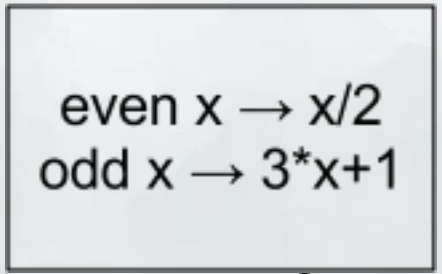
CIS 122

Throwing you for a loop

Definitively Speaking



even x → x/2
odd x → 3*x+1

- How could we solve the collatz problem using loops?
  - How many times do we need to apply HOTPO before we reach 1?

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Definitively Speaking

- How could we solve the collatz problem using loops?
  - How many times do we need to apply HOTPO before we reach 1?
- Uh oh
  - Don't know how many times we'll need to loop
- For loop are definite loops
  - We know exactly how long they will last
  - One loop for every element in our sequence
- The collatz problem requires an indefinite loop
  - We don't know how many loops it will require beforehand

While Loops

- We need a new type of loop
    - While loops

- While some condition is true
    - Keep running block of code

- Very similar to if statement
    - If statement runs block once if condition is true
    - While loop runs block repeatedly while condition is true

Anatomy of a while loop

```
x = 0

while x < 10:
    print x
    x = x + 1
```

Initialization

Loop Condition

Loop body

While Loops

- While condition is True, keep running body
  - What if condition is always true?

- Infinite loop
  - Similar to infinite recursion
  - But no limit on number of loops

- Sometimes an infinite loop is a good thing
  - IDLE shell
  - Operating systems

```
x = 0
while x >= 0:
    print x
    x = x + 1
```

```
x = 0
while True:
    print x
    x = x + 1
```

While Loops

- What if you need to break out of a loop early?
    - Use the break keyword
    - Stop running whatever loop you're in

```
x = 0
while True:
    print x
    x = x + 1
    if x == 10:
        break
```

While Loops

- Avoid using break statements when you can
    - Tend to make code less clear
    - A good loop condition is far more readable
- If you use break statements, comment them well

```
x = 0
while x < 10:
    print x
    x = x + 1
```

```
x = 0
while True:
    print x
    x = x + 1
    if x == 10:
        break
```

While Loop Practice

even x $\rightarrow$ x/2
odd x $\rightarrow$ 3*x+1

- Implement collatz(x) using a while loop
    - How many times do we need to perform HOTPO on x before it reaches 1?

- How could we use a while loop to solve this problem?

While Loop Practice

even x → x/2
odd x → 3*x+1

- Implement collatz(x) using a while loop
  - How many times do we need to perform HOTPO on x before it reaches 1?

- How could we use a while loop to solve this problem?
  - Initialize a counter to 0
  - While x hasn't reached 1...
    - Apply HOTPO to x
    - Increment counter

While Loop Practice

even x → x/2
odd x → 3*x+1

- Implement collatz(x) using a while loop
    - How many times do we need to perform HOTPO on x before it reaches 1?

```
def collatz(x):
    steps = 0                  #Initialize a counter to 0
    while x != 1:              # While x hasn't reached 1
        x = HOTPO(x)              # Apply HOTPO to x
        steps = steps+1          # Increment counter
```

So many Choices

- We've seen two types of loops
- for loops
  - Repeat some task **for** each element in a sequence
  - Definite loops
  - Good for specific tasks
- while loops
  - Repeat some task **while** a condition is true
  - Indefinite loops
  - General purpose

So many Choices

- Which loop should I choose?

- Do have a sequence you want to iterator over?
    - for element in sequence

- Do you know how many times you want to loop?
    - for x in range(n)

- None of the above?
    - while <some condition>

Homework Preview

- Part 0 - Summing Things Up
- Part 1 - Circular Reasoning
- Part 2 - Password Checker
- Part 3 - Guessing Game

Part 0 - Summing Things Up

- Write a function mySum(numbers)
  - Takes a list of numbers
  - Returns their sum
- What loop should we use?
- For inspiration, look over our max function from yesterday

Part 1 - Circular Reasoning

- Turtle graphics are back!

- Write a function circle(radius)
    - Draw circle of the given radius
    - This isn't an easy task
    - But what if we approximate our circle as a polygon

- Write a function polygon(sides, sideLength)
    - Draw a polygon with the given number of sides
    - Repeatedly move forward and turn
    - What loop should we use?

Part 2 - Password Checker

- Make sure passwords are sufficiently secure
  - At least 8 characters long
  - At least 1 letter
  - At least 2 numbers
  - Don't contain 'E' or 'e' (those letters are far too common)

- Write a function passwordChecker(password)
  - Returns False if password fails any tests
  - Returns True if password passes all tests

Part 2 - Password Checker

- Write helper functions to test individual cases
  - Does this string contain a letter?
  - Does this string contain two numbers?
- Call helper functions from main passsword checker
- What loops should we use?

Part 2 - Password Checker

- Special string methods
    - dot notation

```
>>> 'a'.isalpha()
True

>>> 'b'.isdigit()
False


>>> myChar.isupper()
???
```

Part 3 - Guessing Game

- Write a function guessingGame()

- When called, Python should play a guessing game
  - Pick a random number
  - Ask the user to guess a number
  - If they guess wrong, give them a hint (too high, too low)
  - If they guess right, congratulate them
    - And tell them how many guesses they took

- What needs to loop?
  - And loop should we use?