

# Compsci 101

## Pancakes, While loops, Parallel Lists

### Live Lecture



Susan Rodger  
Nicki Washington  
February 25, 2021

2/25/21

Compsci 101, Spring 2021 1

# Latanya Sweeney

PhD. Computer Science, MIT – first black woman  
Over 100 publications, Fellow ACMI



**"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.**



2/25/21

Compsci 101, Spring 2021 2

<http://latanyasweeney.org/>

**Identify 87% of US population using (dob,zip,gender). Prof. Government and Technology @ Harvard, instrumental in HIPAA because of *de-identification* work. Former CTO of the Federal Trade Comm.**

One of her websites you can try:  
<https://aboutmyinfo.org/identity>

## How unique am I?

Find out how much different you are among the masses.

About

Samples

Fill out the form below to see how unique you are, and therefore how easy it is to identify you from these values.  
*Please note that this service is still under development.*

**Date of Birth** Month  Day  Year

**Gender** ☒ Male ☐ Female

**ZIP Code**

ZIP code must be 5 digits long.

Submit →

### Your Profile



Results will appear here.

2/25/21

Compsci 101, Spring 2021 3

<https://aboutmyinfo.org/identity>

## How unique am I?

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Fill out the form below to see how unique you are, and therefore how easy it is to identify you from these values.  
*Please note that this service is still under development.*

**Date of Birth**

**Gender** ☐ Male ☒ Female

**ZIP Code**

ZIP code must be 5 digits long.

Submit →

### Your Profile

**Gender:** Female  
**ZIP Code:**  (pop. 46282 )

<b>Date of Birth</b>	<input type="text"/>	Easily identifiable by birthdate (about 1).
<b>Birth Year</b>	<input type="text"/>	Lots with your birth year (about 273 ).
<b>Range</b>	<input type="text"/> to <input type="text"/>	Wow! There are lots of people in the same age range as you (about 1365 ).

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Compsci 101, Spring 2021 4

## Your Profile

Gender: Female

ZIP Code: [REDACTED] (pop. 46282 )

Date of Birth	[REDACTED]	Easily identifiable by birthdate (about 1).
Birth Year	[REDACTED]	Lots with your birth year (about 273 ).
Range	[REDACTED] to [REDACTED]	Wow! There are lots of people in the same age range as you (about 1365 ).

Five year range

## J is for ...



- **JSON**
  - Format for data transmitted across the web
- **JPEG**
  - Image format based on lossy compression
- **Jacquard Loom**
  - 1804 "automated" loom



## Announcements

- Nothing due today!
- APT-3 due Tuesday, March 2
- Assignment 2 due Thursday, March 4
- Lab 4 Friday – No Prelab
- APT Quiz 1 3/5-3/8

## PFTD

- Files and Data
- Pancake APT
- While loops and Collatz sequence
- Parallel lists
- Exam 1

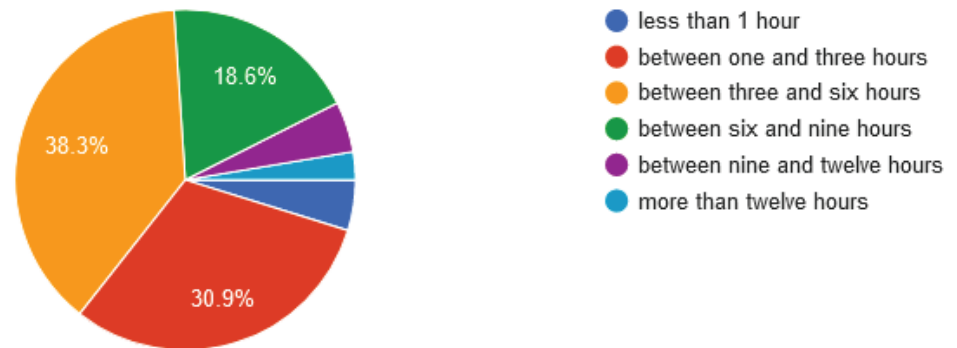
## Exam 1 – Still grading, back soon

- Once graded, you will get an email from GradeScope
  - You will be able to see the full exam
  - We will post solutions
    - If you missed something, you should try to figure out what you did, then look at solutions
  - Regrades will be in Gradescope
- Here is feedback from the Exam 1 Survey

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## Exam 1 – How much time preparing?



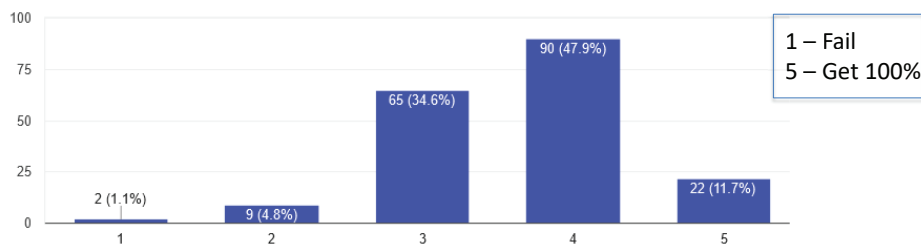
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## Thoughts before and after – how you would do/did

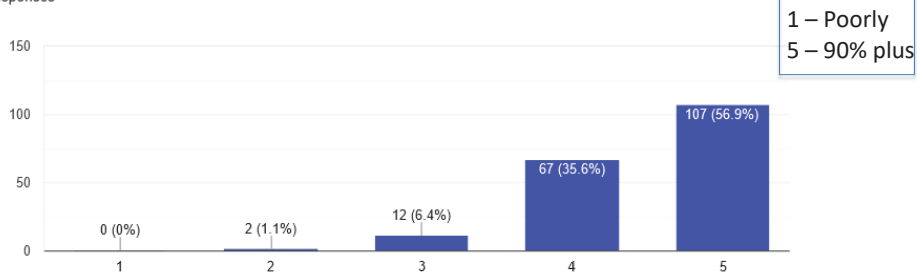
As you sat down to start the exam, how did you think you'd do on the exam?

188 responses



When you completed the exam, how do you think you did?

188 responses



## Was Exam Fair on questions asked?



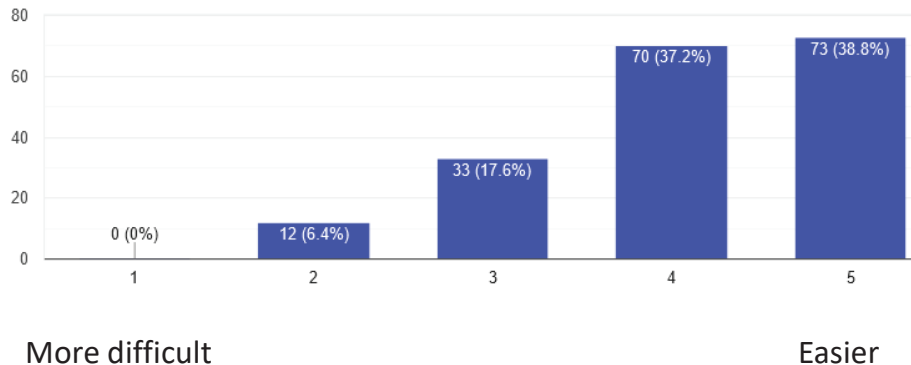
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## How was taking exam on Gradescope?

How was taking the exam online on gradescope?

188 responses



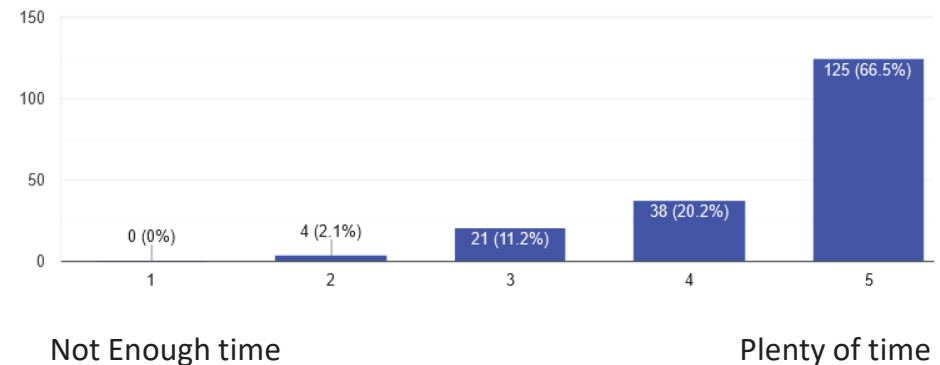
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Compsci 101, Spring 2021 13

## Did you have enough time to take the exam?

Did you have enough time to take the exam?

188 responses



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## APT Quiz 1 coming...

- APT Quiz 1 is 3/5 8AM -3/8 11PM – finish by 11pm
- There are two parts – each part is 1.5 hours
- Pick a start time for each part,
  - Once you start a part, You have 1.5 hours
  - If you get accommodations, you get those
- 4 APTs to solve (2 in each part)
  - Take parts 1 and 2 on same day or different days
- **Start APT Quiz on Sakai!**
- See old APT Quiz problems so you can practice
  - On APT page – NOT FOR CREDIT

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## APT Quiz 1

- **Is your own work!**
  - No collaboration with others!
  - Use your notes, lecture notes, your code, textbook
  - DO NOT search for answers!
  - Do not talk to others about the quiz until grades are posted
- **Post private questions on Piazza**
  - We are not on between 10pm and 8am EDT!
  - We are not on all the time
  - Will try to answer questions between 8am – 10pm

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## Lists of Data

- String lists: `["ant", "fox", "cat", "dog"]`
- Lists of int/float numbers: `[5, 3.14159, -15]`
- What about lists of lists? Variable `plist =`  
`[["Washington", 1789, 57], ["Clinton", 1993, 46]]`
- What is `plist[0]`?
- What is `plist[0][2]`?
  - Can always use a variable:
- First char. of "Washington"?

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## Lists of Data

- String lists: `["ant", "fox", "cat", "dog"]`
- Lists of int/float numbers: `[5, 3.14159, -15]`
- What about lists of lists? Variable `plist =`  
`[["Washington", 1789, 57], ["Clinton", 1993, 46]]`
- What is `plist[0]`? `["Washington", 1789, 57]`
- What is `plist[0][2]`? `57`
  - Can always use a variable:
  - `val = plist[0]`, then `val[2]`
- First char. of "Washington"?  
`plist[0][0][0]`

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WOTO-1 Files  
<http://bit.ly/101s21-0225-1>

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Pancakes!



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# APT Pancake

- How do you solve this (or any) problem?
  - 7 Steps!
- Some APTs are hard problems to solve (step 1-4)
  - Translating to code easy
- Some APTs have easy-to-see algorithms (step 5)
  - Translating to code is hard



## APT: Pancakes

### Problem Statement

You're a short-order cook in a pancake restaurant, so you need to cook pancakes as fast as possible. You have one pan that can fit `capacity` pancakes at a time. Using this pan you must cook `numCakes` pancakes. Each pancake must be cooked for five minutes on each side, and once a pancake starts cooking on a side it has to cook for five minutes on that side.

However, you can take a pancake out of the pan when you're ready to flip it after five minutes and put it back in the pan later to cook it on the other side.

Write the method, `minutesNeeded`, that returns the shortest time needed to cook `numCakes` pancakes in a pan that holds `capacity` pancakes at once. See the examples.

### Specification

```
filename: Pancakes.py

def minutesNeeded (numCakes, capacity):
    """
    return integer representing time to cook pancakes
    based on integer parameters as described below
    """
```

### Examples

```
1. numCakes = 0
   capacity = 4

   Returns: 0
```

It takes no time to cook 0 pancakes.

```
2. numCakes = 2
   capacity = 2

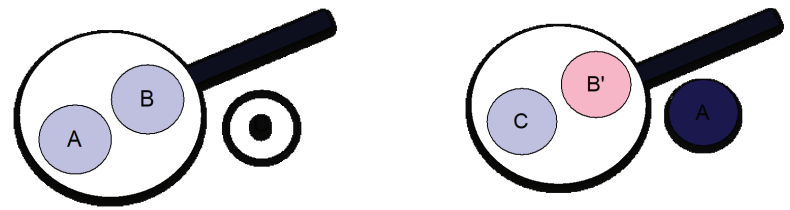
   Returns: 10
```

You cook both pancakes on one side for five minutes, then flip them over and cook each on the other side for another five minutes.

## Step 1: Solve an instance

### Three pancakes in a two-cake pan

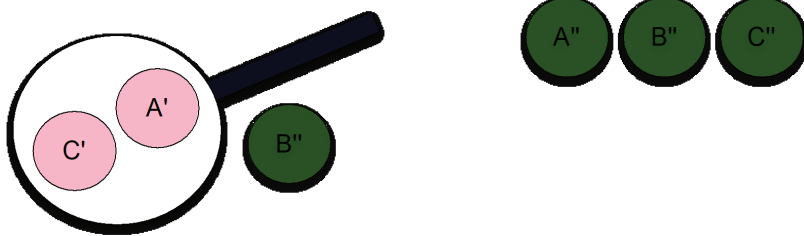
- First 5 minutes
  - 2 half cooking
  - 1 uncooked
- Second 5 minutes
  - 2 half cooking
  - 1 almost cooked



## Step 1: Solve an instance

### Three pancakes in a two-cake pan

- Third 5 minutes
  - 1 done
  - 2 almost cooked
- How many minutes to cook all three pancakes?



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## Step 1: Solve an instance

- What kind of instances? Simple cases that are quickly solved
  - What are these in Pancake problem?
- Don't solve for N, solve for 5 (generalize is step 3)
  - What do when there are two parameters?
    - Fix one, vary the other one
  - Helps identify cases



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## WOTO-2 Pancakes

<http://bit.ly/101s21-0225-2>

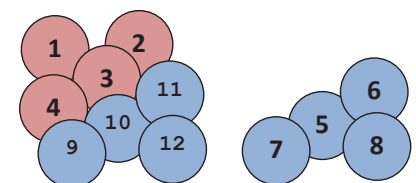
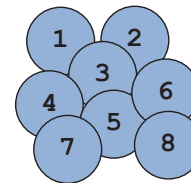
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## Step 1: Solve an instance

- Pan has capacity 8, vary # pancakes
  - Can you cook 12 in 15 minutes? Why?
  - Can you cook 13 in 15 minutes? Why?

cakes	5	6	7	8	9	10	11	12	13	14	15	16	17	18
time	10	10	10	10	?									



2/25/21

Compsci 101, Spring 2021 28



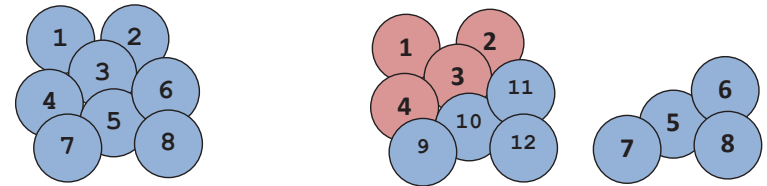
## Step 2: What did we just do?

- $13 - 8 = 5$
- $8/2 = 4$  # Can only take off up to half
- Is  $5 \leq 4$ ?
  - No, warmer trick won't work
- 10 minutes for 8 pancakes + 10 minutes for 5 more pancakes = 20 minutes

## Step 1: Solve an instance

- Pan capacity 8, vary # pancakes, 17 pancakes?

cakes	5	6	7	8	9	10	11	12	13	14	15	16	17	18
time	10	10	10	10	15	15	15	15	20	20	20	20		



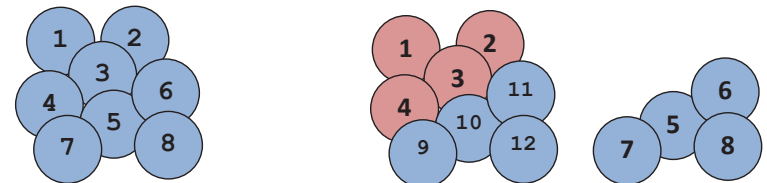
## Step 2: What did we just do?

- $17 - 8 = 9, 9 - 8 = 1$
- $8/2 = 4$
- Is  $1 \leq 4$ ? # Yes, warmer trick will work!
- Total: 25 minutes
  - 10 minutes for 8 pancakes +
  - 5 minutes for 8 pancakes +
  - Take 1 out, start 17<sup>th</sup> pancake
  - 5 minutes finish pancakes 8 to 15 +
  - 5 minutes finish pancake 16 and 17

## Step 3: Generalize

- Pan has capacity 8, Generalize to algorithm?

cakes	5	6	7	8	9	10	11	12	13	14	15	16	17	18
time	10	10	10	10	15	15	15	15	20	20	20	20	25	25





## Step 3: Generalize

- $13 - 8 = 5$
- $8/2 = 4$
- Is  $5 \leq 4$ ?
  - No, warmer trick won't work
- 10 minutes for 8 pancakes + 10 minutes for 5 more pancakes = 20 minutes
- Remove as many as can with panCapacity
- Will the remainder fit in half the pan?
- Yes, use warmer
  - 5 minutes instead of 10 for last batch
- No, don't use warmer
  - 10 minutes for all sets of panCapacity

## Step 4: Test Steps

- Remove as many as can with panCapacity
- Will the remainder fit in half the pan?
- Yes, use warmer
  - 5 minutes instead of 10 for last batch
- No, don't use warmer
  - 10 minutes for all sets of panCapacity
- Case 1:
  - cap 17, cook 34

## Step 4: Test Steps

- Remove as many as can with panCapacity
- Will the remainder fit in half the pan?
- Yes, use warmer
  - 5 minutes instead of 10 for last batch
- No, don't use warmer
  - 10 minutes for all sets of panCapacity
- Case 1:
  - cap 17, cook 34
  - remainder = 0
  - Edge case! No need for warmer
  - Total: 20 minutes
- Case 2:
  - cap 17, cook 42

## Step 4: Test Steps

- Remove as many as can with panCapacity
- Will the remainder fit in half the pan?
- Yes, use warmer
  - 5 minutes instead of 10 for last batch
- No, don't use warmer
  - 10 minutes for all sets of panCapacity
- Case 1:
  - cap 17, cook 34
  - remainder = 0
  - Edge case! No need for warmer
  - Total: 20 minutes
- Case 2:
  - cap 17, cook 42
  - remainder = 8
  - Yes, use warmer
  - Total: 25 minutes

## Step 5: Code

- Remove as many as can with panCapacity
- Will the remainder fit in half the pan?
- Yes, use warmer
  - 5 minutes instead of 10 for last batch
- No, don't use warmer
  - 10 minutes for all sets of panCapacity
- N pancakes
- How many panCapacity can remove?
  - $N // \text{panCapacity}$
- remainder
  - $N \% \text{panCapacity}$
- Half of pan?
  - $\text{panCapacity} / 2$

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## Let's code it up!

2/25/21

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## In Summary

- When it comes to planning the algorithm (Steps 1-4) and coding (Step 5), each part can be easy or hard

```
7 def minutesNeeded(numCakes, capacity):
8     full = numCakes // capacity
9     left = numCakes % capacity
10    minutes = 10 * full
11    if left > capacity/2:
12        minutes += 10
13    elif left > 0:
14        minutes += 5
15    return minutes
```

What are the next steps?

6: Testing!  
7: Debugging

Why > and not >=?

2/25/21

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## How to teach pancake Flipping

- [http://www.youtube.com/watch?v=W\\_gxLKSsSIE](http://www.youtube.com/watch?v=W_gxLKSsSIE)
  - For longer, more complex robotic tasks
    - <http://www.youtube.com/watch?v=4usoE981e7I>



2/25/21

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## Pancake flipping Video



## Review: While Loops

- Don't know: *how many times* loop executes
  - *a priori* knowledge, we'll know afterward
- Do know: condition that should be true after loop
  - Its negation is the expression for `BOOL_CONDITION` (loop guard)

```
while BOOL_CONDITION:  
    LOOP_BODY  
    # modify variables, affect expression
```

## WOTO-3 Collatz and While

<http://bit.ly/101s21-0225-3>

## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

```
["apple", "fox", "vacuum", "lime"]  
[5, 2, 25, 15]
```

- What happens when we read a word?

## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

```
["apple", "fox", "vacuum", "lime"]  
[5, 2, 25, 15]
```

- What happens when we read a word?

Read word "vacuum"?

2/25/2021, Spring 2021 45

## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

```
["apple", "fox", "vacuum", "lime"]  
[5, 2, 26, 15]
```

- What happens when we read a word?

Read word "vacuum"?

2/25/2021, Spring 2021 46

## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

```
["apple", "fox", "vacuum", "lime"]  
[5, 2, 26, 15]
```

- What happens when we read a word?

Read word "cat"?

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## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

```
["apple", "fox", "vacuum", "lime", "cat"]  
[5, 2, 26, 15]
```

Add into words

- What happens when we read a word?

Read word "cat"?

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## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

["apple", "fox", "vacuum", "lime", "cat"]  
[5, 2, 26, 15, 0]

Expand counts

- What happens when we read a word?

Read word "cat"?

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## Parallel Lists Review

- We will use parallel lists to track data
  - Each word is stored in a list named **words**
  - Word's count is stored in a list named **counts**
  - # occurrences of **words[k]** is in **counts[k]**

["apple", "fox", "vacuum", "lime", "cat"]  
[5, 2, 26, 15, 1]

Add one

- What happens when we read a word?

Read word "cat"?

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WOTO-4 File Frequency  
<http://bit.ly/101s21-0225-4>