Anagram Algorithm

- **Recursive Step**
  - Select a letter in one string
  - Remove letter from both words
  - See if remaining letters are anagrams

- **Base Cases**
  - **X** - Strings have different lengths
  - **X** - A letter in one string isn't in the other
  - **O** - Both strings are empty
Assignment 2

- Four recursion themed problems
  - Triangle warmup
  - Puzzling Palindromes
  - Collatz Quandary
  - A Shifty Problem (part 2)
Part 0 - Triangle Warmup

● How many dots does it take to draw a triangle?
  ○ 1 dot on the first row
  ○ 2 dots on the second row
  ○ 3 dots on the third row
  ○ ...

1  3  6  10
Part 0 - Triangle Warmup

● How many dots does it take to draw a triangle?
  ○ 1 dot on the first row
  ○ 2 dots on the second row
  ○ 3 dots on the third row
  ○ ...

● How many dots in a triangle of size 1?
  ○ 1
Part 0 - Triangle Warmup

● How many dots does it take to draw a triangle?
  ○ 1 dot on the first row
  ○ 2 dots on the second row
  ○ 3 dots on the third row
  ○ ...

1 3 6 10

● How many dots in a triangle of size 2?
  ○ 1 + 2 = 3
Part 0 - Triangle Warmup

● How many dots does it take to draw a triangle?
  ○ 1 dot on the first row
  ○ 2 dots on the second row
  ○ 3 dots on the third row
  ○ ...

• How many dots in a triangle of size 3?
  ○ $1 + 2 + 3 = 6$
Part 0 - Triangle Warmup

● How many dots does it take to draw a triangle?
  ○ 1 dot on the first row
  ○ 2 dots on the second row
  ○ 3 dots on the third row
  ○ ...

1 3 6 10

● How many dots in a triangle of size n?
  ○ $1 + 2 + 3 + \ldots + n$
Part 0 - Triangle Warmup

● Write a function `triangle(n)`
  ○ Calculate the nth triangle number
  ○ $1 + 2 + 3 + \ldots + n$

● What's our base case?

● What's our recursive step?
Part 0 - Triangle Warmup

● Write a function $\text{triangle}(n)$
  ○ Calculate the $n$th triangle number
  ○ $1 + 2 + 3 + \ldots + n$

● What's our base case?
  ○ $\text{triangle}(0) = 0$

● What's our recursive step?
Part 0 - Triangle Warmup

● Write a function `triangle(n)`
  ○ Calculate the nth triangle number
  ○ `1 + 2 + 3 + ... + n`

● What's our base case?
  ○ `triangle(0) = 0`

● What's our recursive step?
  ○ `triangle(n) = n + triangle(n-1)`
Part 0 - Triangle Warmup

- Write a function $\text{triangle}(n)$
  - Calculate the $n$th triangle number
  - $1 + 2 + 3 + \ldots + n$

- What's our base case?
  - $\text{triangle}(0) = 0$

- What's our recursive step?
  - $\text{triangle}(n) = n + \text{triangle}(n-1)$

- Very similar to factorial...
Part 1 - Puzzling Palindromes

- A **palindrome** reads the same forwards and backwards
  - pop
  - madam
  - racecar

- Write a function `isPalindrome(word)`
  - Return **True** if word is a palindrome
  - Return **False** otherwise
Part 1 - Puzzling Palindromes

- How do we tell if a word is a palindrome?

RACECAR
Part 1 - Puzzling Palindromes

• How do we tell if a word is a palindrome?
  ○ First and last letters must match

RACECAR
Part 1 - Puzzling Palindromes

● How do we tell if a word is a palindrome?
  ○ First and last letters must match
  ○ Rest of word must be a palindrome

RACECAR
Part 1 - Puzzling Palindromes

- How do we tell if a word is a palindrome?
- Base Cases
- Recursive Step
Part 1 - Puzzling Palindromes

● How do we tell if a word is a palindrome?

● Base Cases
  ○ O - The empty string is a palindrome
  ○ X - First and last letters don't match

● Recursive Step
Part 1 - Puzzling Palindromes

- How do we tell if a word is a palindrome?

- Base Cases
  - O - The empty string is a palindrome
  - X - First and last letters don't match

- Recursive Step
  - If first and last letters match...
  - The rest of the word must be a palindrome
Part 2 - Collatz Quandary

- **HOTPO** - *Half Or Triple Plus One*
  - If number is even, divide it by two
  - If number is odd, multiply by three and add one

- **Collatz Conjecture**
  - Pick any number
  - Repeatedly apply HOTPO
  - Eventually, it will reach 1

- You don't need to prove the Collatz Conjecture
  - It's still an open problem
Part 2 - Collatz Quandary

- Write a function `collatz(n)`
  - How many steps does it take to get from n to 1?
Part 2 - Collatz Quandary

- Write a function `collatz(n)`
  - How many steps does it take to get from `n` to 1?

- We know what the next number in the sequence is
  - If `n` is even, it's `n/2`
  - If `n` is odd, it's `3*n+1`

- What if we knew how long it took that number to get to 1?
  - Clearly, it takes `n` one step more!
Part 2 - Collatz Quandary

- Write a function \texttt{collatz(n)}
  - How many steps does it take to get from \texttt{n} to 1?

- Base Case

- Recursive Step
Part 2 - Collatz Quandary

● Write a function \texttt{collatz}(n)
  ○ How many steps does it take to get from \(n\) to 1?

● Base Case
  ○ \texttt{collatz}(1) = 0
  ○ It's already there!

● Recursive Step
Part 2 - Collatz Quandary

- Write a function \texttt{collatz(n)}
  - How many steps does it take to get from \( n \) to 1?

- Base Case
  - \( \text{collatz}(1) = 0 \)
  - It's already there!

- Recursive Step
  - Find how many steps the number after \( n \) takes
  - \( n \) takes one step more