Python, the next generation
~285,000 high school students in TN

How many are taking AP CS?
Python, the next generation
A few more statistics

\[ y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it} \]
will.i.am: Created the Black Eyed Peas, now taking coding classes.

Mark: Created Facebook.

Bill: Created Microsoft.

Chris: NBA All-Star, coded in college.

27,102,636 have learned an HOUR of CODE™

Anybody can learn.
National 2013 AP Participation

- English Language and Composition US History
- English Literature and Composition Calculus AB
- United States Government and Politics Psychology
- World History Biology
- Statistics Chemistry
- Spanish Language
- Environmental Science
- Human Geography
- European History
- Macroeconomics
- Calculus BC
- Physics B
- Microeconomics
- Physics C - Mechanics
- Computer Science A
- Studio Art - 2-D Design
- Art History
- French Language and Culture
- Comparative Government and Politics
- Physics C - E&M
- Spanish Literature
- Music Theory
- Studio Art - Drawing
- Chinese Language & Culture
- Latin - Vergil
- German Language and Culture
- Studio Art - 3-D Design
- Japanese Language and Culture
- Italian Language and Culture

Number of test takers

CTE ELECTIVES:

BUS3718F/S  Computer Applications
BUS7512F/S  Business Management
SST3696F/SB  IB Business & Mgmt I  
SST3896F/S  IB Business & Mgmt II
HSE8590F/SC  Medical Terminology
VOC8177F/SB  Digital Art/Design
2253 schools taught AP CS last year
24651 public high schools
= 9.1\% upper bound
In Tennessee

251 students took the exam
165 passed
pass rate = 66%
In Tennessee

251 students took the exam
165 passed
pass rate = 66%

25 African American students took the exam
pass rate = 32%
States where no African American students took the exam
States where no Hispanic students took the exam
States where no girls took the exam
Why am I focusing so much on AP CS?
I. Incentives
2. Data

19% of high school students who take AP CS pursue a computing degree.

3% of students who don’t take AP CS pursue a computing degree.

Why does this matter to the Python community?
Why does this matter?

1. We understand that programming is empowering.

2. The *leaky pipeline* affects our community.

3. We care about the long-term success of the language.
Well, what can we do?
29% of AP CS test takers in Tennessee were girls.
29% of AP CS test takers in Tennessee were girls.

Guess why.
This teacher, Jill Pala.

Girls Preparatory School
Chattanooga, TN
Taught 30 / 71 girls who took the exam
1 motivated teacher can set a record.
What can a 200,000 member community do?

+  
-  

Groups: 607  
Members: 211,911  
Interested: 43,416  
Cities: 269  
Countries: 54
Barbara Ericson

2010 Karl V. Karlstrom Outstanding Computing Educator Award recipient
Researcher who did the AP CS 2013 exam results analysis

Dr. Mark Guzdial

2010 Karl V. Karlstrom Outstanding Computing Educator Award recipient
Lead PI on *Georgia Computes!*

Dr. Yasmin Kafai

Early developer and researcher on the Scratch language
Author, *Under the Microscope: A Decade of Gender Equity Interventions in the Sciences*
Professor of Learning Sciences at the University of Pennsylvania Graduate School of Education
4 big areas

- Policy
- Student engagement
- Supporting teachers
- Curriculum development
Policy
States that count CS for math or science credit.
Problem

Computer science is only an elective in most states.
When a class doesn’t count for anything

No incentive for students to take it
No incentive for schools to offer it
No incentive for teachers to train for it
No incentive for schools to offer it
Action

Ask your legislators and school board to count CS for math or science credit.
Problem

Comprehensive per-state data on decision makers and credentials doesn’t exist!
Action

Python + web scraping + version control = better data for policymakers.
Specifically, let’s open source 2 documents:

• An audit of who sets graduation requirements for each state.

• An audit for how credentialing works for each state.

And automate the data acquisition process!
Problem

AP CS is still taught in Java
AP CS through the years

Java  2003 - ?  (11+ years)

C++  1999 - 2003  (6 years)

Pascal  1984 - 1999  (15 years)
# Reid’s List, 2012

## 4. THE TWENTY-SIXTH REID LIST

Table 4. The programming language(s) used and the frequency of occurrence

<table>
<thead>
<tr>
<th>Language</th>
<th>Programs using it</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java</td>
<td>C or Matlab</td>
<td>197</td>
</tr>
<tr>
<td>C++</td>
<td>C++ or Matlab</td>
<td>82</td>
</tr>
<tr>
<td>Python</td>
<td>C++ and Resolve</td>
<td>43</td>
</tr>
<tr>
<td>C</td>
<td>Haskell</td>
<td>18</td>
</tr>
<tr>
<td>Scheme or Racket</td>
<td>HTML/JavaScript</td>
<td>11</td>
</tr>
<tr>
<td>Java with another language</td>
<td>Processing</td>
<td>9</td>
</tr>
<tr>
<td>Visual Basic</td>
<td>Processing / Java</td>
<td>7</td>
</tr>
<tr>
<td>Ada</td>
<td>Python/Java</td>
<td>5</td>
</tr>
<tr>
<td>C/C++</td>
<td>Python or Java</td>
<td>4</td>
</tr>
<tr>
<td>Ada or Python</td>
<td>Python or C#</td>
<td>2</td>
</tr>
<tr>
<td>Alice and Java</td>
<td>Python or C# or Matlab</td>
<td>2</td>
</tr>
<tr>
<td>Alice</td>
<td>Scheme/Python</td>
<td>1</td>
</tr>
<tr>
<td>C#</td>
<td>Visual Basic or C#</td>
<td>1</td>
</tr>
</tbody>
</table>
Reid’s List, 2012

“The growth in Python’s popularity is undeniable. Not only have more schools reported using it in their first programming course, but responding faculty talk about having adopted it, adopting it either last year or this coming year or how their programs are seriously considering the change.”

Action

Engage College Board with the facts on what teachers want.
Policy opportunities

• Advocate for CS as math or science credit.

• Audit who sets graduation requirements for each state.

• Audit how credentialing works for each state.

• Update and open source Reid’s List.

• Engage College Board about Python as the next gen AP language.
Student engagement
Problem

Students don’t know what CS is, so they don’t want to take it.
Action

Support opportunities for early exposure.
Summer camps

(PSF-sponsored Teen Tech Camp, Southwest Durham Regional Library)

Photo credits: @juliaelman, @rmurphey
Girl Scouts, Boy Scouts

(Actual badges you can buy from adafruit.com)
After school programs

https://code.org/learn/local
Take advantage of existing infrastructure for engaging students.
Student engagement opportunities

- Summer camps.
- Girl Scouts, Boy Scouts.
- After school programs.
Supporting teachers
Problem

CS teachers are usually all alone.
Action

Give them a community.
Ways to support teachers

• Offer to answer lesson plan questions.

• Offer to be a TA.

• Offer to visit the class and talk about programming.

• Invite them to the local user group.

• Help connect them with other CS teachers.
Curriculum development
Did you know that there’s a new AP CS?!
The CS Principles Big Ideas

I: Creativity
II: Abstraction
III: Data
IV: Algorithms
V: Programming
VI: The Internet
VII: Impact
Problem

There are no day-by-day curricula for CS Principles, in any language.
Action

This is a huge market opportunity for Python, let’s seize it.
Lesson Plans

Teachers from the current CS Principles pilot have provided exemplar lesson plans that highlight key parts of the Big Ideas and Learning Objectives.

- **Cryptography**: Students understand both simple and complex encryption algorithms using online simulators
  - **Big Ideas**: Algorithms, Internet
  - **Learning Objectives**: 14, 27

- **Data as Art, as Science, as a Reason for Being**: Can Visual representations of data be considered a form of art? If your school were to display data in a public place, what would you present?
  - **Big Ideas**: Creativity, Abstraction, Data, Impact
  - **Learning Objectives**: 2, 9, 14, 28

- **YouSort: An introduction to Sorting Algorithms**: Before learning standard sorting algorithms, students create their own.
  - **Big Ideas**: Algorithms, Creativity
  - **Learning Objectives**: 4, 15, 16, 18
import turtle
import random

def main():
    tList = []
    head = 0
    numTurtles = 10
    for i in range(numTurtles):
        # Code here...

https://github.com/bnmnetp/runestone
Skulpt

```python
# program template for Spaceship
import simplegui
import math
import random

# globals for user interface
WIDTH = 800
HEIGHT = 600
score = 0
lives = 3
time = 0.5
friction = 0.069

class ImageInfo:
    def __init__(self, center, size, radius = 0):
        self.center = center
        self.size = size
        self.radius = radius
        if lifespan:
            self.lifespan = lifespan
        else:
            self.lifespan = float('inf')
        self.animated = animated

https://github.com/skulpt/skulpt
Curriculum development opportunities

- AP CS Principles
- interactivepython.org
- Skulpt
4 big areas

- Policy
- Student engagement
- Supporting teachers
- Curriculum development
251
0.09%
The Python Software Foundation
Sprints

http://pythonsprints.com
Outreach and Education

http://mail.python.org/mailman/listinfo/outreach-and-education
Grants

http://python.org/psf/grants/
Our challenge, by 1 action.
Our challenge, by

PyTennessee
2015
Nashville, TN

Jason Orendorff @jorendorff · 12m
Still a few more slots open for programmers. March 8. Teach, learn, code, have a blast. nashvillecode.org
Resources

• Unlocking the Clubhouse: Women in Computing

• Stuck in the Shallow End: Education, Race, and Computing

• Running On Empty: The Failure to Teach K–12 Computer Science in the Digital Age
  http://www.acm.org/runningonempty/

• 2013 AP CS data
  http://home.cc.gatech.edu/ice-gt/556
Thank you!
Python, the next generation