

## Plan For The Day (PFTD)

- Practice solving problems (algorithms, programs)
  - Some solved with a computer, some with Python
- Learning about vocabulary
  - We'll work with English and Python
- Practice using tools for Duke Compsci courses
  - Eclipse, APT, ambient, ... Python-tutor
  - Sakai, Piazza, Feedback
- Reveling in the wonder of thinking and working
  - How do we know when something works?

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2.1

## Who took Compsci 101?



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2.2

## Why is programming fun? Fred Brooks

- First is the sheer joy of making things
- Second is the pleasure of making things that are useful
- Third is the fascination of fashioning complex puzzle-like objects of interlocking moving parts
- Fourth is the joy of always learning
- Finally, there is the delight of working in such a tractable medium. The programmer, like the poet, works only slightly removed from pure thought-stuff.



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## Algorithm

- Recipe
- Sequence of steps that constitute instructions
- Step-by-step procedure for calculations

What does Nate Silver do?

<http://53eig.ht/1tZy909>



How do Netflix and Amazon know me?

- Compsci101: capable of implementation as a program, but tread gently here

<http://moreintelligentlife.com/content/features/anonymous/slaves-algorithm>

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## Skills and Practice for Game Playing

- I have 7 and 5, dealer showing 5, I should ...



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## Skills and Practice for Game Playing

- <http://www.youtube.com/watch?v=AEBbsZK39es>



\$193, \$540, \$820,  
\$700, \$749. Are  
these reasonable?  
Why?

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## I'm thinking of a number ...

- You guess. I'll tell you *high*, *low*, or *correct*
  - Goal: guess quickly, minimal number of guesses
  - Number between 1 and 100...
  - Number between 1 and 1000...
- Can you describe an algorithm, instructions, that would allow someone to use your instructions to play this game correctly. Start with 1 and 100, but ideally your instructions work with 1 and X

<http://bit.ly/101fall14-828-1>

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## Analyzing the *binary search* algorithm

- Is the algorithm correct?
  - Try it, again, and again and ...
  - Reason about it: logically, informally, ...
- How efficient is the algorithm?
  - How many guesses will it take (roughly, exactly)
  - Should we care about efficiency?
- When do we really care about efficiency?
  - Examples?

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## Concepts you'll learn in Compsci 101

- **Programming**
  - Practice, skill, art, science, engineering, creativity
- **Problem-solving**
  - How to solve problems using programming and a computer
- **Impact of computer science**
  - Scale and automation: powerful forces
- **Foundation for future work**
  - In many areas, not limited to compsci@duke

## Programming Examples

- **Scratch example from class, elaborate in lab**
  - <http://scratch.mit.edu/projects/25866811/>
- **Hour of code: <http://learn.code.org/hoc/1>**
  - Designed for kids, useful to millions
- **Light-bot (many versions, first assignment)**
  - <http://armorgames.com/play/6061/light-bot-20>
- **Python!**

## Python and Programming Concepts

- **Names are important, abstractions**
  - What is <http://152.3.140.1>
  - What is <http://www.amazon.com>
- **Types are important, facilitate operations**
  - What is foo.pdf, foo.mp4, foo.jpg, foo.wav
  - Do the file extensions guarantee file type?
- **Thinking in terms of names and types can help**
  - Python has types, inferred dynamically
  - Python uses types differently from Java and C++

## Latanya Sweeney

I am a computer scientist with a long history of weaving technology and policy together to remove stakeholder barriers to technology adoption. My focus is on "computational policy" and I term myself a "computer (cross) policy" scientist. I have enjoyed success at creating technology that weaves with policy to resolve real-world technology-privacy clashes.



<http://latanyasweeney.org/>

Identify 87% of US population using (dob,zip,gender). Director of Harvard Data Privacy Lab, instrumental in HIPAA because of *de-identification* work, currently Chief Technologist FTC

## (RE)-INTRODUCTION TO PYTHON

## Python data reading code

```
f = open("/data/kjv10.txt")
st = f.read()
len(st)
ac = st.count('a')
zc = st.count('z')
for ch in 'aeiou':
    print ch, st.count(ch)
```

## Vocabulary, grammar, rules: Python

- **Naming**
  - The power of abstraction and parameterization
  - What is abstraction?
  - What are parameters? What has them?
- **Types**
  - What's used in Python? Use console
  - Determine names of types in Python
  - int, float, bool, string, list, ...
  - Operators and expressions: (see web pages)

## Variables, Types, Values

- **Variable is a name associated with "container/stuff"**
  - Assign a value: `x = 5`
  - Print value of variable: `print x`
  - Use variable in expression: `y = x * 55`
- **String is a type and has a value**
  - Assign: `x = "hello"`
  - Print value of variable: `print x`
  - Use in expression: `x + " world"`





## Expressions, Operators, Types

- Why is  $3+5*4$  different than  $(3+5)*4$ ?
  - Operator precedence:  $()$  ( $((($  are your friends)
- Why is  $5/3$  different than  $5.0/3$ ?
  - We use Python 2.7, different in Python 3.0
- What happens when operators go bad?
  - What is "apple" + 3? What is "apple" + "pi"?
  - What is "apple" \* 3? What is "apple" \* "pi" ?

## ALGORITHMIC INTERLUDE

## Whole Genome Shotgun with words

olve problems.  
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compsci101 we get t  
01 we get to work colla  
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y, create, and s  
e get to work collabo  
...

- Creation algorithm
  - Take a phrase
  - Replicate it four times
  - Chop into "chunks"
    - 15-22 characters
- How to recreate original phrase?

<http://bit.ly/101fall14-828-2>

## Getting ready to code in Python

- We need a programming environment
  - Eclipse, PyDev, Python, Ambient
    - Open source or free for academics
- We need a computer with an operating system
  - Installing the suite of tools can be cumbersome
    - Persist, Persevere, Get Help, start over ☹
- Getting used to the environment can take time
  - Once you've got it, second nature!
    - Easy to reuse with a new language

## What is an APT? BMI APT

- **Automated/Algorithmic Problem Testing**
  - Write one function, 2-30 lines, solve a problem
  - Tested automatically in Eclipse or the browser
  - Test test test ... Quality of code not an issue
- **Start simple, build toward more complex**
  - What is a function? A function call?
  - What is a parameter? Argument?
  - How do you run/execute a program

