

# I'm Not Teaching You To Program!

Extra credit: If you type the following into your calculator, what do you get?

“1<enter>2 + 5<enter>2 – x”

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# PICUP

- Lowering the barriers for the integration of computation into your curriculum



PICUP

PARTNERSHIP FOR INTEGRATION OF COMPUTATION INTO UNDERGRADUATE PHYSICS

# Outline

- Faculty Hurdles Encountered
- Student Hurdles Encountered
- How to Fail at Integrating Computation

# Departmental Norms

- Some faculty opposed to computational modeling in introductory courses
  - *"Not your job"*

# Not My Job

- It's not my job to teach students how to....
  - *switch a calculator to radians*
  - *access material in the LMS*
  - *solve a quadratic equation*
  - *integrate a polynomial*
  - *write a paper*
  - *modify a computer program*

# Implementation

- I was expecting them to program
- Activities not well implemented

# Myth of the Lone Professor

- “I’ve got a PhD...”
- “I’ve been teaching physics for a number of years...”
- “I’ve read the literature...”
- “I know how to program...”
- I was just as much of a hurdle

# It's All About the Community

- Why should we include computational modeling
  - *Reasons to take to colleagues*
- How can we make modeling meaningful to students
- How to go about incorporating computation into classes



Link to reports on PICUP website

# I'm Not Teaching You to Program

- Students see programming as part of CS
- Students don't see how it is relevant
- Students don't see how it helps them to understand physics
- Students see it as extra work

# “Why are we learning programming?”

- Students haven’t seen this in other physics classes
- Don’t call it programming
  - *Computational modeling*
- Don’t say “we are programming” or “we are coding”
  - “*We are modifying code*”

■ What is “1<enter>2 + 5<enter>2 – ×” equal to?



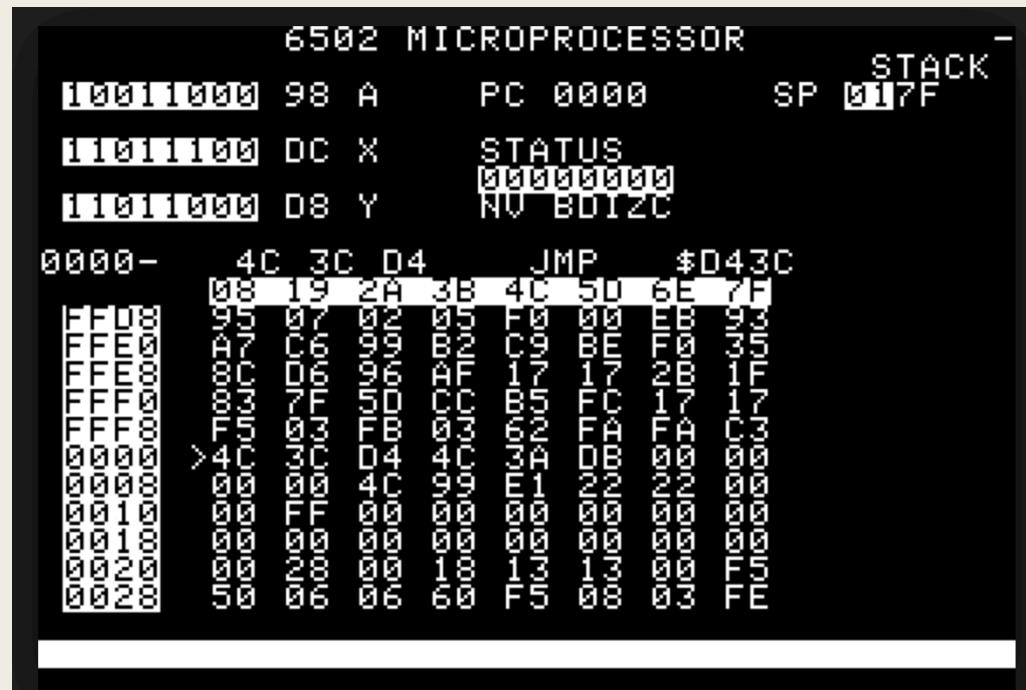
■  $(1 + 2) \times (5 - 2) = 9$

# That's not programming!

- # ■ This isn't programming...

```
1 from vpython import *
2
3 sphere()
4
5 print("Hello Sphere")
```

- # ■ THIS is programming...



# “This is a physics course”

- Show how learning objectives tie to computational modeling
- Make it relevant
  - *Long term projects*
  - *Include exam questions*
- Talk about computational thinking



# "I should be learning physics"

- Solve problems that aren't possible otherwise
  - *Electric field of a rod of charge not on axis or perpendicular to axis*
- Show things that aren't intuitive
  - *Field between two charged plates*

# A Short History of Computational Modeling

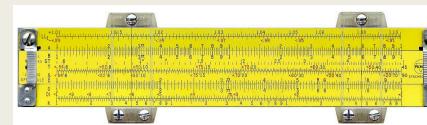
- Hand-written math: ~ 3000 BCE - ...



- Logarithm Tables: 1614 to ?



- Slide Rules: 1620 to 1975



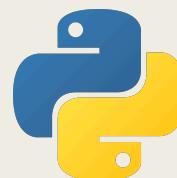
- Handheld Calculator: 1972 - ...



- Personal Computer: 1977 – ...



- Python: 1989 - ...



# “Just one more thing to learn”

- Start small
  - *Modify working code or minimally working code*
- Provide resources
  - *Video tutorials*
  - *Online courses in Python*
- Provide timely feedback
  - *Don’t be afraid to “give them the answer”*



# What if I fail?



- Too much content to cover
- Colleagues don't know Python
- Departmental norms

# Content Coverage

- 3-credit Statics course
  - No *lab or discussion*
- Talk to "downstream" instructors and departments
- Does "coverage" equal "understanding"?

# Lack of knowledge

- Colleagues don't use Python
  - *Send them to FDW*
- Co-teach a course
- Give them your intro material

# Departmental Norms

- Serendipity
  - *Keep trying when circumstances change*
- Mentor new faculty
  - *Set the new norms*
- “Change happens one retirement at a time”

# Join PICUP

- Lowering the barriers for the integration of computation into your curriculum



PARTNERSHIP FOR INTEGRATION OF COMPUTATION INTO UNDERGRADUATE PHYSICS

- Join the conversation and ask your questions on Slack:



# Thank You

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