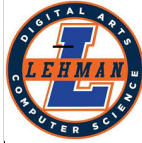# Fall 2021 Precalc Lesson 13.1

Dr. O'Brien
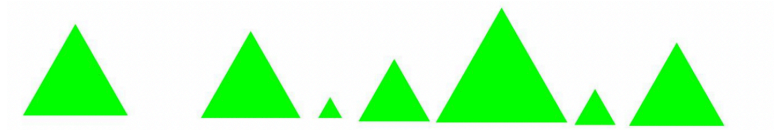Herbert H. Lehman High School
13 December 2021

VOCAB:
nested loop

Do now

be sure to: Get out your **binder**. Make sure you receive your **Brainstorm your own game** worksheet. Copy the **goal** and answer **do now** questions below. Write a complete sentence for each answer:

Let's say we want to make the image below in Pyret.

1. What functions would we need to use (check your contracts handout).
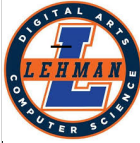2. Make a prediction: How many lines of code would we need to run?

class: precalc **goal:** HDW define our own functions in Pyret?

1 seems more efficient, since you're only asking one question.

+How can we measure 'efficiency'? which operation is faster? One will probably take less time

+What might be some problems with situation (1)? if a lot of people share the same birthday as you, it might get confusing.

DIGITAL ARTS LEHMAN COMPUTER SCIENCE

Do now
be sure to: Get out your **binder**. Make sure you receive your **Brainstorm your own game** worksheet. Copy the **goal** and answer **do now** questions below. Write a complete sentence for each answer:

Making this would get find of tedious because because we'd be using the triangle function over and over again.

There has to be a better way…

```
triangle( 50,  "solid",  "green")
triangle( 80,  "solid",  "green")
triangle(200,  "solid",  "green")
triangle(275,  "solid",  "green")
```
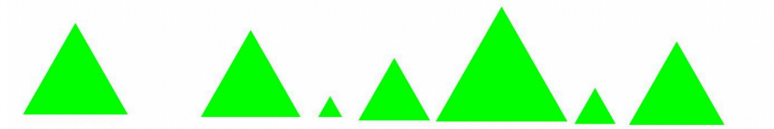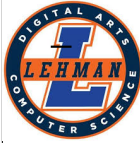
class: precalc **goal:** HDW define our own functions in Pyret?

1 seems more efficient, since you're only asking one question.

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+What might be some problems with situation (1)? if a lot of people share the same birthday as you, it might get confusing.

framing
- **what:** define our own functions in Pyret
- **why:** Making our own functions will be useful to getting our images to move around on the screen in our game. But it will also deepen our understanding of mathematical functions.
- **where to:** using functions in Pyret to solve mathematical word problems

class: precalc **goal:** HDW define our own functions in Pyret?

Vocab

example
Shows the use of a function on specific inputs and the computation the function should perform on those inputs
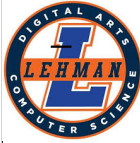
function
a mathematical object that takes in an input and produces a unique output

function definition
Code that names a function, defines its arguments, and states the expression to compute when code is used

class: precalc **goal:** HDW define our own functions in Pyret?

Coding to learn: warm up

be sure to: Answer the questions below in your **notebook**. Be prepared to share out.

1. Define a function $f(x)$ so that it will output the appropriate values given the inputs to the right
2. Define a function $g(x)$ so that it will give the appropriate outputs given the inputs to the right
3. How could you write a contract specifying the domain and range for $f(x)$ and $g(x)$?

$$f(1) = 4$$
$$f(2) = 5$$
$$f(3) = 6$$
$$f(5) = 8$$

$$g(1) = 3 \times 1 = 3$$
$$g(2) = 3 \times 4 = 12$$
$$g(3) = 3 \times 9 = 27$$
$$g(5) = 3 \times 25 = 75$$

class: precalc **goal:** HDW define our own functions in Pyret?

1. f(x) = x + 3
2. g(x) = 3x^2
3. the contract will be Number -> Number; in other words the domain maps any real number to another real number.

Model how to write functions in pyret (next page)

Coding to learn: warm up

be sure to: Write the definitions below in your **notebook**.

Regular math: $f(x) = x + 3$

Pyret: **fun** f(x): x + 3 **end**

$f(1) = 4$
$f(2) = 5$
$f(3) = 6$
$f(5) = 8$

Regular math: $g(x) = 3x^2$

Pyret: **fun g**(x): 3 * num-sqr(x) **end**

$g(1) = 3 \times 1 = 3$
$g(2) = 3 \times 4 = 12$
$g(3) = 3 \times 9 = 27$
$g(5) = 3 \times 25 = 75$

class: precalc **goal:** HDW define our own functions in Pyret?

Model how to write these functions in Google Classroom. Make sure students copy definitions below in notes:

#FUNCTION DEFINITIONS
fun f(x): x + 3 end
fun g(x): 3 * num-sqr(x) end

+How are the function definitions in Pyret different from standard math definitions? They're written in a funny way, with fun at the beginning and end telling us where the function ends. Also instead of an '=' we have a ':'.

Mini-lesson

```
#1 WARM UP EXAMPLES
#CONTRACT
#f :: Number -> Number
#g :: Number -> Number

#EXAMPLES
examples:
  f(1) is 4
  f(2) is 5
  f(3) is 6
  f(5) is 8
end

examples:
  g(1) is 3 * 1
  g(2) is 3 * 4
  g(3) is 3 * 9
  g(5) is 3 * 25
end


#FUNCTION DEFINITIONS
fun f(x):   x + 3   end
fun g(x): 3 * num-sqr(x) end
```

class: precalc **goal:** HDW define our own functions in Pyret?

The examples block creates a set of examples which are test on the funcion. If the function returns the correct output for each input, they pass.

Illustrate by changing def. of f(x) to x + 4, then change value of output.

Coding to learn: activity

Be sure to… work with your partner to answer these questions in your notebook. Write code in your Pyret file as needed.

1. Examine the examples and function definition for the function gt. Describe how the function works.
2. How could you write a contract identifying the domain and range for gt?
3. Write out a function gt2() that produces a triangle with <u>double</u> the size of the input.
4. Will the domain and range for gt2() be any different from gt()? Explain why or why not in a complete sentence.
5. Bonus questions:
   A. How could you rewrite gt2() as the composition two functions? Describe the functions and experiment with rewriting the function in Pyret.
   B. Write a function in Pyret for $h(x) = \sqrt{3x^2 - 2}$. Describe the contract for this function.

class: precalc **goal:** HDW define our own functions in Pyret?

+Examine the examples and function definition for the function gt. Describe how the function works. -> the function takes in a number and produces a solid green triangle of that size.
+How could you write a contract identifying the domain and range for gt? gt :: Number -> Image
+Write out a function gt2() that produces a triangle with double the size of the input.
gt(x): triangle(2 * x, "solid", "green")
Will the domain and range for gt2() be any different from gt()? Explain why or why not in a complete sentence. No, because the function can still take any positve number and produces an image as an output.
Bonus questions:
How could you rewrite gt2() as the composition two functions? Describe the functions and experiment with rewriting the function in Pyret. f(x): 2 * x and gt2(x): gt(f(x))

Write a function in Pyret for . Describe the contract for this function. h(x): num-sqrt((2 * num-sqr(x)) - 2)

Dr. O'Brien 12/13
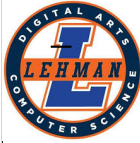
Reflection: Thinking about thinking

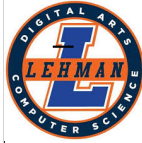be sure to: Answer each question below with a complete sentence.

1. Why is it useful for a programmer to be able to define a function?
2. Why is it useful to be able to define a function in math?
3. How do you think functions will make it easier to build our video game?
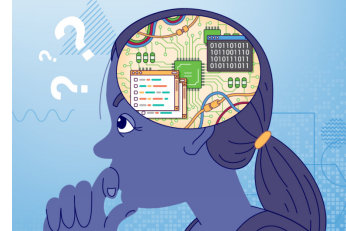
class: precalc **goal:** HDW define our own functions in Pyret?

1. answers will vary.
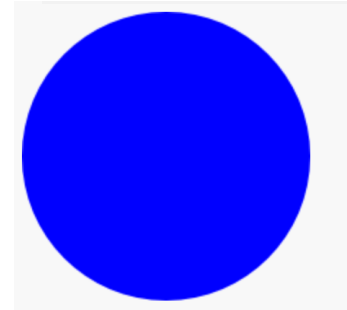2. using functions for manipulating images, e.g. scale(), overlay, etc.

exit ticket
be sure to: Answer each question below with a complete sentence.

Let's say we want to define a function called bc() that would make a solid blue circle of whatever radius we want.
1. Write out how to define this function in Pyret.
2. What would the contract for this function look like?

class: precalc **goal:** HDW define our own functions in Pyret?

1. How many times does the for loop iterate? How many times does the while loop iterate? Why are they different?
2. The for loop will iterate 5 times. The while loop will iterate 6 times. The while loop will iterate one more time because the inequality <= is used instead of <. The while loop will run when the variable = 5 whereas the for loop will not.