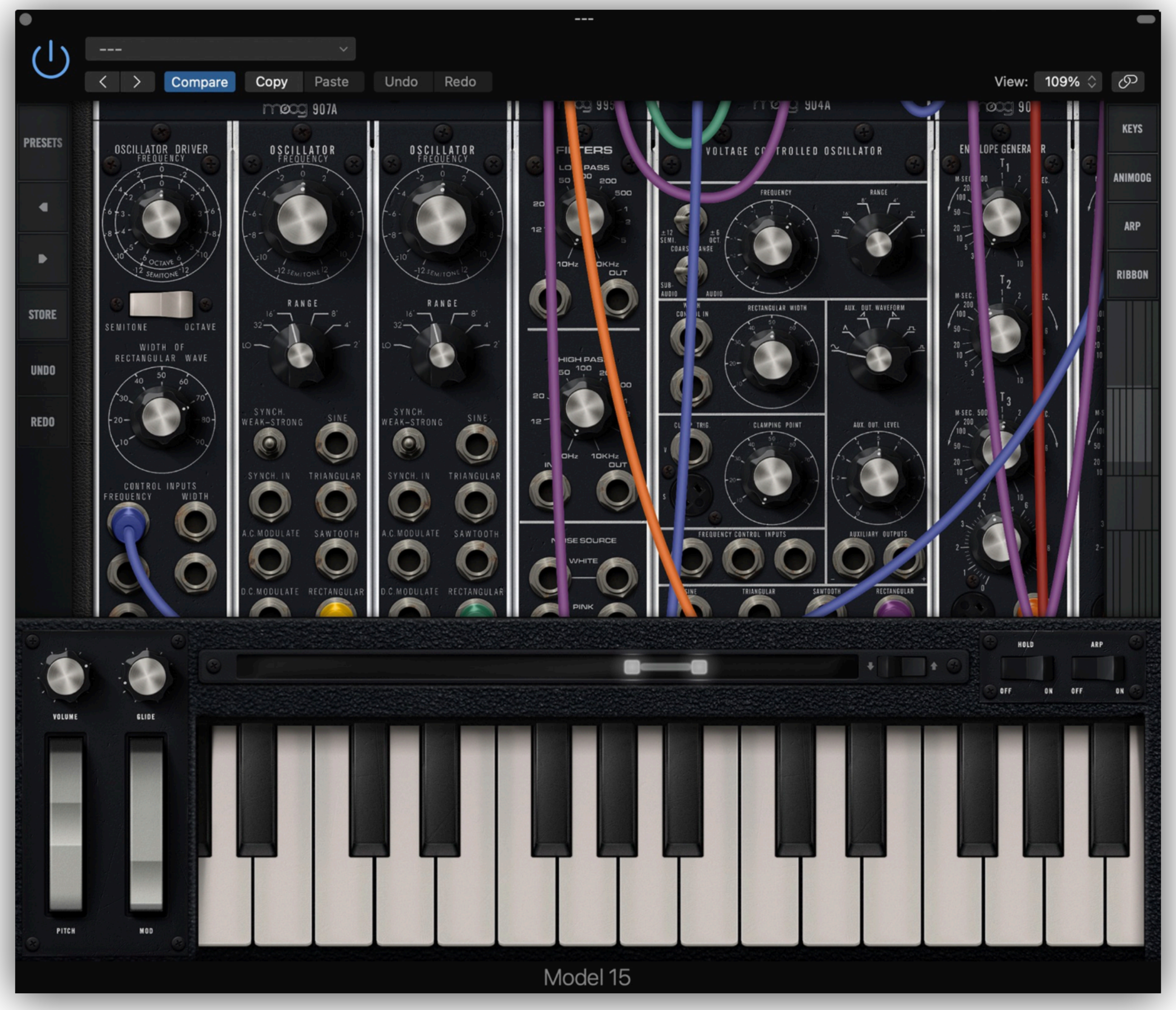
finding which physical places are most likely to be visited by a person

figuring out which two people would make a great couple 😘😍

…



A long time ago in a galaxy far,
far away. . . .


Compare
Copy
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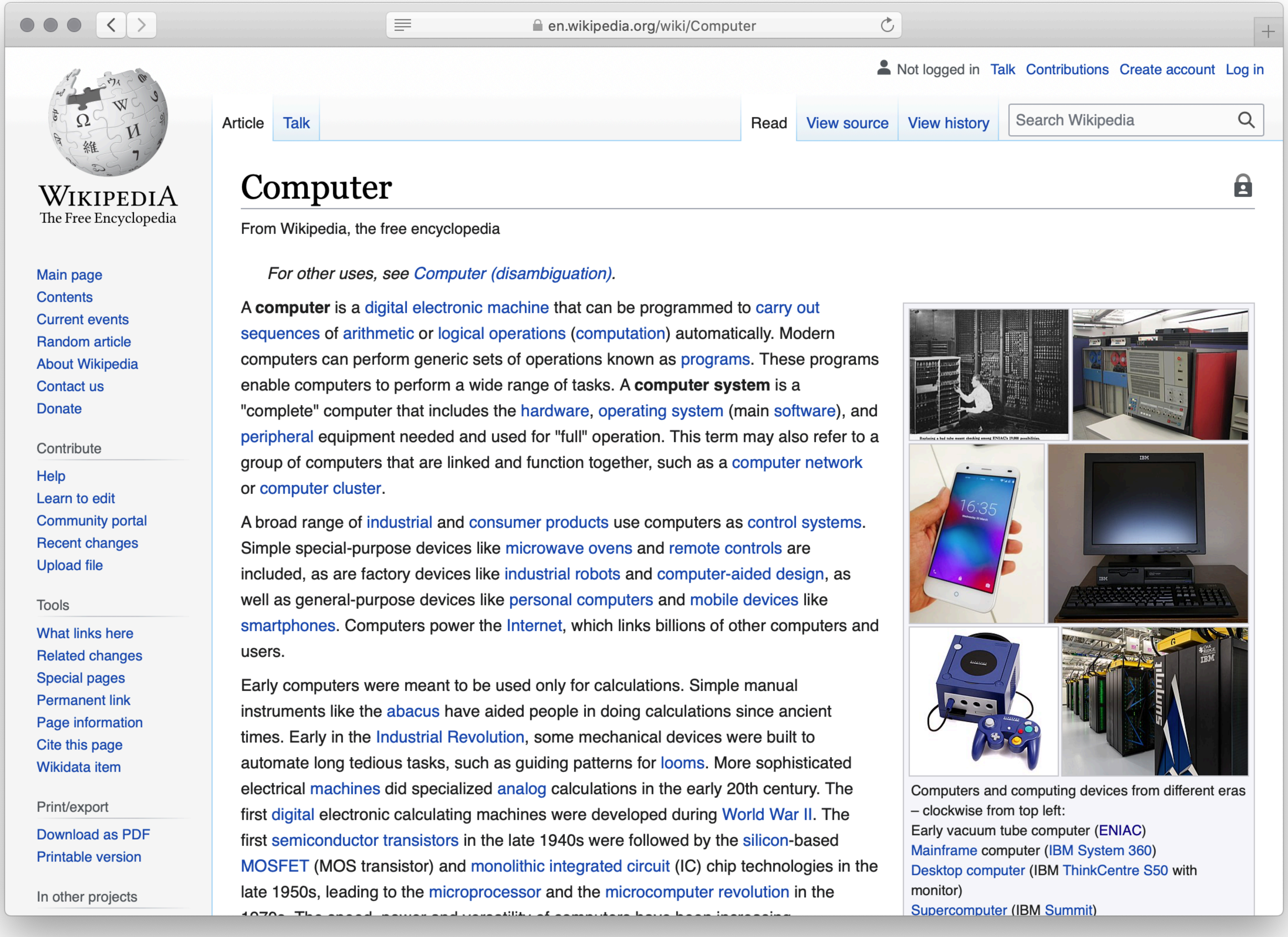
Undo
Redo
View: 109%
PRESETS
STORE
UNDO
REDO
KEYS
ANIMOOG
ARP
RIBBON
moog 907A
OSCILLATOR DRIVER
OSCILLATOR
OSCILLATOR
FILTERS
moog 904A
VOLTAGE CONTROLLED OSCILLATOR
ENVELOPE GENERATOR
VOLUME
GLIDE
PITCH
MOD
HOLD
ARP
OFF
ON
Model 15



en.wikipedia.org/wiki/Computer

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Computer

From Wikipedia, the free encyclopedia

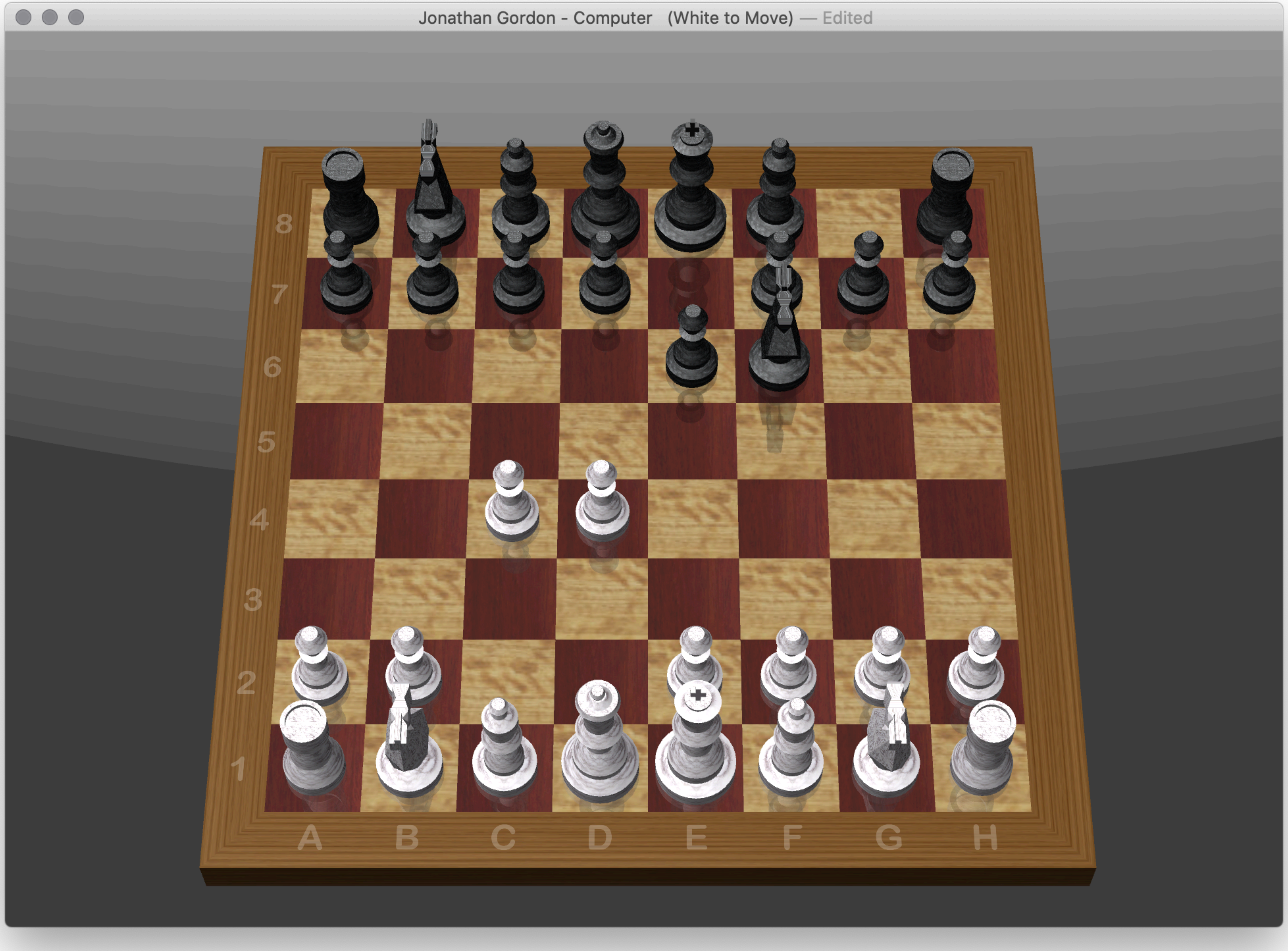
For other uses, see Computer (disambiguation).

A **computer** is a digital electronic machine that can be programmed to carry out sequences of arithmetic or logical operations (computation) automatically. Modern computers can perform generic sets of operations known as programs. These programs enable computers to perform a wide range of tasks. A **computer system** is a "complete" computer that includes the hardware, operating system (main software), and peripheral equipment needed and used for "full" operation. This term may also refer to a group of computers that are linked and function together, such as a computer network or computer cluster.

A broad range of industrial and consumer products use computers as control systems. Simple special-purpose devices like microwave ovens and remote controls are included, as are factory devices like industrial robots and computer-aided design, as well as general-purpose devices like personal computers and mobile devices like smartphones. Computers power the Internet, which links billions of other computers and users.

Early computers were meant to be used only for calculations. Simple manual instruments like the abacus have aided people in doing calculations since ancient times. Early in the Industrial Revolution, some mechanical devices were built to automate long tedious tasks, such as guiding patterns for looms. More sophisticated electrical machines did specialized analog calculations in the early 20th century. The first digital electronic calculating machines were developed during World War II. The first semiconductor transistors in the late 1940s were followed by the silicon-based MOSFET (MOS transistor) and monolithic integrated circuit (IC) chip technologies in the late 1950s, leading to the microprocessor and the microcomputer revolution in the 1970s. The speed, power and versatility of computers have been increasing

Computers and computing devices from different eras – clockwise from top left:
Early vacuum tube computer (ENIAC)
Mainframe computer (IBM System 360)
Desktop computer (IBM ThinkCentre S50 with monitor)
Supercomputer (IBM Summit)


Jonathan Gordon - Computer (White to Move) — Edited
8
7
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The magic of a computer is its ability to become almost anything you can imagine…

…as long as you can explain *exactly* what that is.

When we program a computer to do something, everything needs to be described precisely.

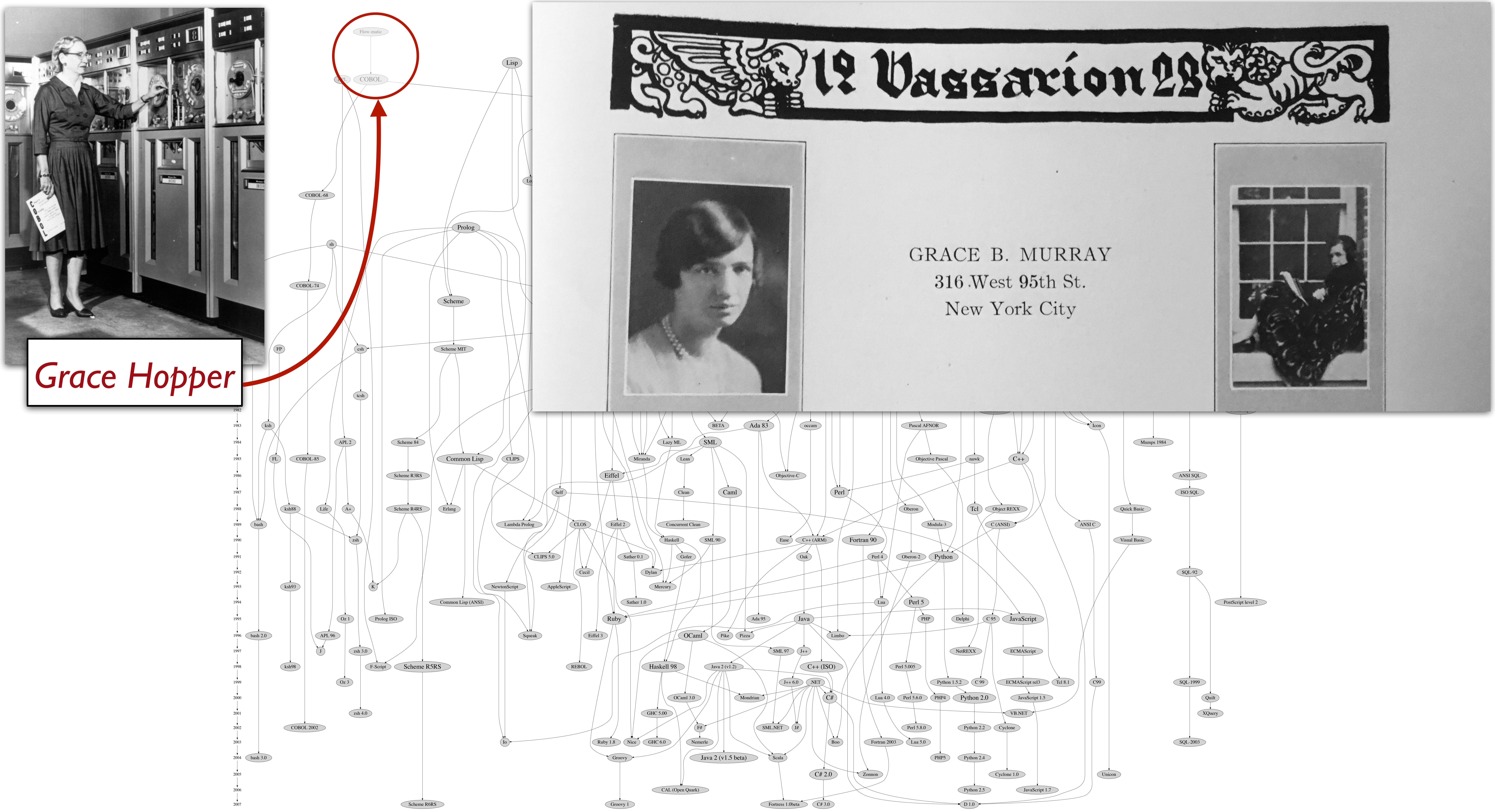
Say you tell an accounting program to bill your clients the amount each owes.

Should the computer send a weekly bill for $0 to clients who owe nothing?

If you tell the computer to send a threatening letter to clients who haven’t paid, then clients who owe nothing will receive threatening letters until they send you a payment of $0!

When computers behave intelligently, it’s because a person used *their* intelligence to design an intelligent program.

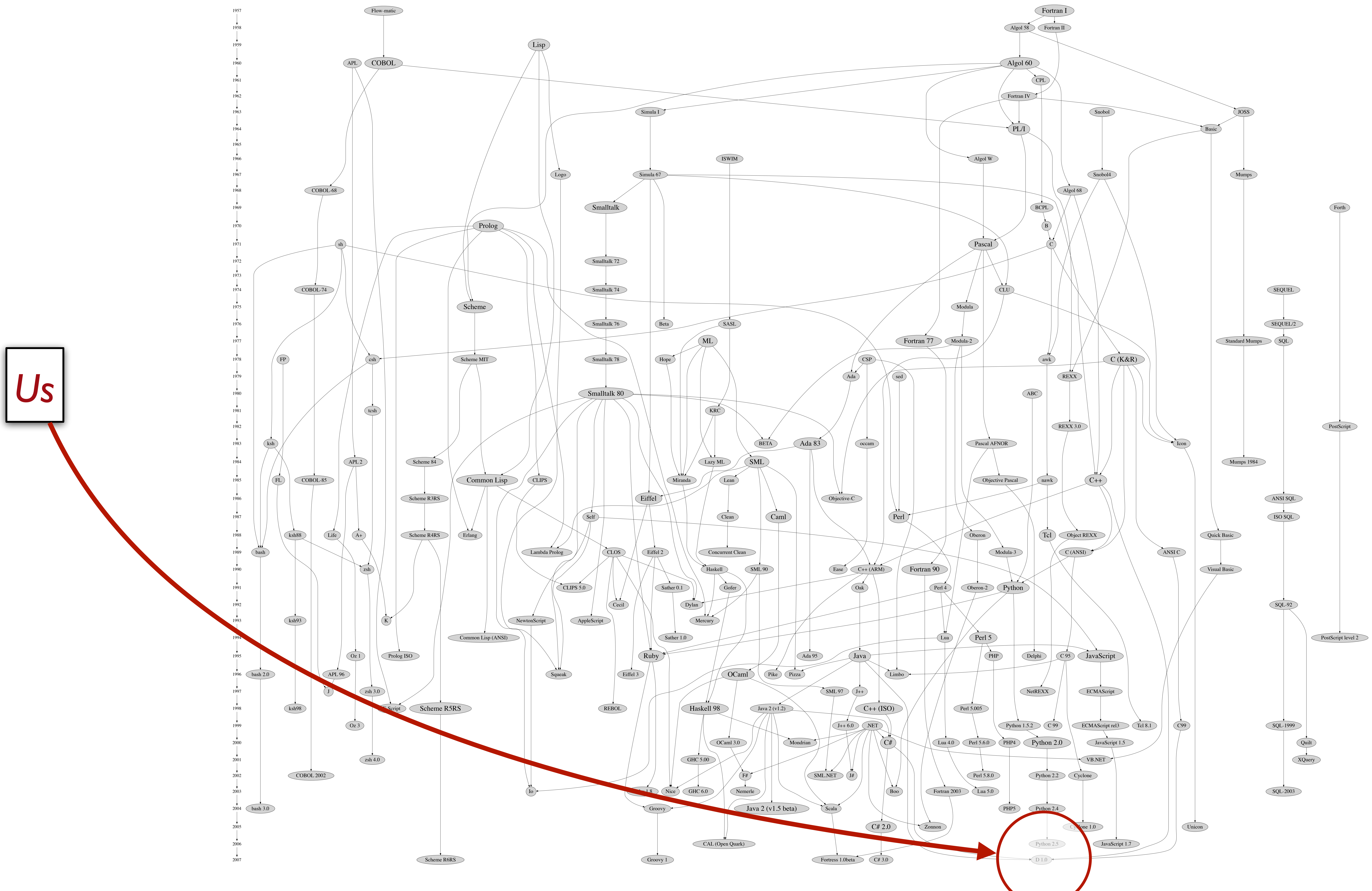
There are many programming languages we can use to write these programs.



19 Vassarion 28

GRACE B. MURRAY
316 West 95th St.
New York City

github.com/stereobooster/programming-languages-genealogical-tree



Us

github.com/stereobooster/programming-languages-genealogical-tree

There are many programming languages due to

intended use

history

habit

taste

Ancient history (my childhood)

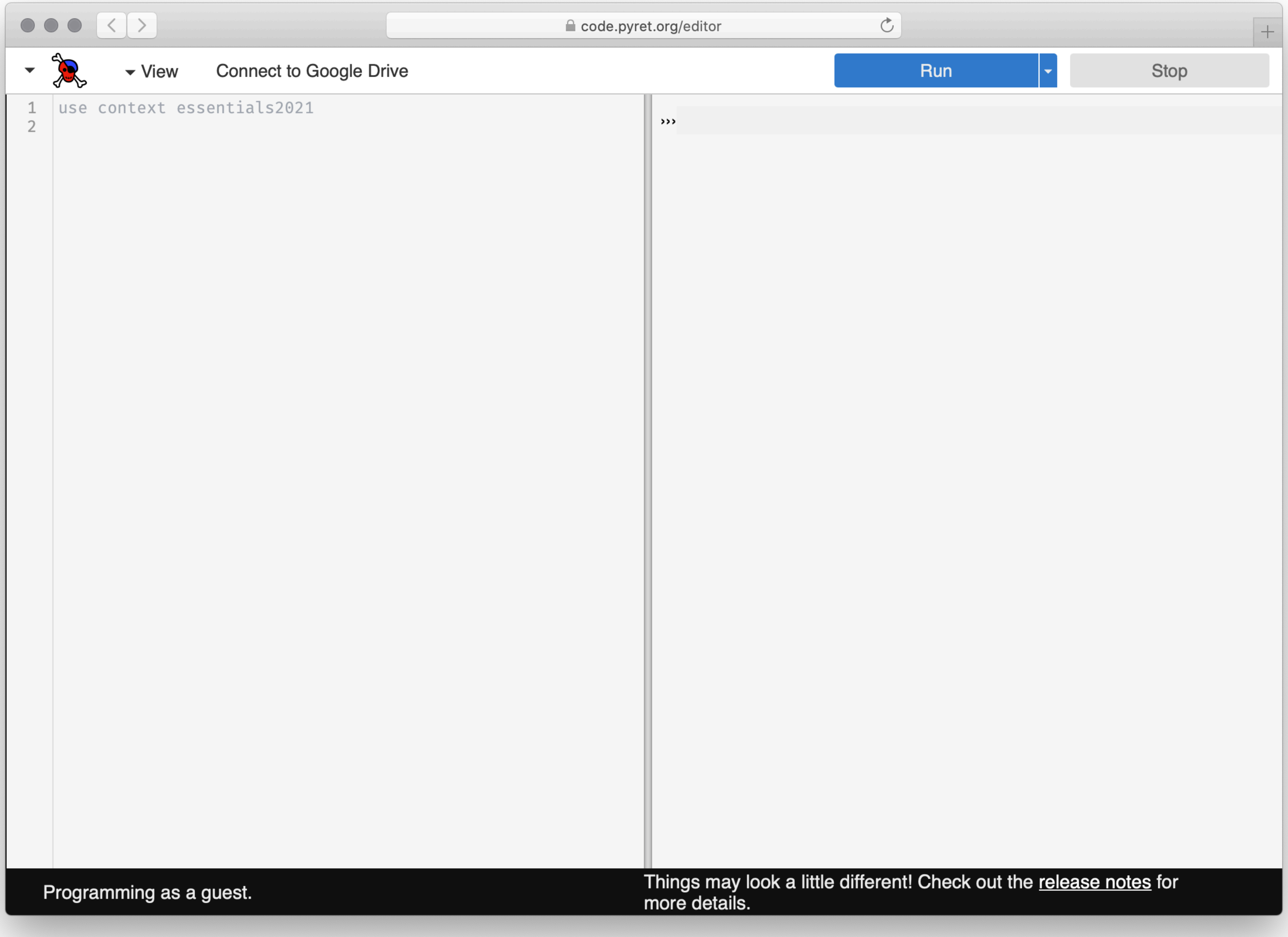
```
MEMORY SIZE?
MEMORY SIZE?
RADIO SHACK LEVEL II BASIC
READY
>?MEM
 31956
READY
>_
```

In this course, we'll be working in two programming languages:

Why join the navy if you can be a pirate?

famous Steve Jobs quote

—with apologies to Grace Hopper, who was actually a rear admiral in the Navy!

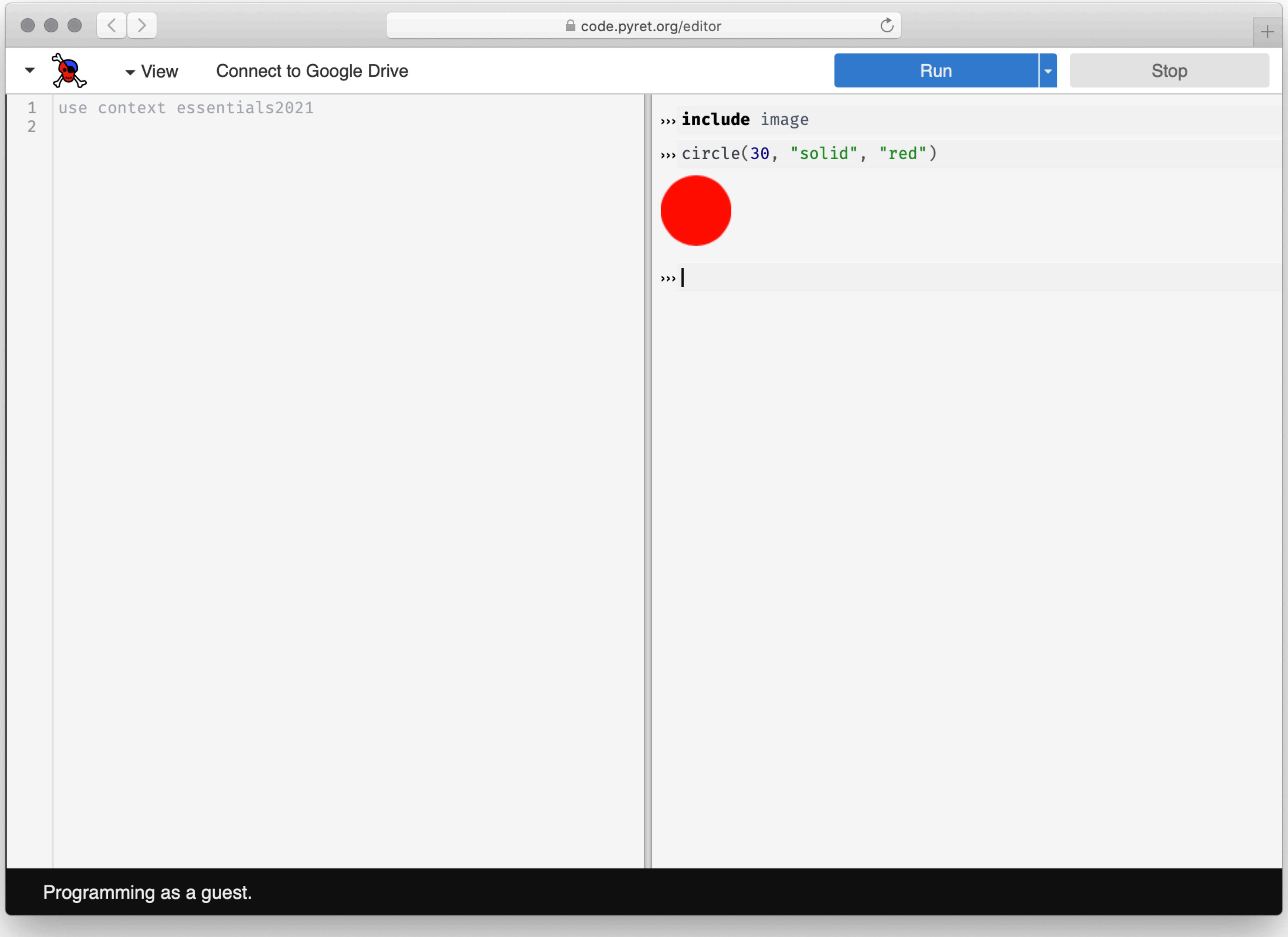


```
use context essentials2021
```

Programming as a guest.

Things may look a little different! Check out the release notes for more details.

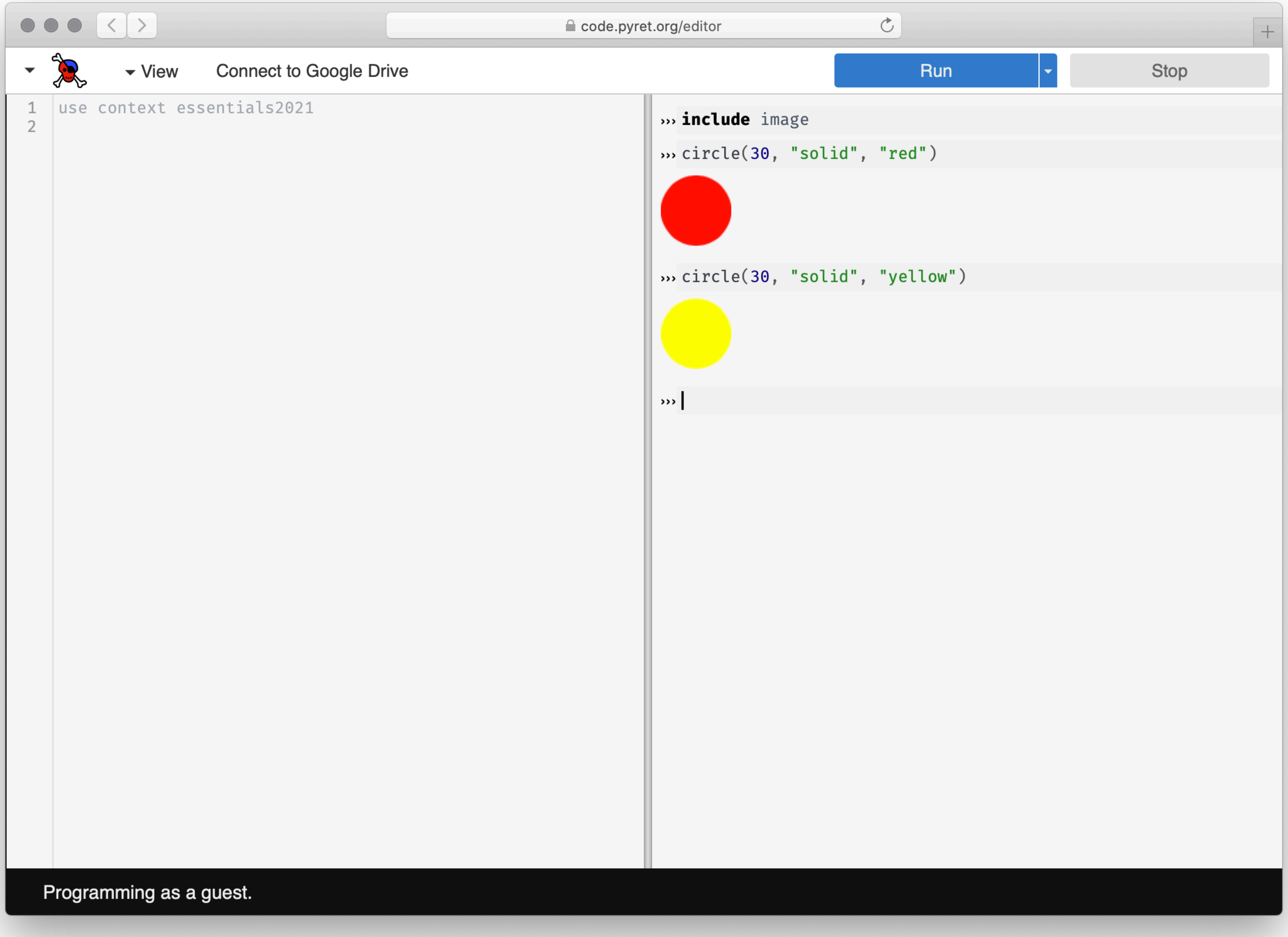
code.pyret.org/editor



```
use context essentials2021
```

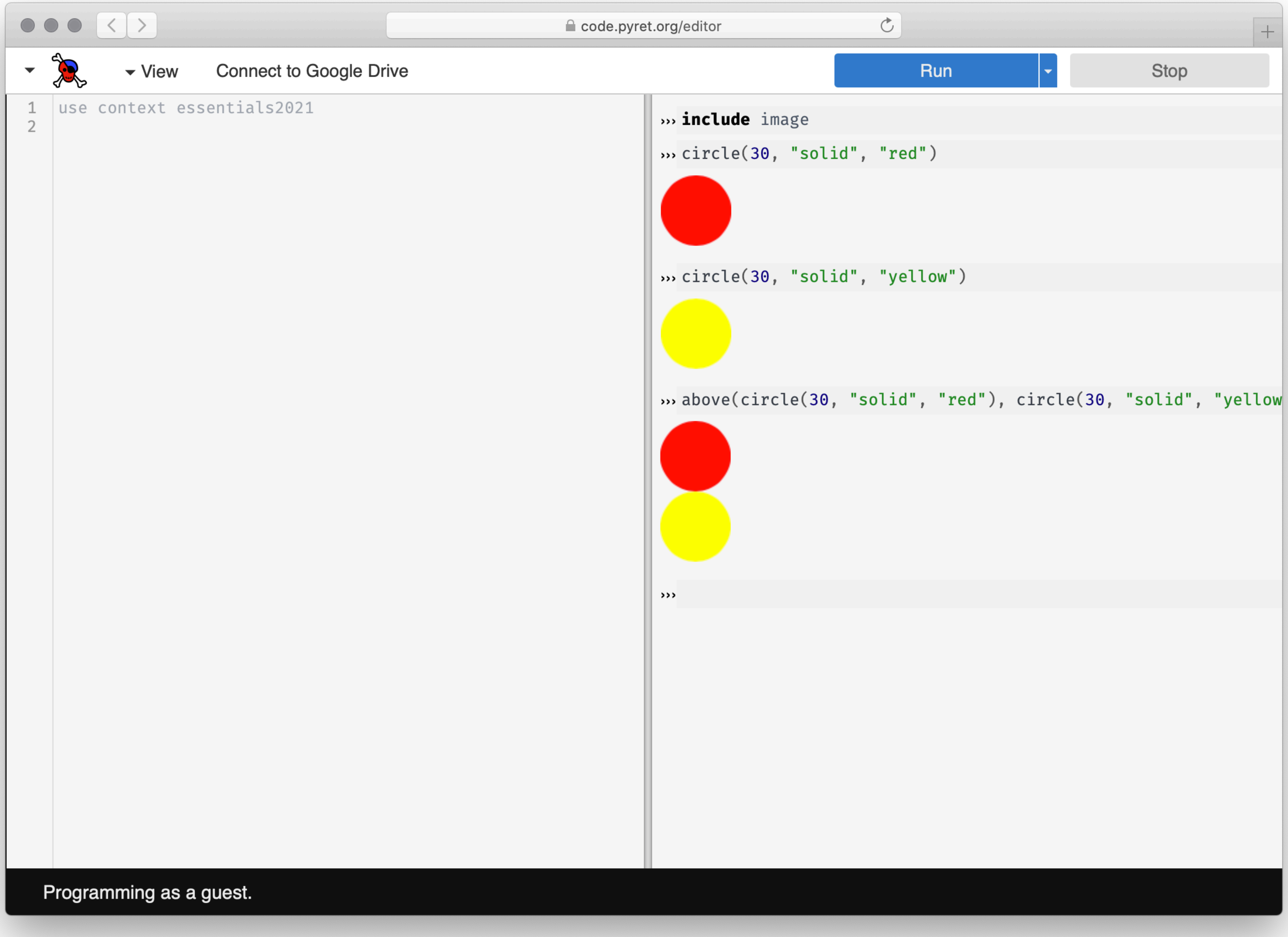
```
››› include image
››› circle(30, "solid", "red")
›››
```

Programming as a guest.



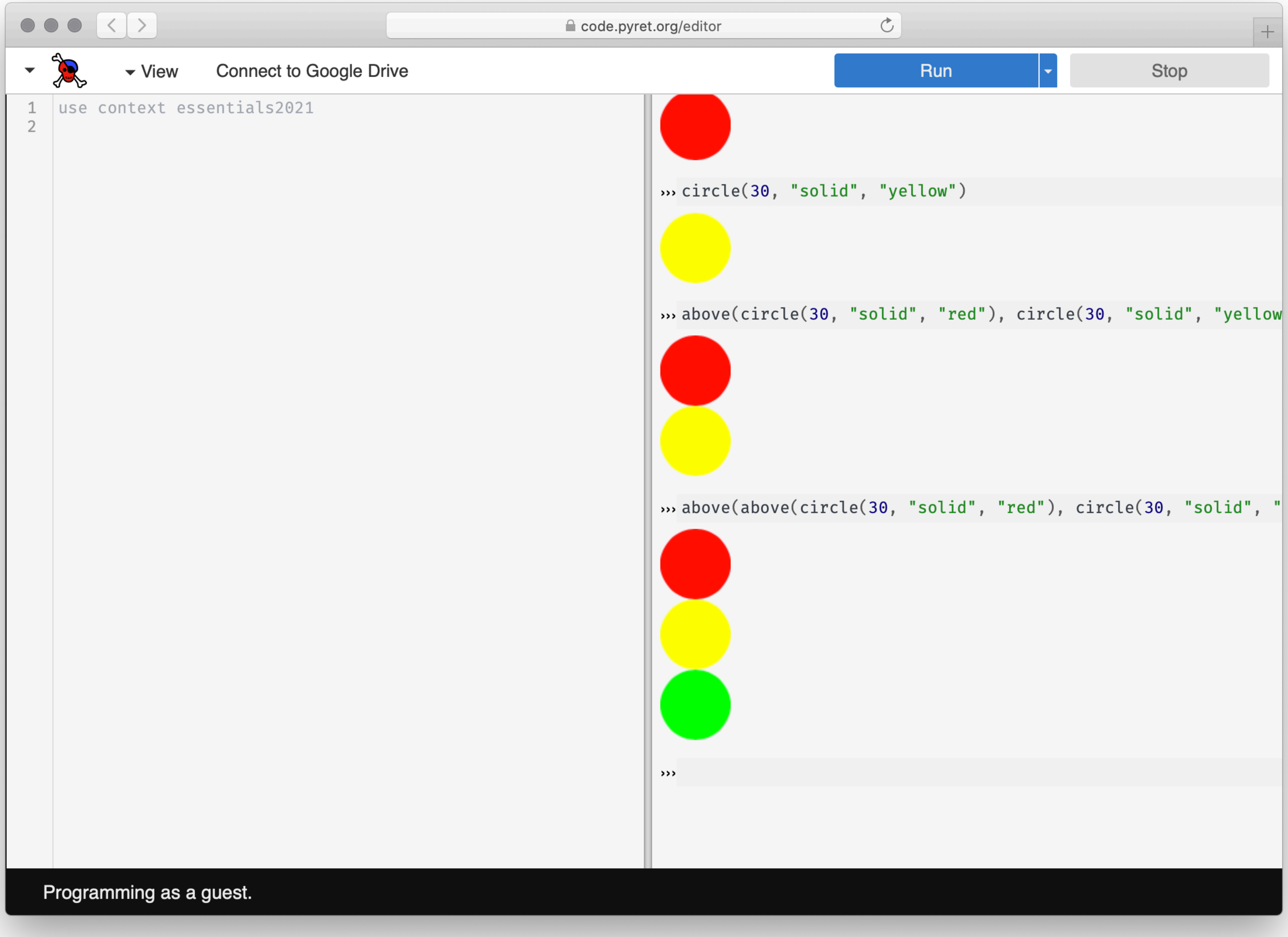
```
use context essentials2021
```

```
››› include image
››› circle(30, "solid", "red")
››› circle(30, "solid", "yellow")
›››
```



```
use context essentials2021
```

```
››› include image
››› circle(30, "solid", "red")
››› circle(30, "solid", "yellow")
››› above(circle(30, "solid", "red"), circle(30, "solid", "yellow
›››
```



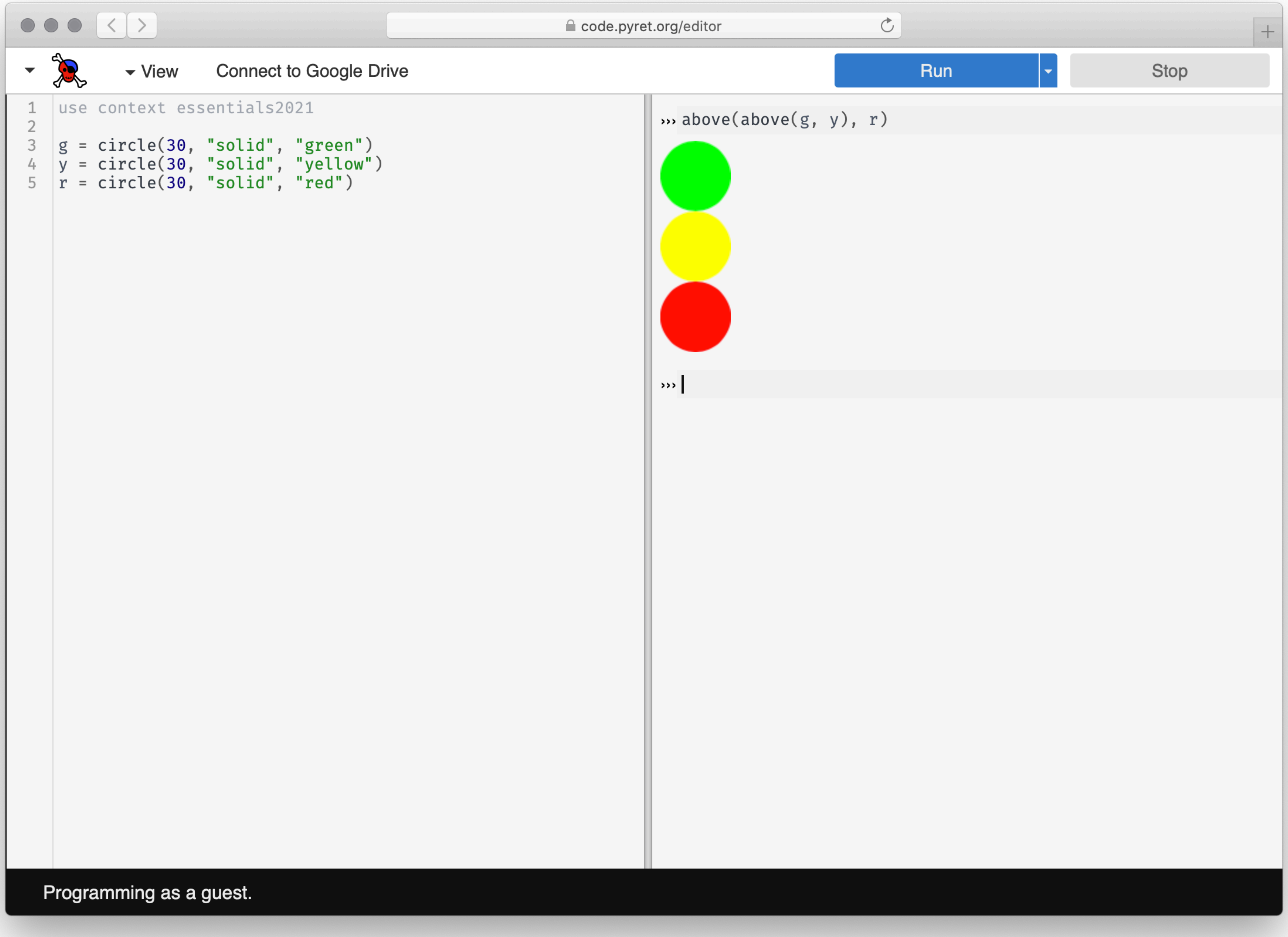
```
use context essentials2021
```

```
››› circle(30, "solid", "yellow")
››› above(circle(30, "solid", "red"), circle(30, "solid", "yellow
››› above(above(circle(30, "solid", "red"), circle(30, "solid", "
›››
```

Drawing pictures this way is fun – but also a lot of typing.

Here's where things gets interesting:

We can define new words.

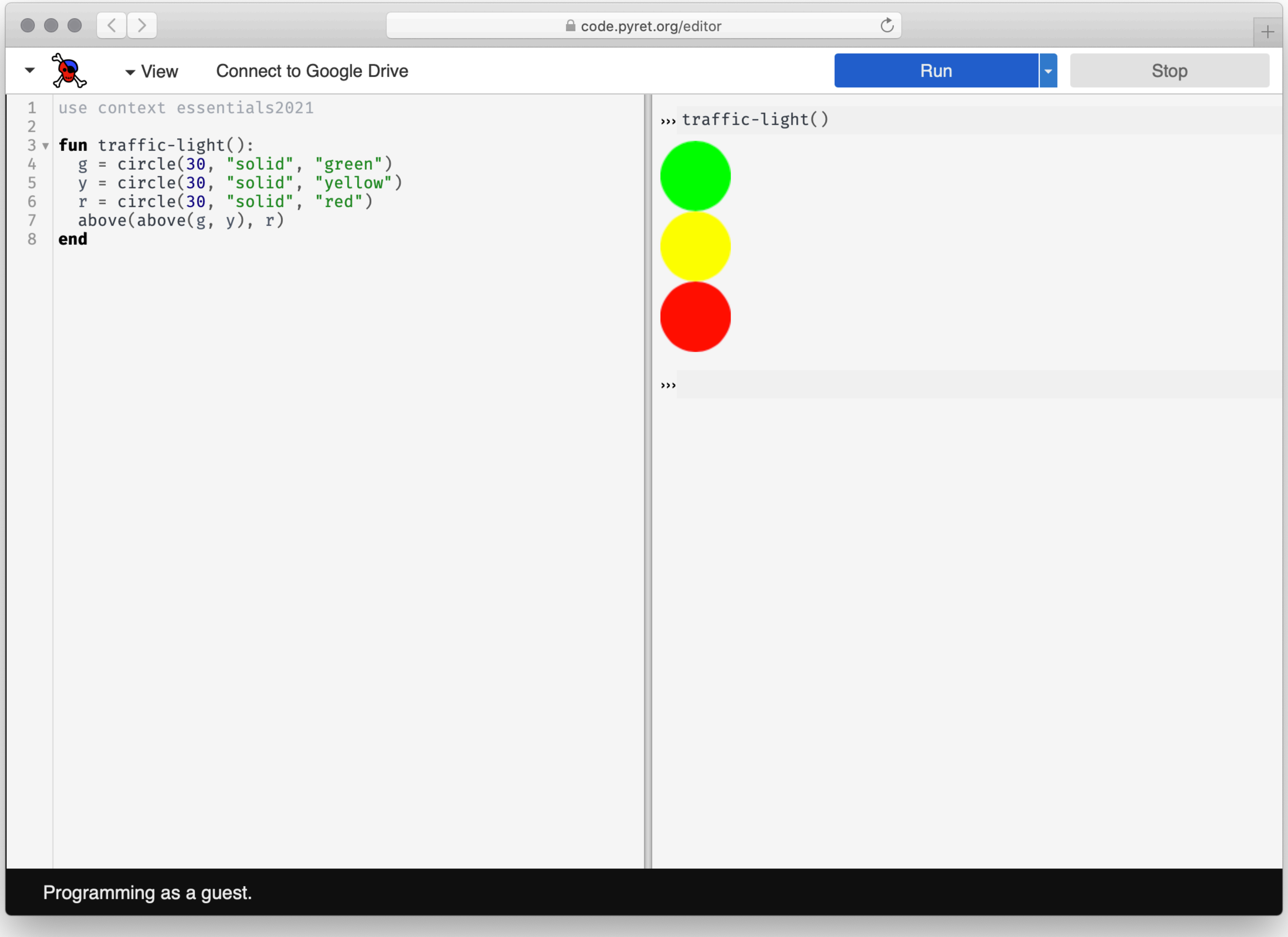


```
use context essentials2021

g = circle(30, "solid", "green")
y = circle(30, "solid", "yellow")
r = circle(30, "solid", "red")
```

```
››› above(above(g, y), r)
```

```
›››
```

Programming as a guest.



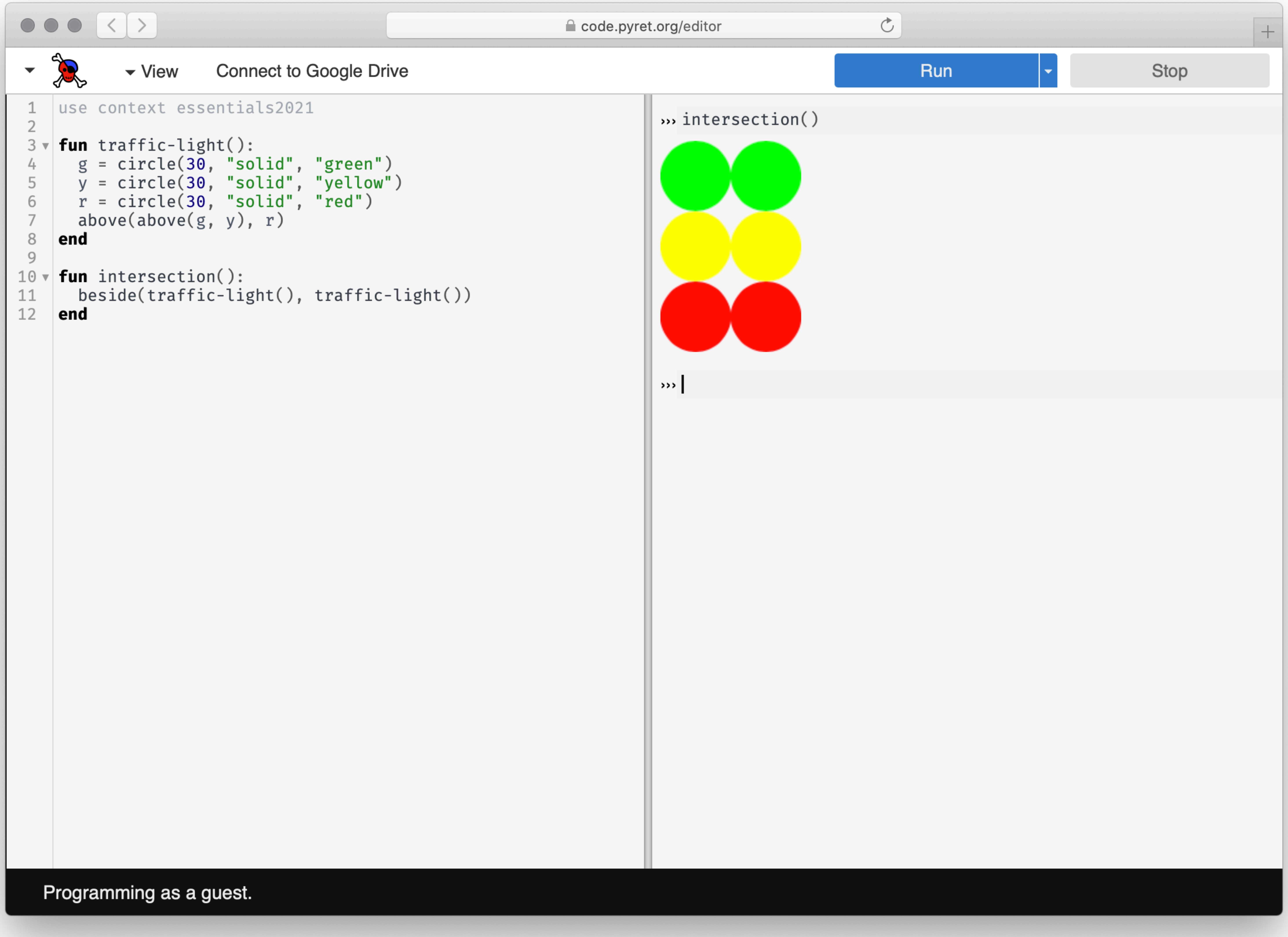
```
use context essentials2021

fun traffic-light():
  g = circle(30, "solid", "green")
  y = circle(30, "solid", "yellow")
  r = circle(30, "solid", "red")
  above(above(g, y), r)
end
```

```
››› traffic-light()
```

```
›››
```

Programming as a guest.

In extending the language, the programmer uses the power of functional abstraction to *create new building blocks*.

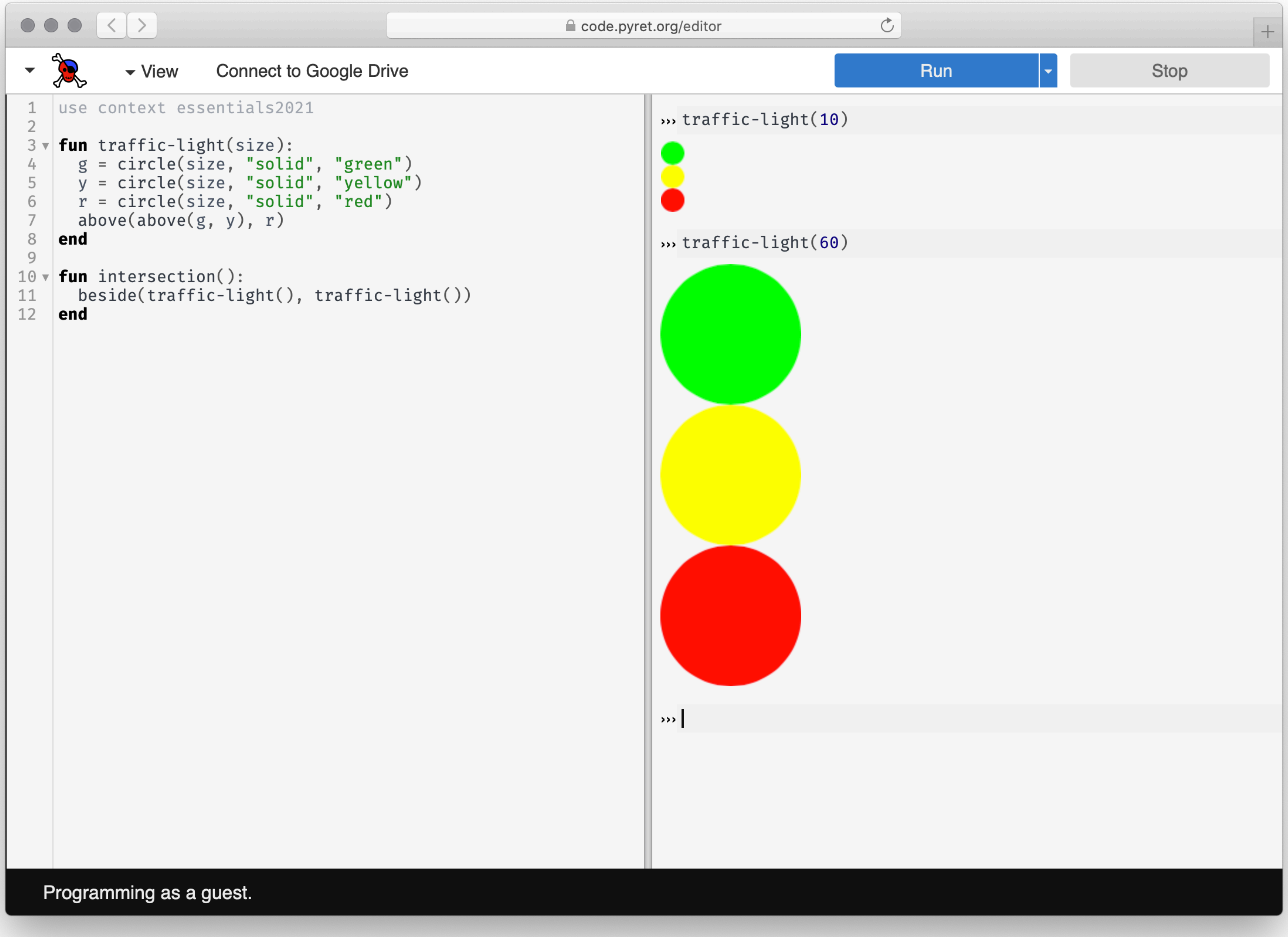


```
use context essentials2021

fun traffic-light():
  g = circle(30, "solid", "green")
  y = circle(30, "solid", "yellow")
  r = circle(30, "solid", "red")
  above(above(g, y), r)
end

fun intersection():
  beside(traffic-light(), traffic-light())
end
```

```
››› intersection()
```

```
›››
```

Programming as a guest.



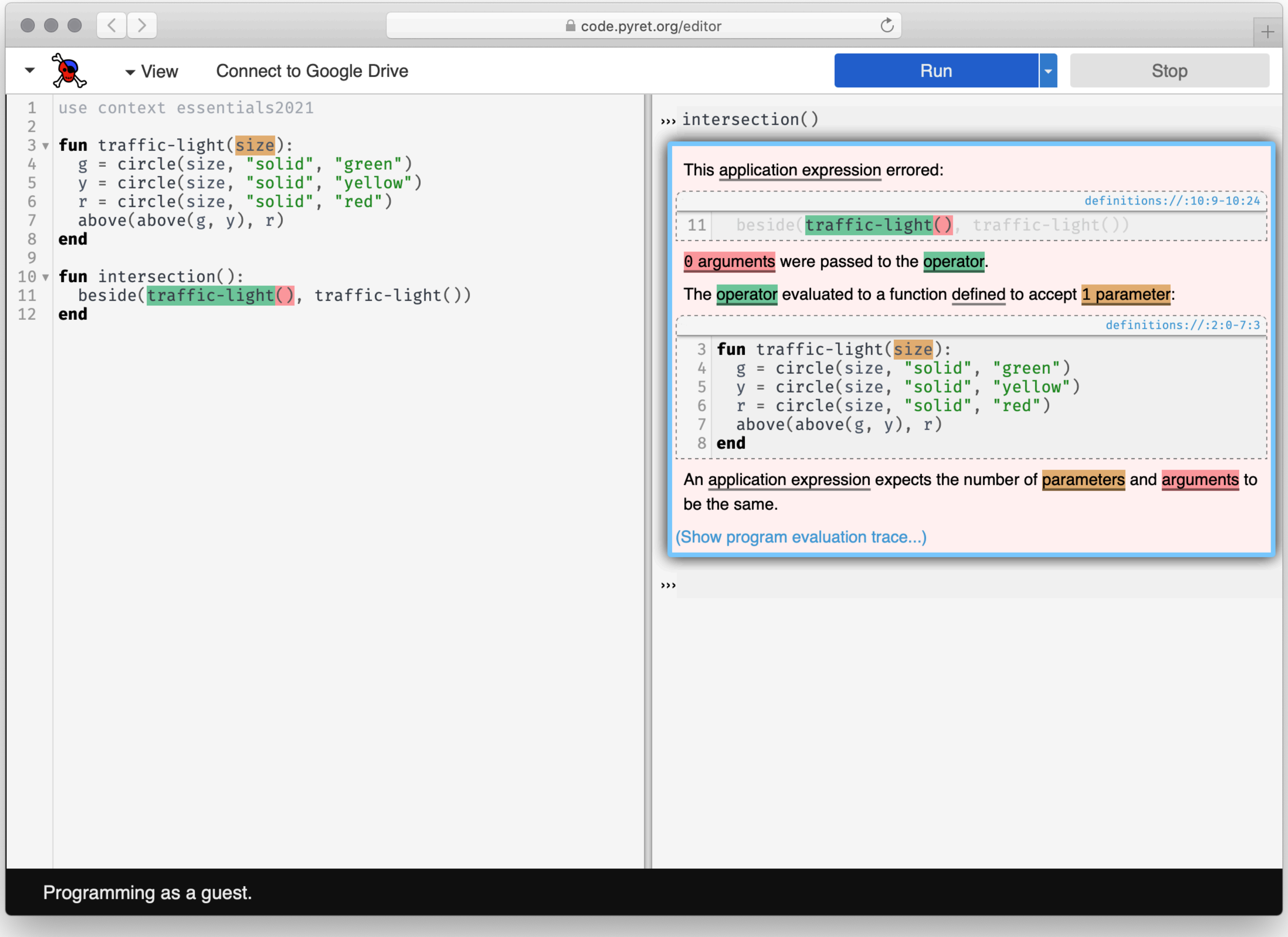
```
use context essentials2021

fun traffic-light(size):
  g = circle(size, "solid", "green")
  y = circle(size, "solid", "yellow")
  r = circle(size, "solid", "red")
  above(above(g, y), r)
end

fun intersection():
  beside(traffic-light(), traffic-light())
end
```

```
››› traffic-light(10)
```

```
››› traffic-light(60)
```

```
›››
```

Programming as a guest.



```
use context essentials2021

fun traffic-light(size):
  g = circle(size, "solid", "green")
  y = circle(size, "solid", "yellow")
  r = circle(size, "solid", "red")
  above(above(g, y), r)
end

fun intersection():
  beside(traffic-light(), traffic-light())
end
```

```
››› intersection()
```

This application expression errored:

definitions://:10:9-10:24

```
11   beside(traffic-light(), traffic-light())
```

0 arguments were passed to the operator.

The operator evaluated to a function defined to accept 1 parameter:

definitions://:2:0-7:3

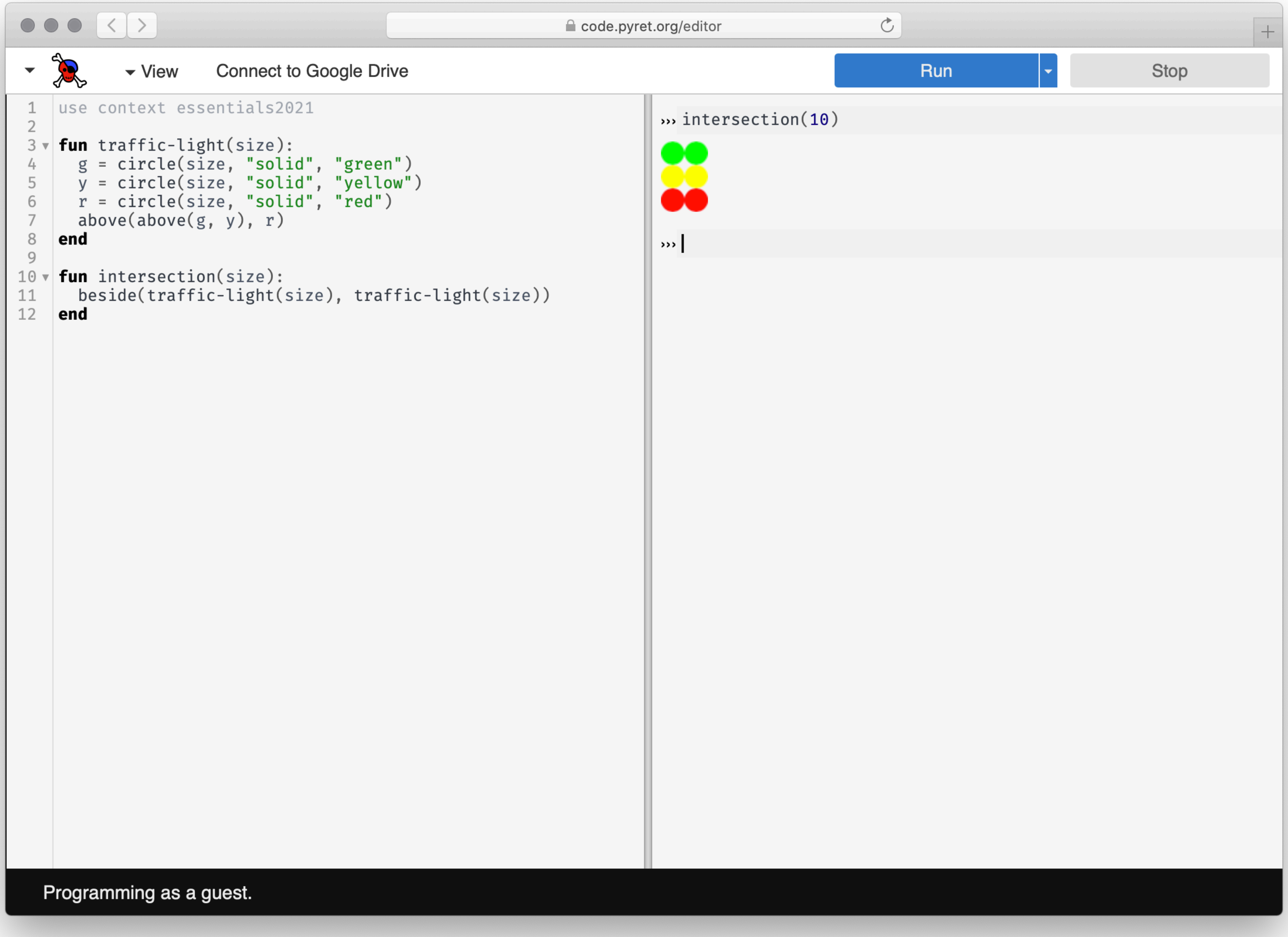
```
3 fun traffic-light(size):
4   g = circle(size, "solid", "green")
5   y = circle(size, "solid", "yellow")
6   r = circle(size, "solid", "red")
7   above(above(g, y), r)
8 end
```

An application expression expects the number of parameters and arguments to be the same.

(Show program evaluation trace...)

```
›››
```

Programming as a guest.



```
use context essentials2021

fun traffic-light(size):
  g = circle(size, "solid", "green")
  y = circle(size, "solid", "yellow")
  r = circle(size, "solid", "red")
  above(above(g, y), r)
end

fun intersection(size):
  beside(traffic-light(size), traffic-light(size))
end
```

```
››› intersection(10)
```

```
›››
```

What will we do in this course?

1 Identify and organize the data needed to solve a problem — *Data design*

2 Break a problem down into subproblems that can be solved with computations — *Programming*

3 Express computations over the data — *Programming/CS*

4 Test those computations to make sure they're doing what they're supposed to — *Testing*

0 Think about whether it’s a good idea to solve the problem, and how your solution might affect the world around you.

This course teaches skills that will help you both in computer science and beyond.

Two major units:

Tabular / data science data Other core CS data structures and how to program with them	*Pyret*
Additional data structures and programming techniques	*Python*

Goals

Apply fundamental data-organizations (called data structures) to capture the information in a computing problem.

Break down a computing question into manageable smaller problems.

Write programs to compute answers to questions over fundamental data structures.

Check whether your programs behave as intended/required.

Course information

Class:

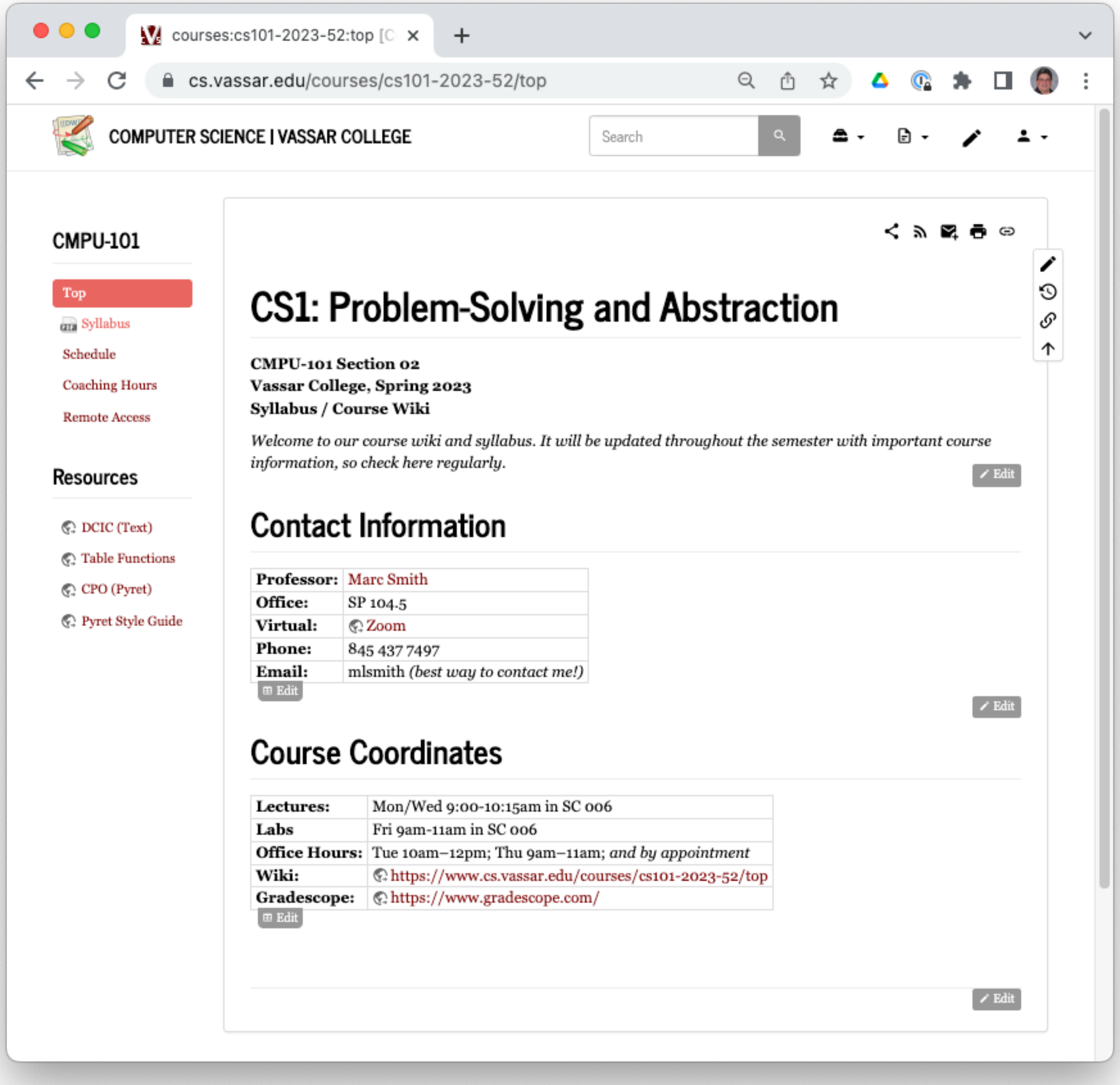
Monday & Wednesday, 9:00–10:15 a.m.

Sanders Classroom 006

Lab:

Friday, 9:00–11:00 a.m.

Sanders Classroom 006



CS1: Problem-Solving and Abstraction

CMPU-101 Section 02
Vassar College, Spring 2023
Syllabus / Course Wiki

Welcome to our course wiki and syllabus. It will be updated throughout the semester with important course information, so check here regularly.

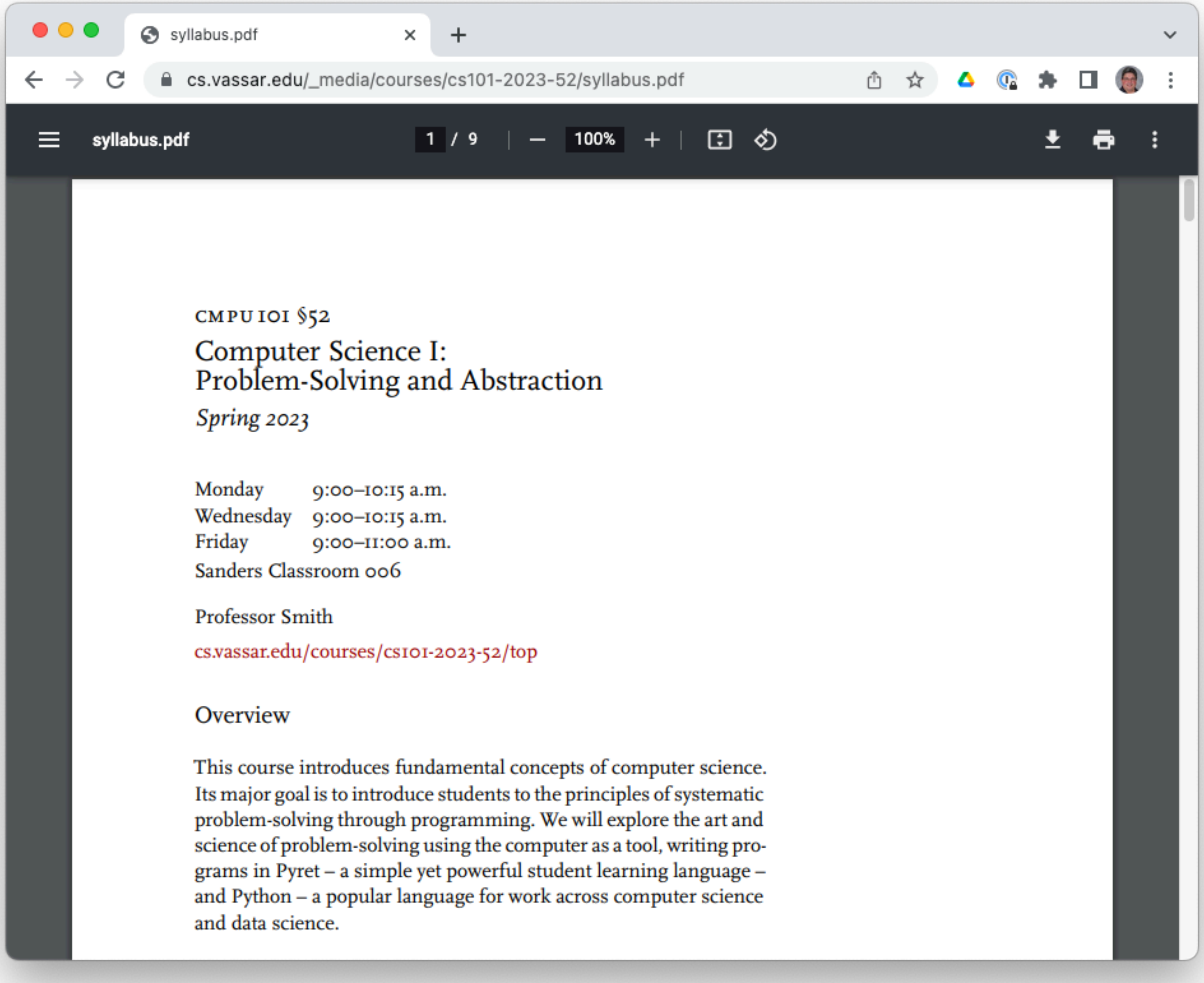
Contact Information

Professor:	Marc Smith
Office:	SP 104.5
Virtual:	Zoom
Phone:	845 437 7497
Email:	mlsmith *(best way to contact me!)*

Course Coordinates

Lectures:	Mon/Wed 9:00-10:15am in SC 006
Labs	Fri 9am-11am in SC 006
Office Hours:	Tue 10am–12pm; Thu 9am–11am; *and by appointment*
Wiki:	https://www.cs.vassar.edu/courses/cs101-2023-52/top
Gradescope:	https://www.gradescope.com/

https://www.cs.vassar.edu/courses/cs101-2023-52/top



CMPU 101 §52

Computer Science I: Problem-Solving and Abstraction

Spring 2023

Monday	9:00–10:15 a.m.
Wednesday	9:00–10:15 a.m.
Friday	9:00–11:00 a.m.

Sanders Classroom 006

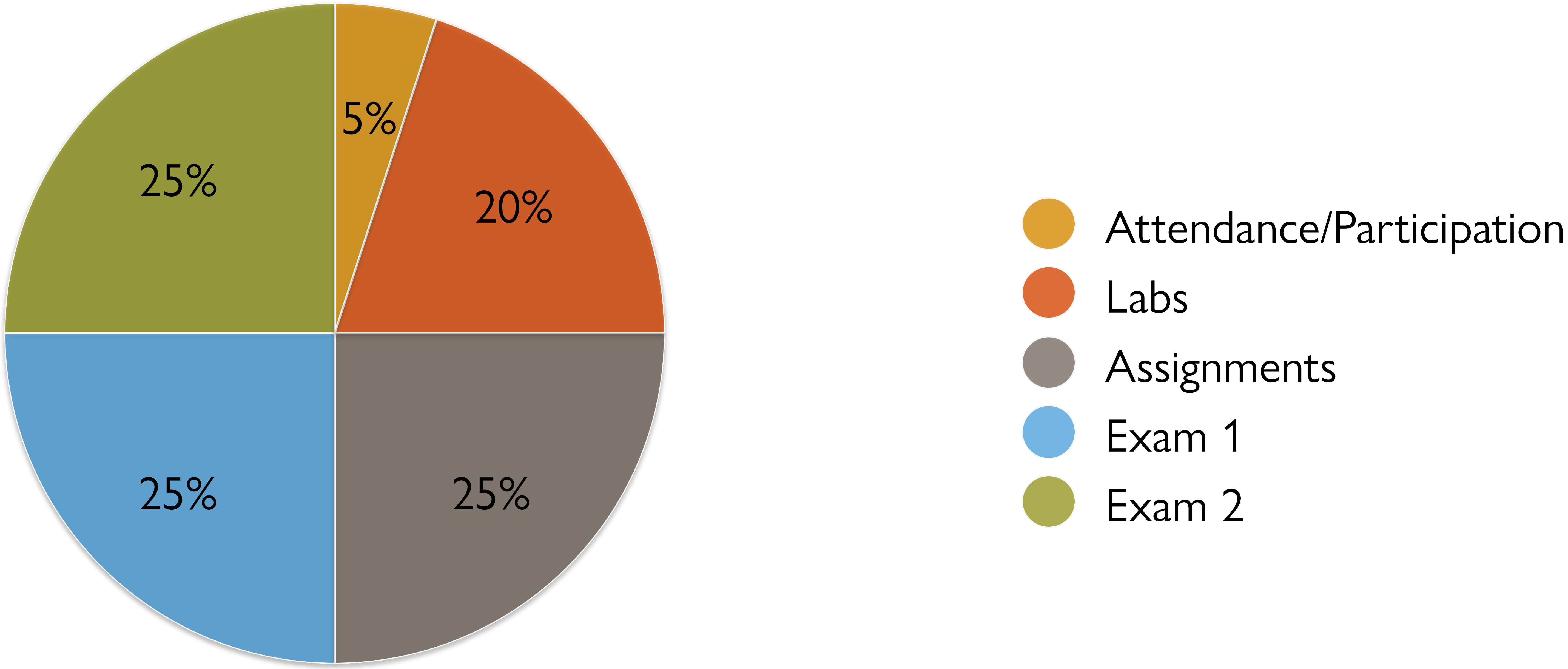
Professor Smith

cs.vassar.edu/courses/cs101-2023-52/top

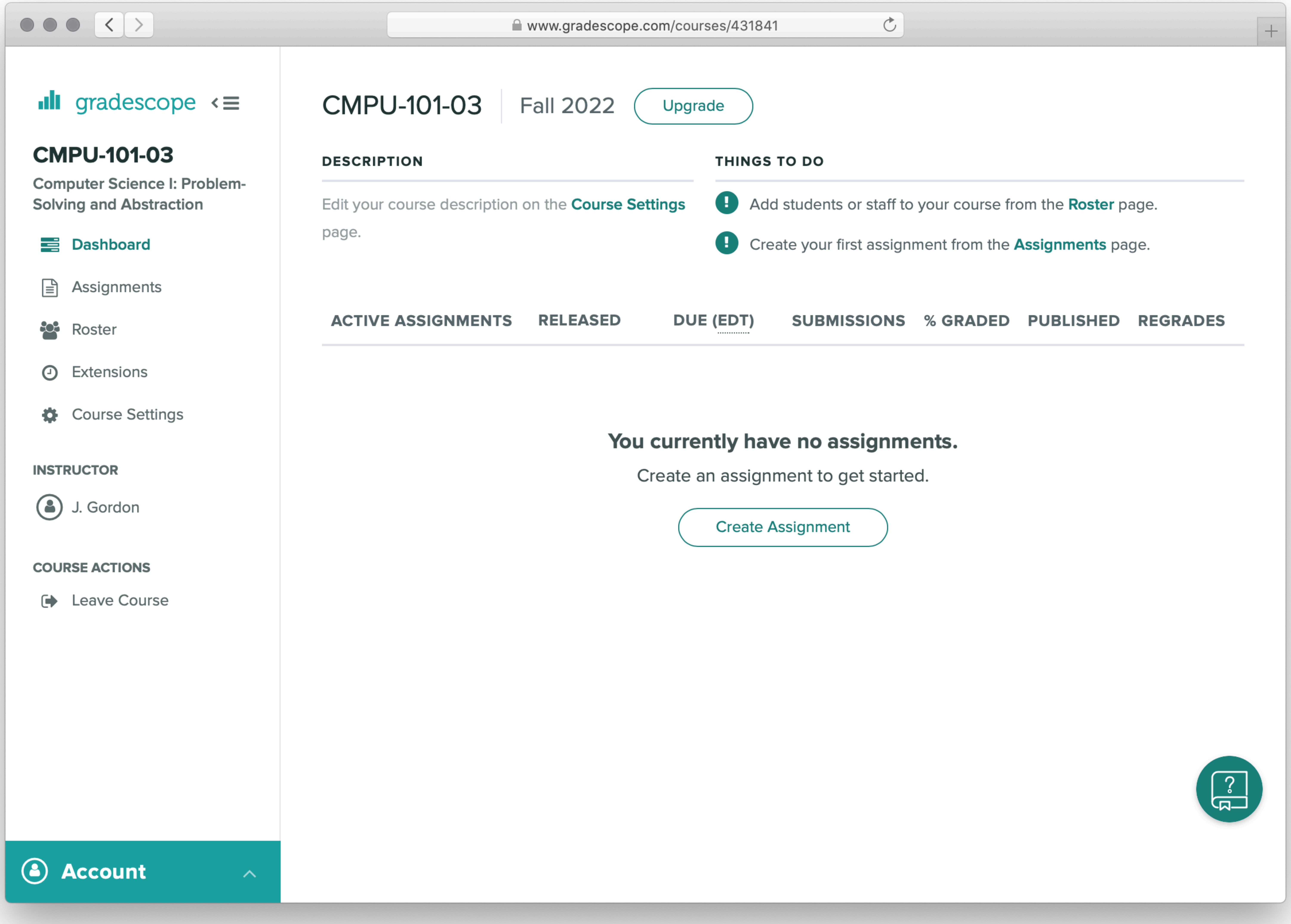
Overview

This course introduces fundamental concepts of computer science. Its major goal is to introduce students to the principles of systematic problem-solving through programming. We will explore the art and science of problem-solving using the computer as a tool, writing programs in Pyret – a simple yet powerful student learning language – and Python – a popular language for work across computer science and data science.

Grading



5 components



CMPU-101-03

Computer Science I: Problem-Solving and Abstraction

INSTRUCTOR

J. Gordon

COURSE ACTIONS

CMPU-101-03 | Fall 2022

DESCRIPTION

Edit your course description on the **Course Settings** page.

THINGS TO DO

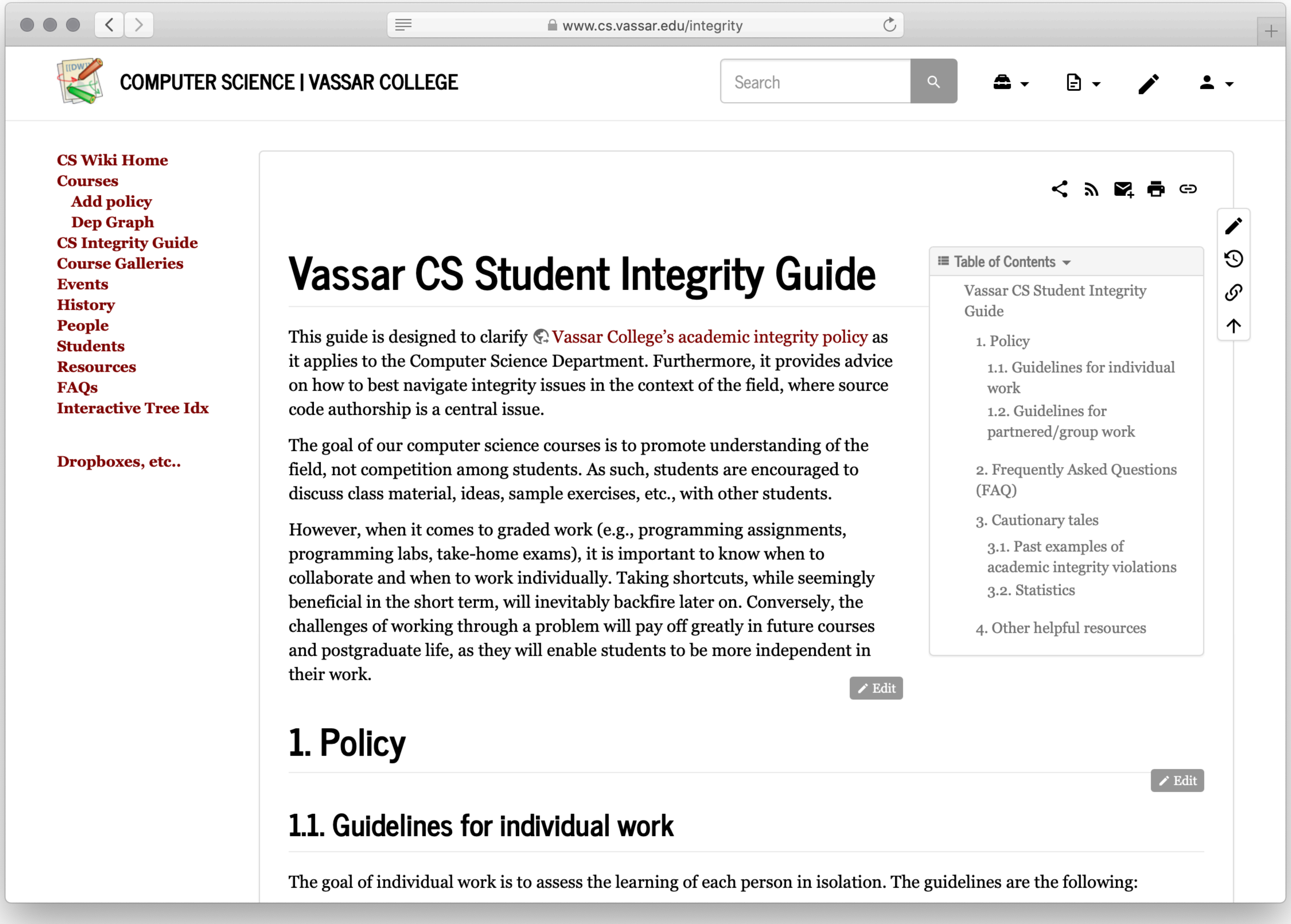
- Add students or staff to your course from the **Roster** page.
- Create your first assignment from the **Assignments** page.

ACTIVE ASSIGNMENTS	RELEASED	DUE (EDT)	SUBMISSIONS	% GRADED	PUBLISHED	REGRADES

You currently have no assignments.

Create an assignment to get started.

gradescope.com



Vassar CS Student Integrity Guide

This guide is designed to clarify Vassar College's academic integrity policy as it applies to the Computer Science Department. Furthermore, it provides advice on how to best navigate integrity issues in the context of the field, where source code authorship is a central issue.

The goal of our computer science courses is to promote understanding of the field, not competition among students. As such, students are encouraged to discuss class material, ideas, sample exercises, etc., with other students.

However, when it comes to graded work (e.g., programming assignments, programming labs, take-home exams), it is important to know when to collaborate and when to work individually. Taking shortcuts, while seemingly beneficial in the short term, will inevitably backfire later on. Conversely, the challenges of working through a problem will pay off greatly in future courses and postgraduate life, as they will enable students to be more independent in their work.

1. Policy

1.1. Guidelines for individual work

The goal of individual work is to assess the learning of each person in isolation. The guidelines are the following:

www.cs.vassar.edu/integrity

“All through our education, we are being taught a kind of reverse mindfulness. A kind of Future Studies where – via the guise of mathematics, or literature, or history, or computer programming, or French – we are being taught to think of a time different to the time we are in. Exam time. Job time. When-we-are-grown-up time.

To see the act of learning as something not for its own sake but because of what it will *get* you reduces the wonder of humanity. We are thinking, feeling, art-making, knowledge-hungry, marvelous animals, who understand ourselves and our world through the act of learning. It is an end in itself. It has far more to offer than the things it lets us write on application forms. It is a way to love living right now.”

Matt Haig, *Notes on a Nervous Planet*

So…

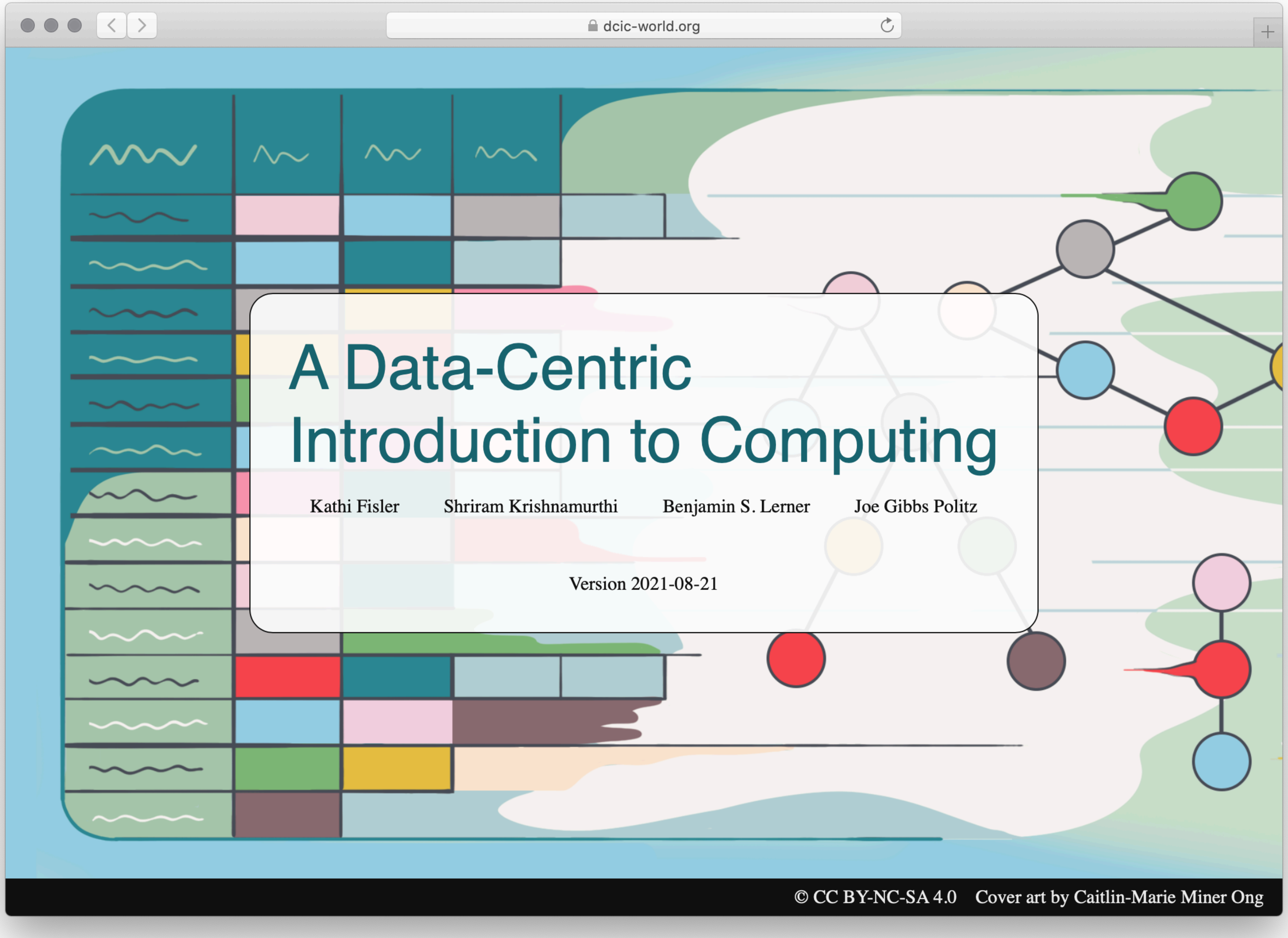
Don’t just focus on grades.

Don’t just focus on what happens if you get an A in the course.

Be here now.

If you worry about whether you understand what we’re doing in class, in lab, and on the assignments, your grades will take care of themselves.

Trust me.



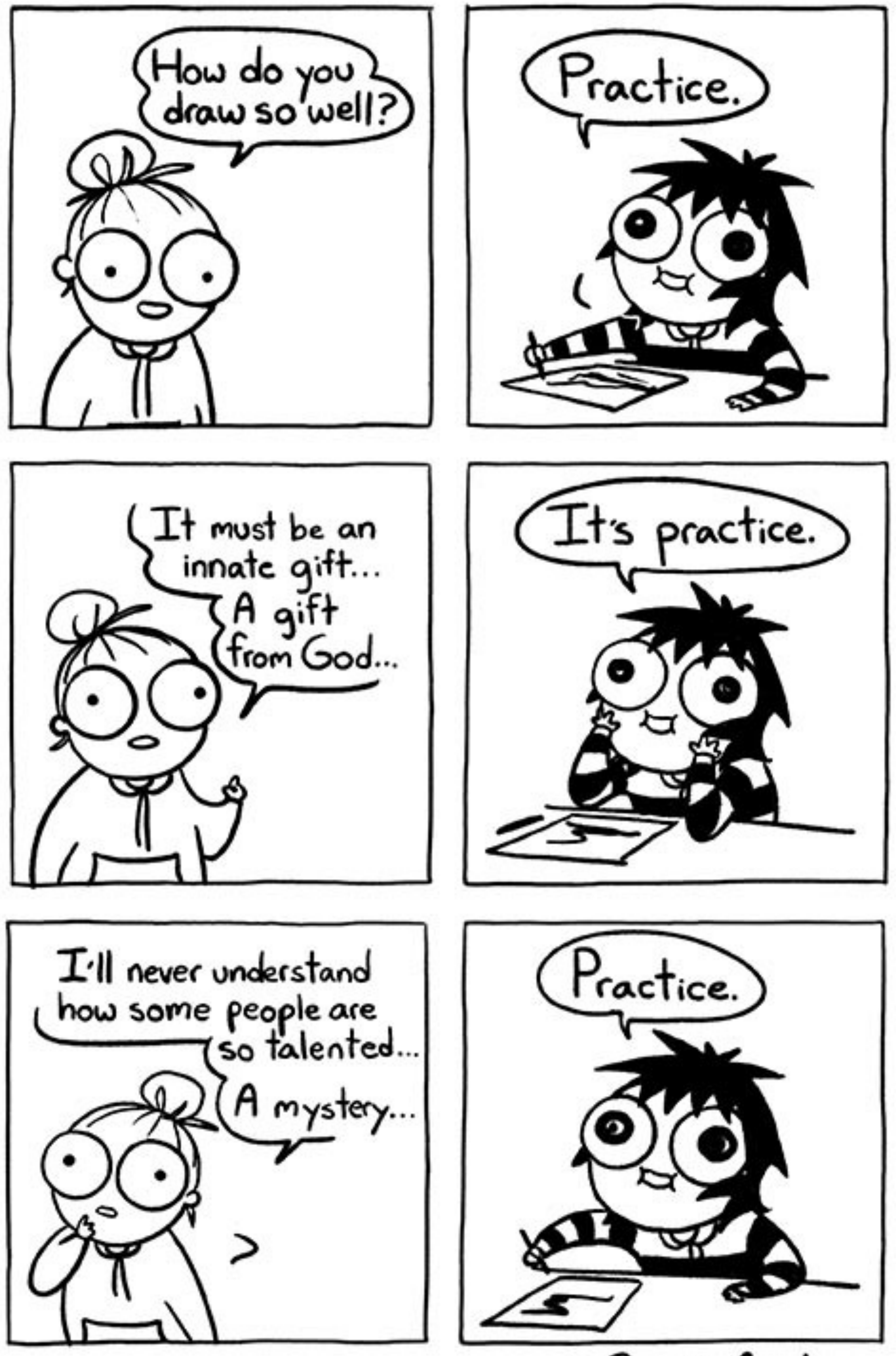
A Data-Centric Introduction to Computing

Kathi Fisler Shriram Krishnamurthi Benjamin S. Lerner Joe Gibbs Politz

Version 2021-08-21

Cover art by Caitlin-Marie Miner Ong

dcic-world.org


How do you draw so well?
Practice.
It must be an innate gift... A gift from God...
It's practice.
I'll never understand how some people are so talented... A mystery...
Practice.

We’ve got a big journey ahead of us. I hope you’re excited!

Acknowledgments

This class incorporates material from:

Peter J. Denning and Matti Tedre, *Computational Thinking*

Kathi Fisler and Doug Woos, Brown University

W. Daniel Hillis, *The Pattern on the Stone*