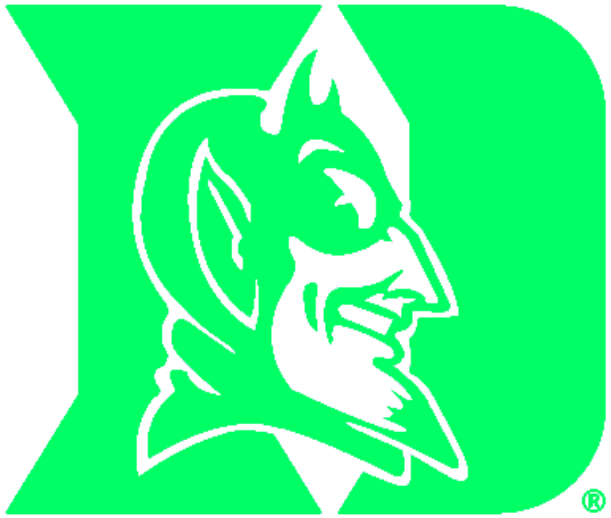
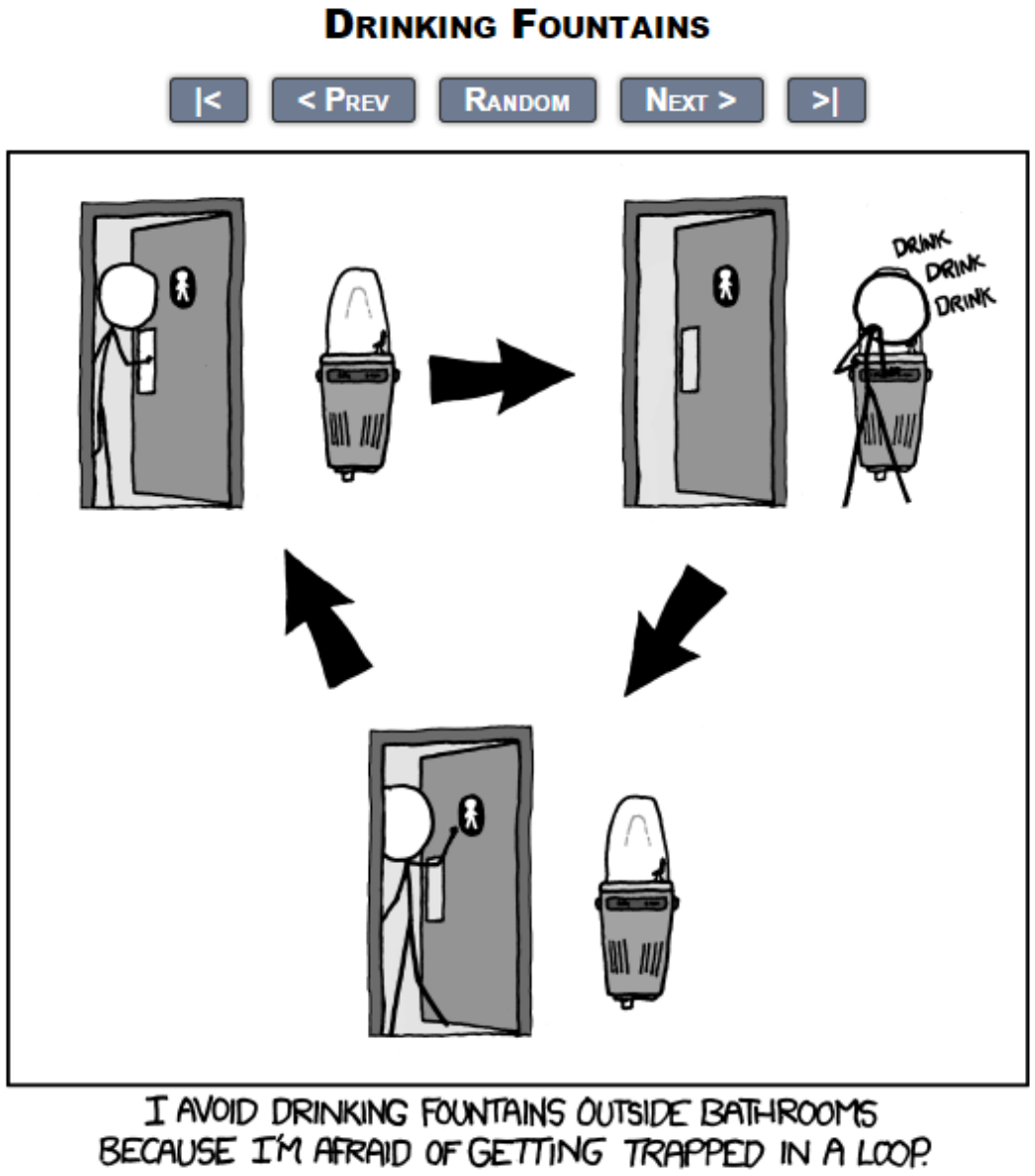
# CompSci 101
# Introduction to Computer Science



Oct. 25 , 2016

Prof. Rodger

from
xkcd


DRINKING FOUNTAINS
|<
< PREV
RANDOM
NEXT >
>|
DRINK
DRINK
DRINK
I AVOID DRINKING FOUNTAINS OUTSIDE BATHROOMS
BECAUSE I'M AFRAID OF GETTING TRAPPED IN A LOOP.

# Grace Hopper Celebration of Women in Computing Conference

# Latanya Sweeney

**Chief Technologist at FTC. 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**

# aboutmyinfo.org


- Entered my data

## How Unique are You?

Enter your ZIP code, date of birth, and gender to see how unique you are (and therefore how easy it is to identify you from these values).

Date of Birth Month... Day... Year...

Gender ◉ Male ○ Female

5-digit ZIP

Submit

About | Samples | Harvard

# aboutmyinfo.org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5-digit ZIP

Submit

About | Samples | Harvard

- Entered my data
- Easily identifiable by birth date (about 1)
- Lots with my birth year (about 273)
- Lots of people in my age range (of four years) – (1,365)

# Announcements

- Reading and RQ14 due next time
- Assignment 5 due Thursday
- APT 5 due today, APT 6 out

- This week:
  - Nested loops, tuples, images and more with sets

# Problem: Given list of words, find word with most vowels

- Example:
  - Given [‘dog’, ‘cat’, ‘gerbil’, ‘elephant’]
  - ‘elephant’ has 3 vowels, the most
- To solve – nested loops:
  - Loop over words in list
    - For each word: Loop over characters in word

# Bit.ly/101f16-1025-1

```
def wordWithMostVowels(words):
    maxcnt = 0
    maxword = ""
    cnt = 0
    for word in words:
        for letter in word:
            if isVowel(letter):
                cnt += 1
        if cnt > maxcnt:
            maxcnt = cnt
            maxword = word
    return maxword
```

# Problem 2 – Given two lists of names, print a list of pairs of names in which the two names are the same length

- A = [‘mo’,’ted’,’bill’]
- B = [‘billie’, ‘jes’, ‘bo’]

mo, bo

ted jes

- To solve
  - for name in A:

        for name in B:

            Check length

            print pair

# bitly/101f16-1025-2

```
for aname in A:
    for bname in B:
        if len(aname) == len(bname):
            print aname + ", " + bname
print
for bname in B:
    for aname in A:
        if len(aname) == len(bname):
            print aname + ", " + bname
```

# Tuples

- Like a list, but cannot change them
  - Define them with “,”

    (5, 7, 8)  or  5, 7, 8
- Use most list operations on them
  - they are a type of list
  - But immutable
- Examples

# Example

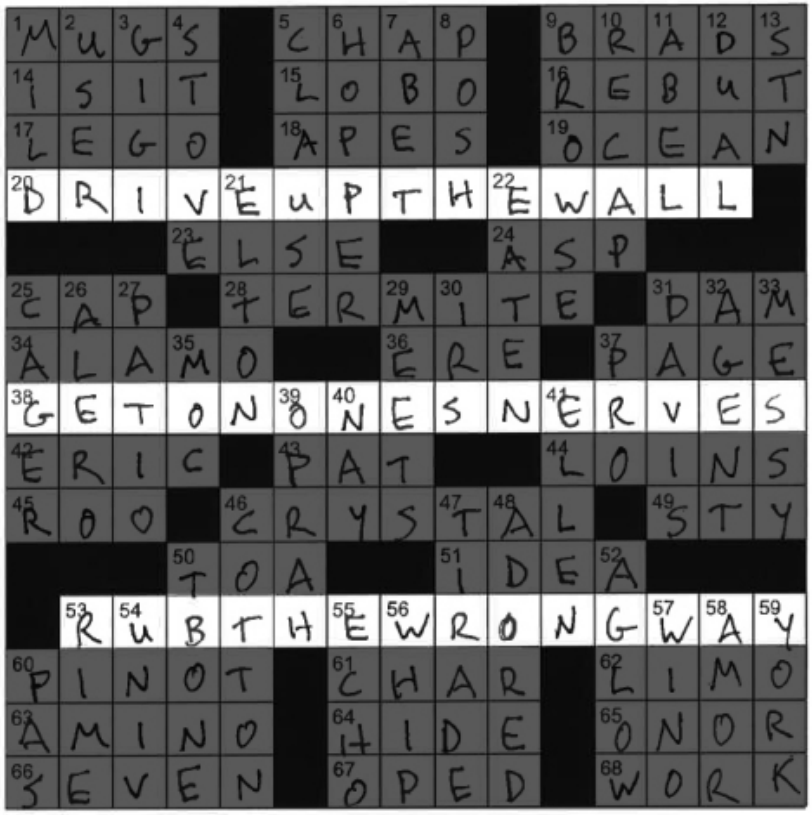
```
x = (4, 6, 8)
y = 9, 5, 6
print x
print y
print x[1]
print y[1]
y[0] = 2
z = ([5,6], [7,8])
print z
z[0][1] = 12
print z
z[0].append(4)
print z
z[0].remove(5)
z[0].remove(12)
z[0].remove(4)
print z
```

# Crossword Plagiarism

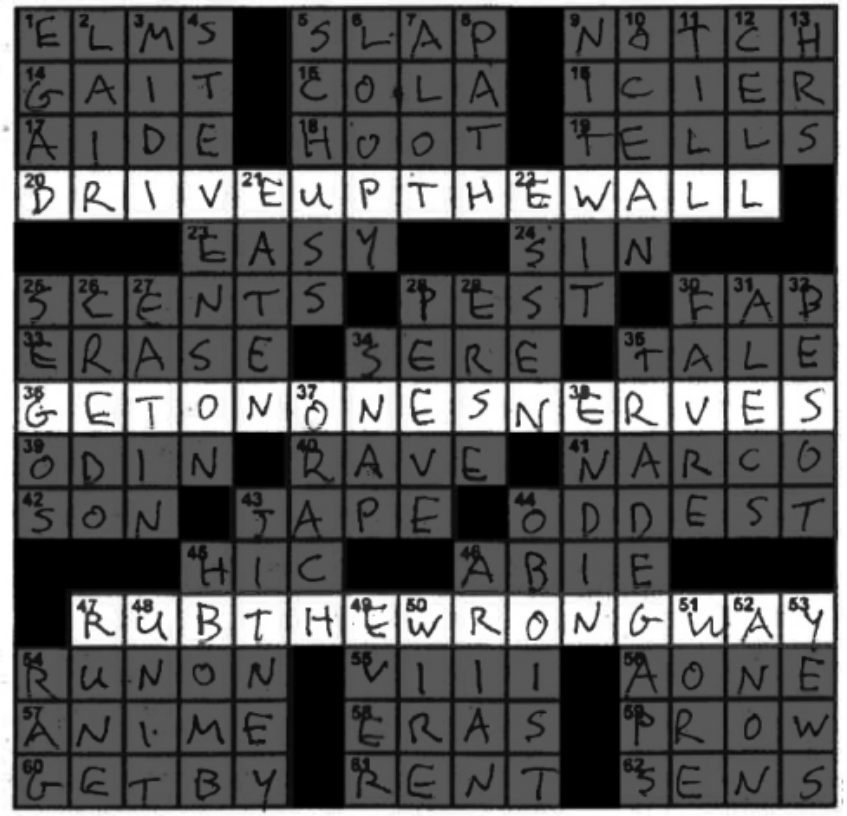
bit.ly/crossword-0308 - from fivethirtyeight.com

**EXAMPLE OF "SHADY"**

Answers in white are the same.



| | |
|---|---|
| PUBLICATION | The New York Times |
| PUBLISH DATE | January 8, 2001 |
| BYLINE | Gregory E. Paul |
| EDITED BY | Will Shortz |

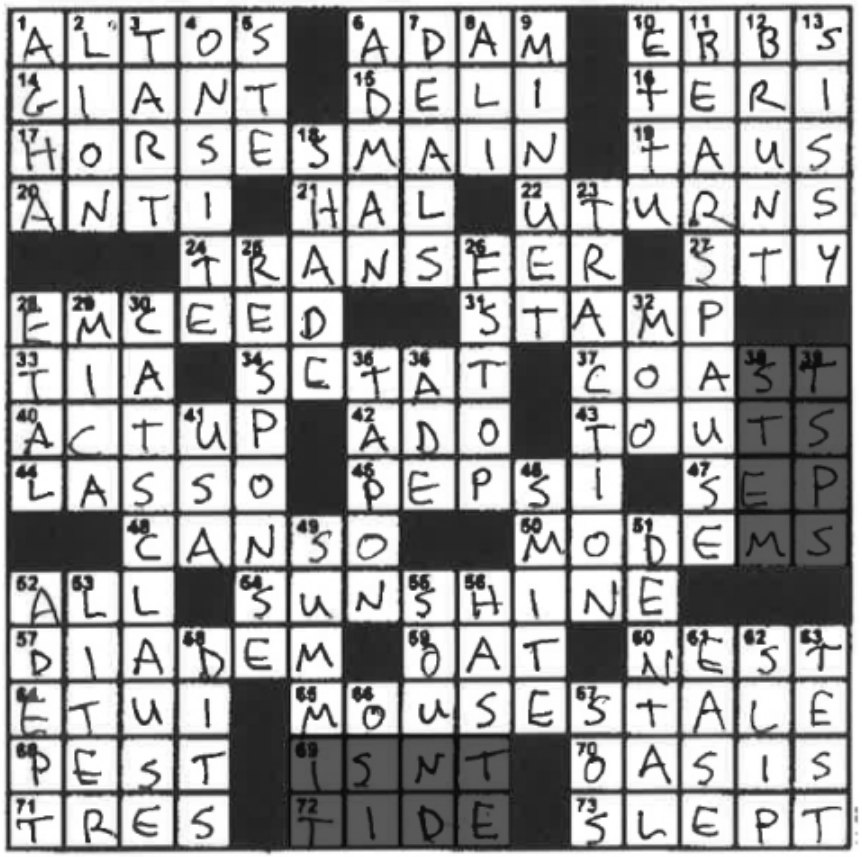


| | |
|---|---|
| PUBLICATION | USA Today |
| PUBLISH DATE | June 4, 2010 |
| BYLINE | Mark Howard |
| EDITED BY | Timothy Parker |

# Crossword Plagiarism

**EXAMPLE OF "SHODDY"**

Answers in white are the same.



| | |
|---|---|
| PUBLICATION | USA Today |
| PUBLISH DATE | November 30, 2004 |
| BYLINE | Kendall Twigg |
| EDITED BY | Timothy Parker |

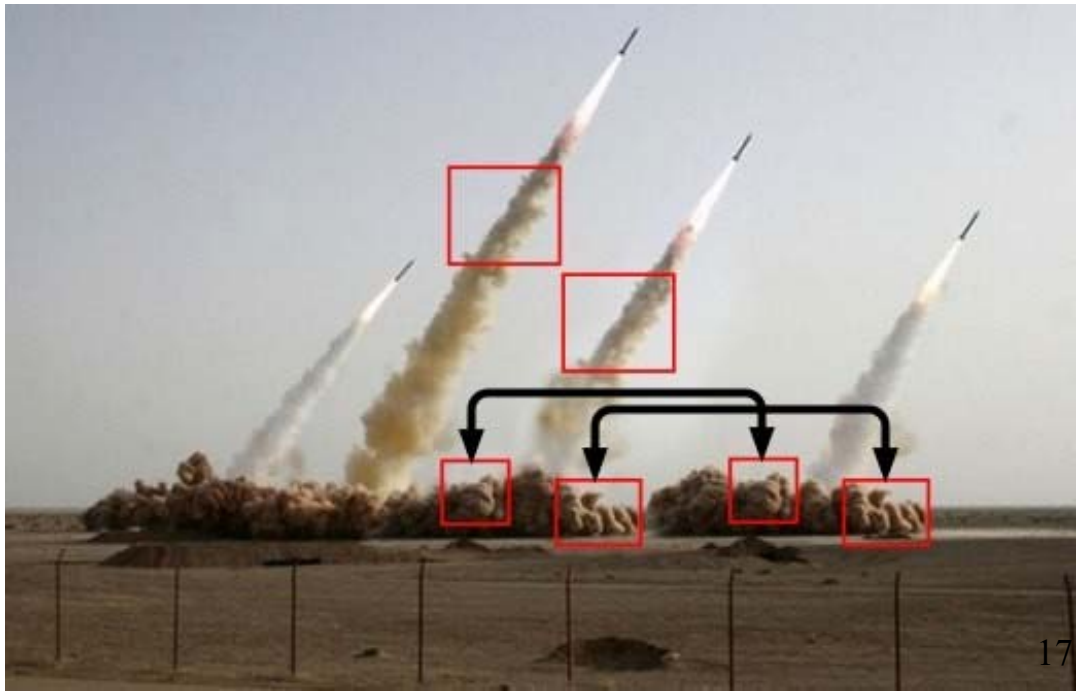
| | |
|---|---|
| PUBLICATION | USA Today |
| PUBLISH DATE | November 9, 2011 |
| BYLINE | Harper Dantley |
| EDITED BY | Timothy Parker |

# Puzzles with at least 25% similarity to previous puzzle since May 2003

| | PUBLICATION | |
|---|---|---|
| ORIGINAL | REPEATER | NO. OF PUZZLES |
| Universal | USA Today | 537 |
| USA Today | Universal | 162 |
| New York Times | Universal | 64 |
| New York Times | USA Today | 28 |
| Chicago Tribune | Universal | 15 |
| Los Angeles Times | USA Today | 14 |
| Los Angeles Times | Universal | 12 |

# Image Processing

- What's real, what's Photoshopped
  - http://bit.ly/1Kj0Kn6 from 2008
  - Learn more at http://bit.ly/1Psi0hG, we'll do very basic stuff in class and lab, next assignment too!



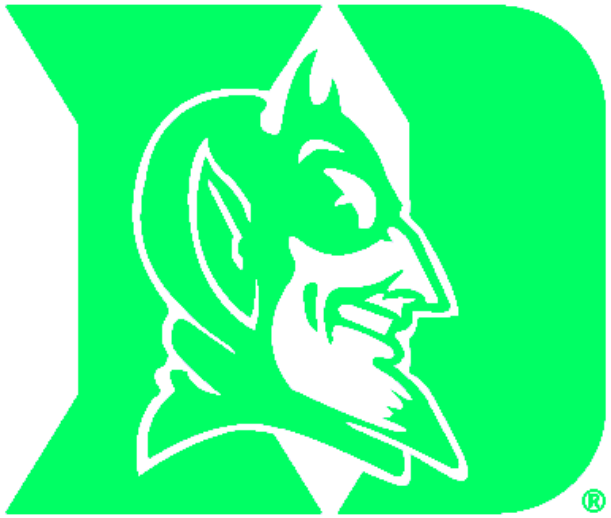
# Example: convert color to gray scale

*Process each pixel*
*Convert to gray*

# Example: convert blue to green

*Process each pixel*
*Convert blue ones to green*

*Is this like red-eye removal?*



# Need new concepts and Image library

- Red, Green, Blue color model
  - Triples of (R,G,B) are processed as Python tuples.
  - *Let's study tuples!*

- Images can be very big, what's  4K display?
  - 4,096 x 2,160 = 8,847,360 pixels, 8Mb at least
  - Creating huge lists takes up memory
  - Sometimes only need one pixel at-a-time
  - *Let's study generators!*

# Need new concepts and Image library

- Red, Green, Blue color model
  - Additive model, each pixel specified by (r,g,b) triple, values of each between 0-255
  - https://en.wikipedia.org/wiki/RGB_color_model
  - White is (255,255,255) and Black is (0,0,0)
- Images stored as sequence of (r,g,b) tuples, typically with more data/information too
  - 256 values, represented as 8 bits, $2^8 = 256$
  - 32 bits per pixel (with alpha channel)
  - In Python we can largely ignore these details!

# Image library: Two ways to get pixels

- Each pixel is a *tuple* in both models
  - Like a list, indexable, but *immutable*
  - `pix = (255,0,0)`
    - What is `pix`?, `pix[0]`? What is `pix[5]`?
- Invert a pixel: by subscript or named tuple
  - Access by assignment to variables!

```
npx = (255-pix[0],255-pix[1],255-pix[2])
```

```
(r,g,b) = pix
npx = (255-r,255-g,255-b)
```

# Let's look at GrayScale.py

- Key features we see
  - Import Image library, use API by example
  - Image.open creates an image object
- Image functions for Image object im
  - `im.show()`, displays image on screen
  - `im.save("xy")`, saves with filename
  - `im.copy()`, returns image that's a copy
  - `im.load()`, [x,y] indexable pixel collection
  - `im.getdata()`, iterable pixel collection
- Let's look at two ways to process pixels!

# Image Library: open, modify, save

- `Image.open` can open most image files
  - .png, .jpg, .gif, and more
  - Returns an image object, so store in variable of type Image instance
  - Get pixels with `im.getdata()` or `im.load()`
- `Image.new` can create a new image, specify color model "RGB" and size of image
  - Add pixels with `im.putdata()`

- These belong to Image package

# `im.getdata()`, accessing pixels

- Returns something *like* a list
  - Use: `for pix in im.getdata():`
  - Generates pixels on-the-fly, can't slice or index unless you use `list(im.getdata())`
  - Structure is called a Python generator!
  - Saves on storing all pixels in memory if only accessed one-at-a-time

- See usage in GrayScale.py, note how used in list comprehension, like a list!

# Alternate : Still Tuples and Pixels

- The `im.getdata()` function returns list-like iterable
  - Can use in list comprehension, see code
  - Use `.putdata()` to store again in image

```
pixels = [makeGray(pix) for pix in im.getdata()]
```

```
def makeGray(pixel):
    r,g,b = pixel
    gray = (r+g+b)/3
    return (gray,gray,gray)
```

# Making Tuples and Generators

- Overuse and abuse of parentheses
  - To create a tuple, use parentheses

```
for pix in im.getdata():
   (r,g,b) = pix
   npx = (255-r,255-g,255-b)
```

  - To create a generator use parentheses as though creating a list comprehension!

```
[2*n for n in range(10000)]
(2*n for n in range(10000))
```

- See this in PyDev console

# Questions about Image Code

bit.ly/101f16-1025-3

# `im.load()`, accessing pixels

- Returns something that can be indexed [x,y]
  - Only useful for accessing pixels by x,y coords
- Object returned by `im.load()` is …
  - Use pix[x,y] to read and write pixel values
- Note: this is NOT a generator

```
pix = im.load()
tup = pix[0,0]
pix[1,1] = (255,255,0)
```

# Lab 7

- You'll create new images
  - Invert
  - Solarize
  - Darken
  - Brighten
  - etc

# NC State Fair

- Experience it!