Compsci 101
Lists, Mutation, Objects
Live Lecture

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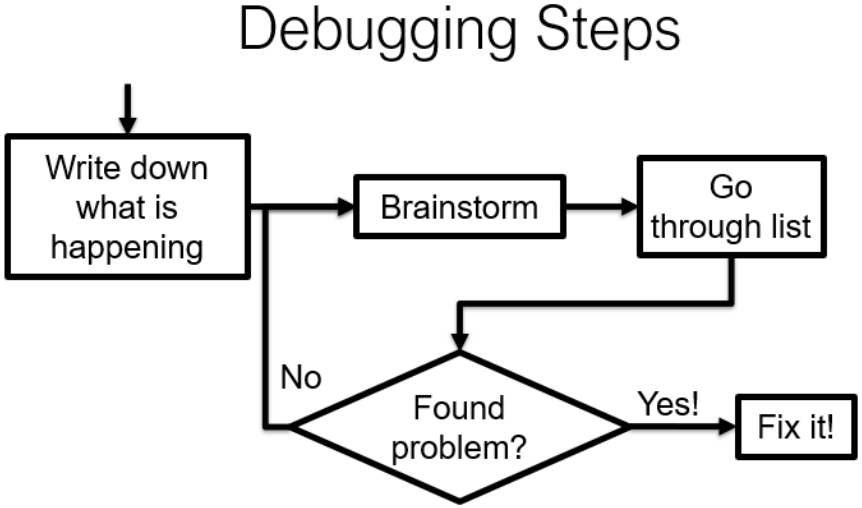
Nicki Washington
February 9, 2021



Announcements

- Assign 1 Totem, due Thursday, Feb 11
- Lab 3 Friday, Do Prelab 3 before lab
  - Note do prework for Feb 11, before Prelab 3
- Sakai QZ due by lecture time each day

- Exam 1 – Tuesday, Feb 16
- Need SDAO letters for exams!
  - Email them to Ms. Velasco

    yvelasco@cs.duke.edu

Genesis Bond ‘16

- Struggled at Duke
  - 5 years
  - Dismissed 1 semester due to grades
- Revature
  - Trainer Full Stack Development
  - She worked smarter
- Facebook Engineer, big success!
- Her story: http://bit.ly/dukebond

“Poor preparation promotes poor performance. In anything you do, your preparation will show.”

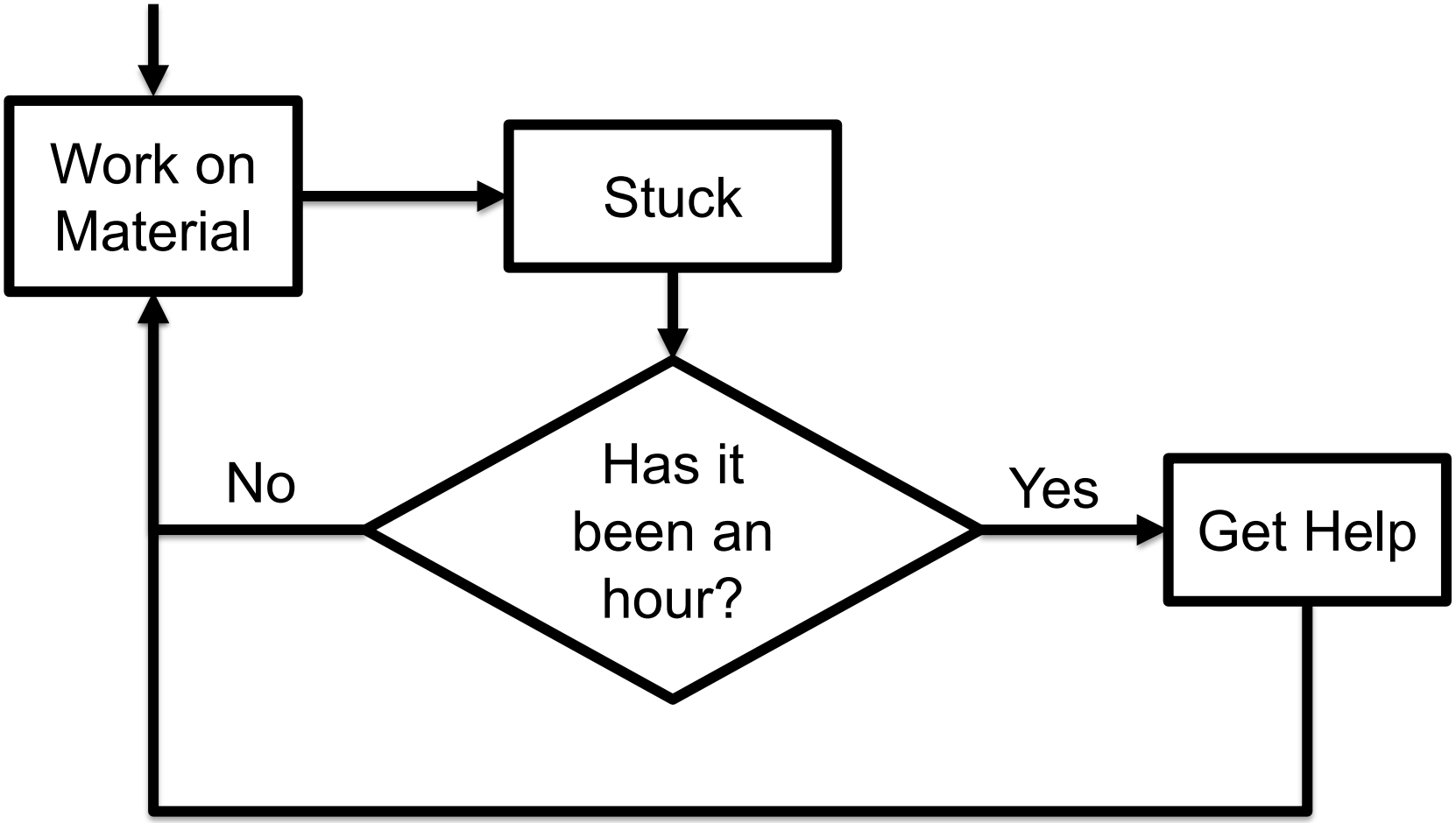
Top 10 list - Surviving in CompSci 101

10. Read the book
9. Check Piazza every day
8. Ask Questions
7. Visit office hours/consulting hours
6. Understand what you turn in

Top 10 list (cont)

5. Learn how to debug your programs
4. Think smarter, not harder
3. Follow the 7-step process
2. Seek help (One Hour Rule!)
1. Start programming assignments early

One Hour Rule for Getting Help



PFTD

- Slicing
- Totem
- Debugging
- List concatenation and nesting
- Mutability
- Objects and what that means
- Exam 1

Exam 1 – Feb 16, 2021

- All topics through Thur. Feb 11 except loops
  - Understand/Study
    - Reading, lectures
    - Assignment 1, APT-1,
    - Labs 0-3 (except for loops in Lab 3)
  - Old tests and solutions on resources tab
    - See recommended ones posted today
- Logistics:
  - Online, More details next time
  - Pick a time to take it on Feb 16

Exam 1 – Feb 16, 2021 (cont)

- What you should be able to do
  - Read/trace code
  - Determine output of code segment
  - Write syntax
- Similar format to Test 1 Fall 2020
  - But note that test covers more topics
  - See posted list of problems posted on calendar page on today's date

Slicing Python Sequences

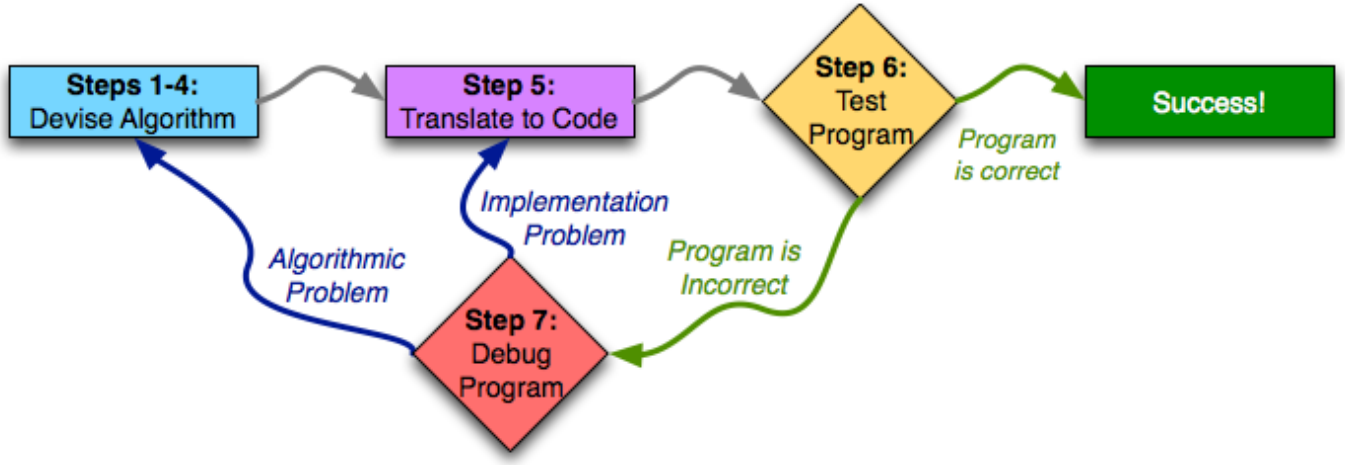
- **`s="hello world"`**
- **`l=["my", "big", "beautiful", "world"]`**
- Slicing provides sub-sequence (string or list)
  - `seq[n:m]` – all elements `i`, s.t. `n <= i < m`
  - Compare **`s[0:3]`** and **`l[0:3]`**
  - What is length of subsequence? **`seq[2:4]`**
  - Compare **`s[4:-1]`** and **`l[2:-1]`**
  - Is last index part of subsequence?

- We can omit value, e.g., **`s[2:]`** or **`s[:3]`**, good shortcut!

WOTO-1 Slicing
http://bit.ly/101s21-0209-1

Debugging

- Finding what is wrong + fixing it
  - Finding is its own skill set, and many find difficult
  - Fixing: revisit Step 1—5



How Not To Debug

- **Bad (but tempting) way to debug**
  - Change a thing. Does it work now?
  - No … another change … how about this?
- **Trust doctor if they say?**
  - "Ok try this medicine and see what happens?"
- **Trust mechanic if they say?**
  - "Let's replace this thing and see what happens"

It may be easy, but that doesn't make it a good idea!

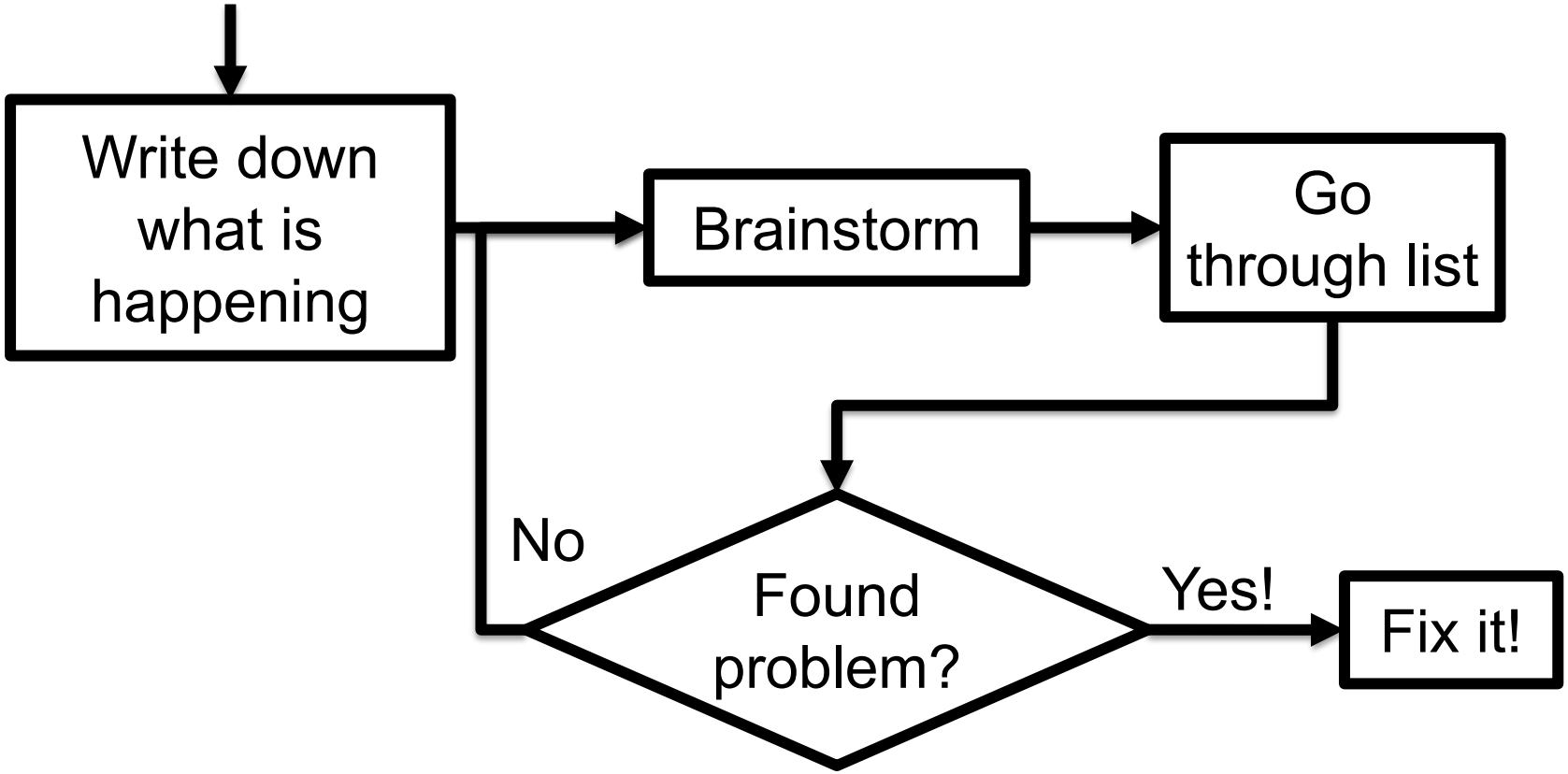
Debugging Steps

1. **Write down exactly what is happening**
    1. input, output, what should be output
    2. ____ happened, but ____ should happen
2. **Brainstorm possible reasons this is happening**
    1. Write down list of ideas
3. **Go through list**
4. **Found it?**
    1. Yes, fix it using the 7-steps
    2. No, go back to step 2

This is what experts do!

Remember: One-hour rule

Debugging Steps



WOTO-2 – Relate W's to Debugging http://bit.ly/101s21-0209-2

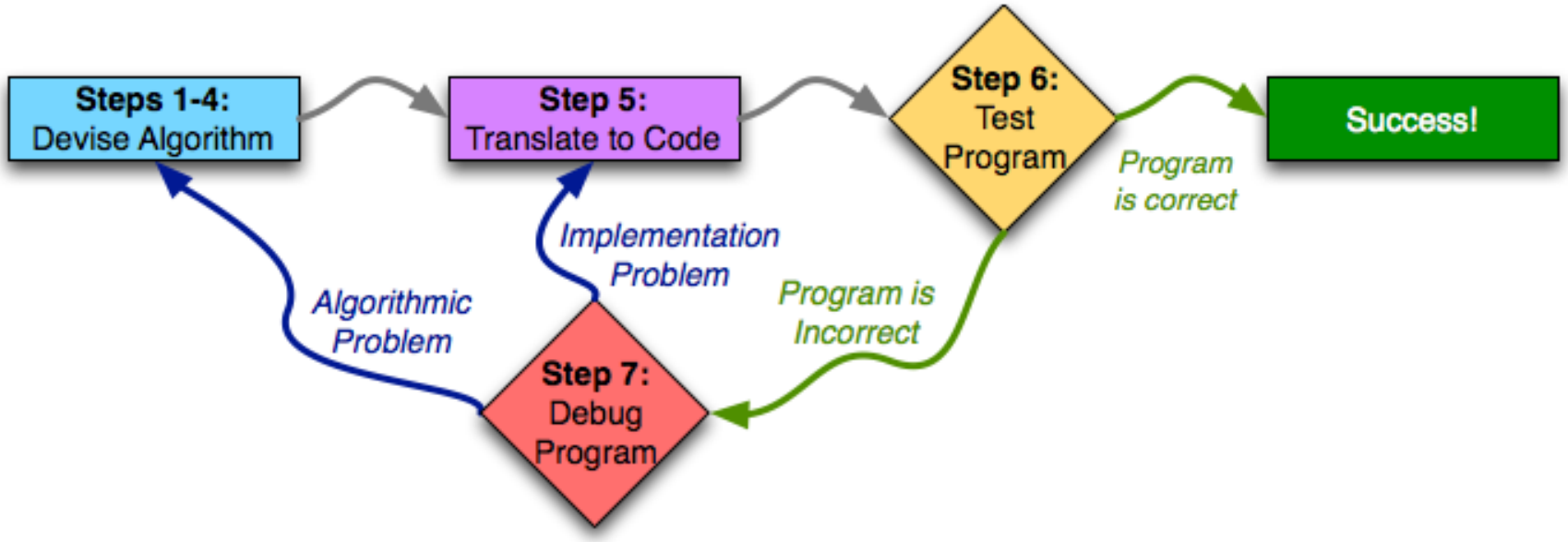
- Who was involved?
  -
- What happened?
  -
- Where did it take place?
  -
- When did it take place?
  -
- Why/How did it happen?
  -

Translate these questions to debugging

WOTO-2 – Relate W's to Debugging http://bit.ly/101s21-0209-2

- **Who was involved?**
  - Which variables are involved?
- **What happened?**
  - What kind of error/bug is it?
- **Where did it take place?**
  - Where in the code did this happen?
- **When did it take place?**
  - Does it happen every time? For certain cases?
- **Why/How did it happen?**
  - Given the answers to the above, how did the error/bug happen?

Step 7 -> Steps 1-4 or 5



Which year is a leap year?

- A Leap Year must be divisible by four.
- But Leap Years don't happen every four years … there is an exception.
  - If the year is also divisible by 100, it is not a Leap Year unless it is also divisible by 400.

WOTO: Buggy Leap Year
http://bit.ly/101s21-0209-3

```
7   def is_leap_year(year):
8       if year % 4 == 0:
9           return True
10      if year % 100 == 0:
11          return False
12      if year % 400 == 0:
13          return True
14      return False
```

Input: 1900
Output: True
Should be: False

WOTO: Buggy Leap Year
http://bit.ly/101s21-0209-3

- Who? (Which variables)
- What kind of bug is it?
- Where in the code?
- When does it happen?
- Why/How did it happen?
  -

```
7   def is_leap_year(year):
8       if year % 4 == 0:
9           return True
10      if year % 100 == 0:
11          return False
12      if year % 400 == 0:
13          return True
14      return False
```

Input: 1900
Output: True
Should be: False

WOTO: Buggy Leap Year
http://bit.ly/101s21-0209-3

- **Who? (Which variables)**
  - `year` (only one)
- **What kind of bug is it?**
  - Semantic error
- **Where in the code?**
  - One of the places it returns True
- **When does it happen?**
  - Input: 1900, but not 2016 nor 2019
- **Why/How did it happen?**
  - A property 1900 has but not 2016 and 2019

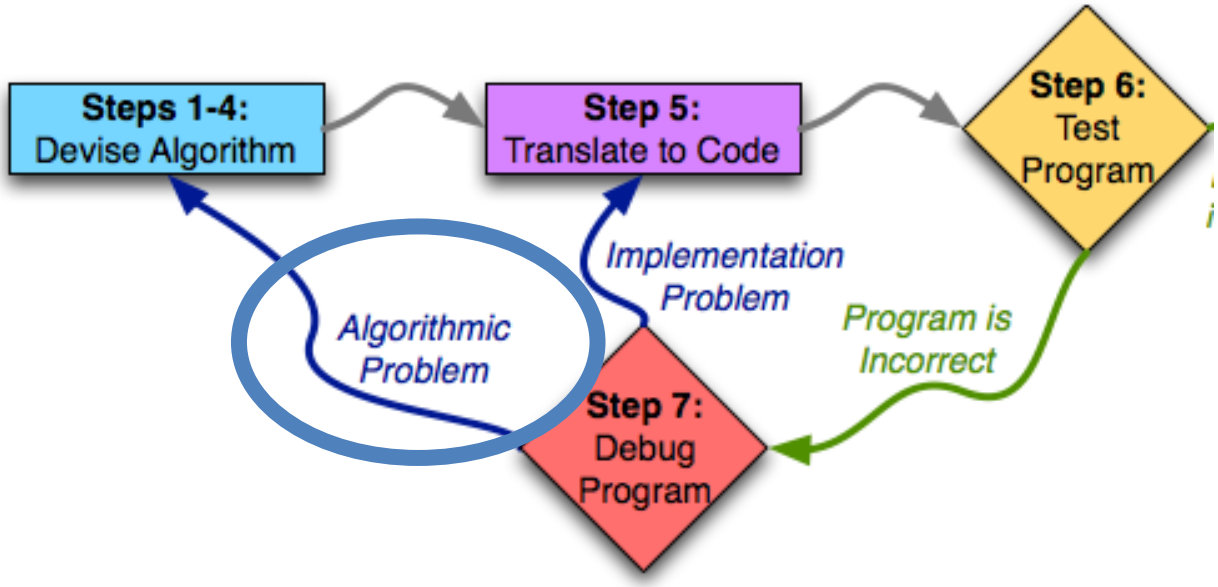
```
7   def is_leap_year(year):
8       if year % 4 == 0:
9           return True
        if year % 100 == 0:
            return False
        if year % 400 == 0:
            return True
        return False
```

How find which statement?

Input: 1900
Output: True
Should be: False

Why Leap Year Buggy?

- Why: Should not always return True if year is divisible by 4
- Solution: Check first for %400, then %100, and finally %4



Another Example: Function withCutOff

- This function should calculate an overall quiz score, using the total points of all your quizzes.
- If you earn 75% or more of the total points you get a 100% or 1.0
- If you earn less than 75% then your score is the total number of points you have, divided by the number of points that would represent 75% of the score.

withCutOff Function Examples

- Example 1, total points is 100, you have 90 points
  - 75% of points is 75 points, you have many more
  - Your score is 100% or 1.0.
- Example 2, total points is 100, you have 60 points
  - 75% of points is 75
  - your score is 60/75 is 80% or 0.8.
- Example3, total points is 134, you have 50 points
  - 75% of points is 100, (134*0.75 is 100)
  - Your score is 50/100 is 50% or 0.5.

WOTO: Buggy withCutOff function http://bit.ly/101s21-0209-4

WOTO: Buggy withCutOff function http://bit.ly/101s21-0209-4

```
7   def withCutOff(total, possible):
8       denominator = int(possible*0.75)
9       percent = total/denominator
10      if percent > 1:
11          percent = 1.0
12      return percent
```

Input: (1,1)
Output: Error
Should be: 1.0

WOTO: Buggy withCutOff function http://bit.ly/101s21-0209-4

- **Who? (Which variables)**
  - total, denominator
- **What kind of bug is it?**
  - Runtime error
- **Where in the code?**
  - Line 9
- **When does it happen?**
  - Input (1,1), but not (75,100) nor (50,134)
- **Why/How did it happen?**
  - Divide by zero, so denominator variable is zero

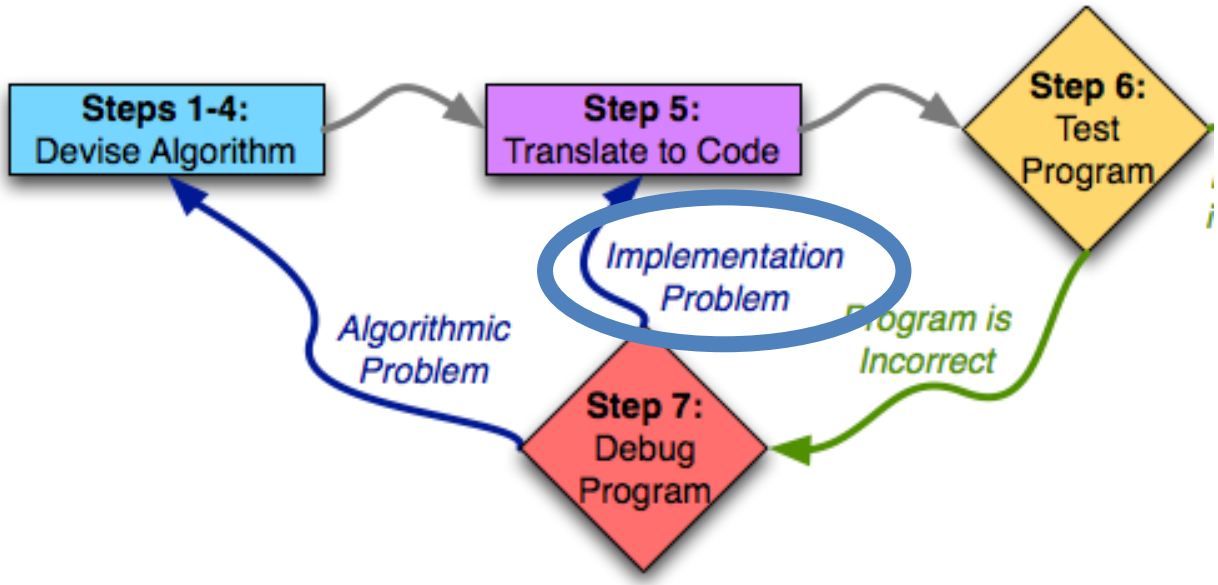
```
7   def withCutOff(total, possible):
8       denominator = int(possible*0.75)
9       percent = total/denominator
10      if percent > 1:
11          percent = 1.0
12      return percent
```

Input: (1,1)
Output: Error
Should be: 1.0

Why is it 0? Where does it get its value?

Why Score Buggy?

- Why: Not accounting for possibility of rounding down to 0
- Solution: Check if denominator is 0 and have special case



Mutating Lists

- **`lt = [‘Hello’, ‘world’]`**
  - Change to: `[‘Hello’, ‘Ashley’]`
- Concatenation: **`lt = [lt[0]] + [‘Ashley’]`**
- Index: **`lt[1] = ‘Ashley’`**

- How change **`‘b’`** in **`lt = [1, ‘a’, [2, ‘b’]]`**?
  - `lt[2][1] = ‘c’`

WOTO-5 List Mutation
http://bit.ly/101s21-0209-5