CS105 Problem Solving

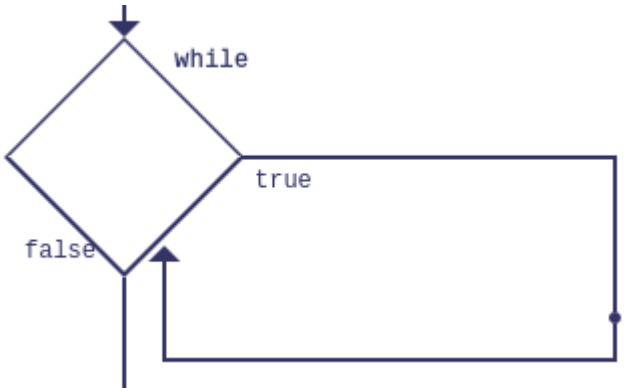
Loops and Counters

Wholeness

- What if the user doesn’t enter the right input? What if we want to make a circle (360 steps) with Turtle Graphics?
- Both of these cases require loops, but two different types of loops. The first should loop an undetermined amount of times until the right input is given, while the other should loop a very specific amount of times.
- Both let us write the steps once, and let the loop do the rest – do less and accomplish more
- We're also going to take a look at how to access individual characters in a string, and how to create random numbers.

While Loop

- The While loop has a condition diamond, and a branch.
  - When the condition evaluates to true it executes the loop body that comes back to the condition
  - When the condition evaluates to false execution continues to beyond the loop



Example

- We can make a program that keeps asking the user “Really?”, until the user enters “Yes”.
  - This is an example of checking for correct input

Exercise

- Create a program that asks the user to guess a number – the program should continue asking the user to guess until the user enters 5.

Main Point

- A loop starts by checking the condition and executes its steps if the condition evaluates to true, after the steps it returns to the condition to see if it should go again.
- Purification leads to progress, not until the right condition has been met can we progress.

Loop with a Counter

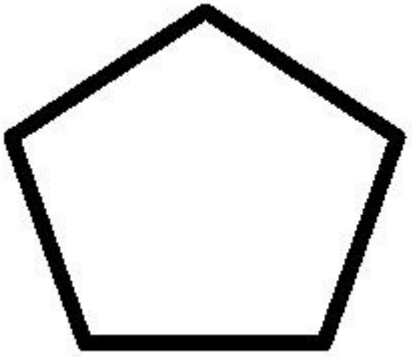
- Many loops have a specific amount of times that they should execute
  - Instead of an unknown amount (until condition)

- In order to keep track of how many times a loop has executed we need a counter

- This is such a common pattern that most programing languages call this a 'for' loop.

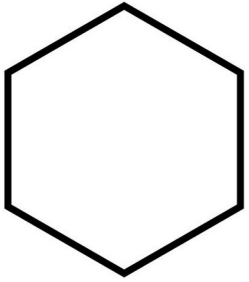
Example

- Lets make a pentagon with a loop!



Exercise

- Write a program that draws a hexagon by using a loop



Example

- Lets make a program that counts from 1 to 100!

Exercise

- Make a program that counts to 50
  - Once it works, make it only print the even numbers up to 50

Main Point

- By controlling a loop with a counter we can make sure that the loop body is executed exactly the amount of times we want.
- Order is present everywhere

More About Strings

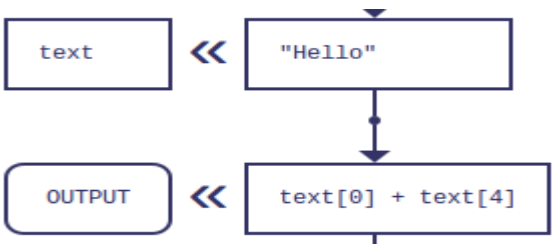
- There are a variety of things that you can do with strings that we haven’t discussed yet
- The most important of these are:
  - You can ask a string for its length
  - You can ask a string for the character at a position
  - There is a lot more if you’re interested:

  http://www.w3schools.com/jsref/jsref_obj_string.asp

Character at a Position

- To get the character at a specific position
  - You can use the index syntax: [index]
  - Alternately use the method: .charAt(index)

- For both of these, the first character is at 0
  - The length of string is index beyond the end



Example

- Print each character of a string

Exercises

- Print every other character in a string
  - For example, for “Hello” it should print “Hlo”

- For those done quickly:
  - Print a string in reverse

Main Point

- You can use string indexing to access the individual characters of a string
- The whole can always give us access to the parts

Input Takes Time

- Often an exercise will say something like “Write a program that takes 3 numbers from the user”
- When running these examples it takes time to type the numbers
  - What if we could do this more efficiently?
  - Could the computer just give a random number?

The Math Object

- The Math object has a variety of Math related values and functions that we can use
- For example:
  - Math.random()
  - Math.PI
  - Math.abs(number)
  - Math.pow(number, number)
  - Math.round()

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Math

Example

- Lets write a program that generates 10 random numbers between 0 and 10

- Easy changes:
  - What if I wanted to generate numbers between 0 and 100?
  - What if I wanted to generate numbers between 20 and 30?

Exercise

- Update your guess 5 game so that the user has to guess for a number created by Math.random()
  - Hint: start the program by creating (and storing) the random number that the user has to guess

Chances and Random Numbers

- Random numbers can also be used for chances
  - A coin flip is 50% heads, 50% tails
  - A random number is between 0 and 1
    - 0.00 to 0.50 is heads 0.50 to 1 is tails
    - Or multiply it by 2 and then 0 to 1 is heads and 1 to 2 is tails

- What about rolling a 6 sided (normal) dice?

Main Point

- The Math object has a variety of math constants and methods, including a method to generate a random number.
- From one source we can create an enormous amount of random different numbers, similar to how all of creation has its source in the unified field.

Summary

- A while loop continues executing until some condition is met
- Often we want to loop a certain amount of times, in such cases we need a counter
- Strings have a length and can give access to each character
- Random Values can be created with the Math.random() function