

Name: _____



BOOTSTRAP:2

www.bootstrapworld.org

Class: _____

Lesson 1

	Racket Code	Pyret Code
Numbers	<pre>(define AGE 14) (define A-NUMBER 0.6) (define SPEED -90)</pre>	<pre>AGE = 14 A-NUMBER = 0.6 SPEED = -90</pre> <p>Two of your own:</p> <hr/> <p>MY-NUMBER = 75.9</p> <hr/> <p>THREE = 3</p>
Strings	<pre>(define CLASS "Bootstrap") (define PHRASE "Coding is fun!") (define A-STRING "2500")</pre>	<pre>CLASS = "Bootstrap" PHRASE = "Coding is fun!" A-STRING = "2500"</pre> <p>Two of your own:</p> <hr/> <p>MY-NAME = "Elizabeth"</p> <hr/> <p>MY-NUMBER = 75.9</p>

<i>Images</i>	<pre>(define SHAPE (triangle 40 "outline" "red")) (define OUTLINE (star 80 "solid" "green")) (define SQUARE (rectangle 50 50 "solid" "blue"))</pre>	<pre>SHAPE = triangle(40, "outline", "red") OUTLINE = star(80, "solid", "green") SQUARE = rectangle(50, 50, "solid", "blue")</pre> <p>One of your own:</p> <hr/> <p><u>MY-SHAPE = rhombus(90, 60, "solid", "red")</u></p>
<i>Booleans</i>	<pre>(define BOOL true) (define BOOL2 false)</pre>	<pre>BOOL = true</pre> <p>One of your own:</p> <hr/> <p><u>BOOL2 = false</u></p>
<i>Functions</i>	<pre>; double : Number -> Number ; Given a number, multiply by ; 2 to double it (EXAMPLE (double 5) (* 2 5)) (EXAMPLE (double 7) (* 2 7)) (define (double n) (* 2 n))</pre>	<pre># double : Number -> Number # Given a number, multiply by # 2 to double it examples: double(5) is 2 * 5 double(7) is 2 * 7 end fun double(n): 2 * n end</pre>

Fast Functions!

Fill out the contract for each function, then try to write two examples and the definition by yourself.

double : Number -> Number
name domain range

examples:

$$\begin{array}{l} \text{double } (\underline{\quad} \overset{\text{n}}{\boxed{5}} \underline{\quad}) \text{ is } 2 * \overset{\text{n}}{\boxed{5}} \\ \text{double } (\underline{\quad} \overset{\text{n}}{\boxed{7}} \underline{\quad}) \text{ is } 2 * \overset{\text{n}}{\boxed{7}} \end{array}$$

end

fun double (n):

$$2 * n$$

end

triple : Number -> Number
name domain range

examples:

$$\begin{array}{l} \text{triple } (\underline{\quad} \overset{\text{n}}{\boxed{16}} \underline{\quad}) \text{ is } 3 * \overset{\text{n}}{\boxed{16}} \\ \text{triple } (\underline{\quad} \overset{\text{n}}{\boxed{8}} \underline{\quad}) \text{ is } 3 * \overset{\text{n}}{\boxed{8}} \end{array}$$

end

fun triple (n):

$$3 * n$$

end

Fast Functions!

Fill out the contract for each function, then try to write two examples and the definition by yourself.

plus1 : Number -> Number
name domain range

examples:

$$\begin{array}{ll} \text{plus1} (6) \text{ is } & \begin{array}{c} n \\ | \\ 6 + 1 \end{array} \\ \text{plus1} (55) \text{ is } & \begin{array}{c} n \\ | \\ 55 + 1 \end{array} \end{array}$$

end

fun plus1 (n):

$$n + 1$$

end

mystery : Number -> Number
name domain range

examples:

$$\begin{array}{ll} \text{mystery} (75) \text{ is } & \begin{array}{c} n \\ | \\ 75 - 4 \end{array} \\ \text{mystery} (30) \text{ is } & \begin{array}{c} n \\ | \\ 30 - 4 \end{array} \end{array}$$

end

fun mystery (n):

$$n - 4$$

end

Fast Functions!

Fill out the contract for each function, then try to write two examples and the definition by yourself.

red-spot : Number -> Image
name domain range

examples:

red-spot (20) is circle(20, "solid", "red")
red-spot (99) is circle(99, "solid", "red")

end

fun red-spot (radius):

circle(radius, "solid", "red")

end

: ->
name domain range

examples:

 () is
 () is

end

fun ():

end

Bug Hunting: Pyret Edition

#1	<pre>SECONDS = (7) STRING = my string</pre>	<u>SECONDS = 7</u> <u>STRING = "my string"</u>
#2	<pre>SHAPE1 = circle(50 "solid" "blue") SHAPE2 = triangle(75, outline, yellow)</pre>	<u>SHAPE1 = circle(50, "solid", "blue")</u> <u>SHAPE2 = triangle(75, "outline", "yellow")</u>
#3	<pre># triple : Number -> Number # Multiply a given number by # 3 to triple it examples: triple(5) = 3 * 5 triple(7) = 3 * 7 end</pre>	<u># triple : Number -> Number</u> <u># Multiply a given number by 3 to triple it</u> examples: triple(5) is 3 * 5 triple(7) is 3 * 7 end
#4	<pre>fun triple(n): 3 * n</pre>	fun triple(n) : 3 * n end
#5	<pre># ys : Number -> Number # Given a number, create a solid # yellow star of the given size examples: ys(99) is star(99, "solid", "yellow") ys(33) is star(99, "solid", "yellow") ys(size): star(size "solid" "yellow") end</pre>	<u># ys : Number -> Number</u> <u># Given a number, create a solid yellow star of the given size</u> examples: ys(99) is star(99, "solid", "yellow") ys(99) is star(99, "solid", "yellow") end ys(size) : star(size, "solid", "yellow") end

Lesson 2

Word Problem: double-radius

Write a function `double-radius`, which takes in a radius and a color. It produces an outlined circle of whatever color was passed in, whose radius is twice as big as the input.

Contract+Purpose Statement

Every contract has three parts:

double-radius : Number, String -> Image
name Domain Range
Consumes a number and a string, produces an outlined circle of the given color, whose radius is twice the given number

Give Examples

Write examples of your function in action

examples:

double-radius ( ) is
the user types...
 
circle( * 2, "outline", "pink")
...which should become
 
double-radius ( ) is
the user types...
 
circle( * 2, "outline", "orange")
...which should become

end

Function

Circle the changes in the examples, and name the variables.

Write the code, copying everything that isn't circled, and using names where you find variables!

```
fun doubleRadius( radius, color ):
```

```
circle(radius * 2, "outline", color)
```

end

Word Problem: double-width

Write a function `double-width`, which takes in a number (the length of a rectangle) and produces a solid green rectangle whose width is twice the given length.

Contract+Purpose Statement

Every contract has three parts:

double-width : Number → Image
name Domain Range

Consumes a length and produces a solid green rectangle whose width is twice the given length
What does the function do?

Give Examples

Write examples of your function in action

examples:

double-width (45) is
the user types...

rectangle(45, 45 * 2, "solid", "green")
...which should become

double-width (8) is
the user types...

rectangle(8, 8 * 2, "solid", "green")
...which should become

end

Function

Circle the changes in the examples, and name the variables.

Write the code, copying everything that isn't circled, and using names where you find variables!

fun double-width (length) :

rectangle(length, length * 2, "solid", "green")

end

Word Problem: next-position

Write a function *next-position*, which takes in two numbers (an x and y-coordinate) and returns a Coord, increasing the x-coordinate by 5 and decreasing the y-coordinate by 5.

Contract+Purpose Statement

Every contract has three parts:

next-position : Number, Number → Coord

name

Domain

Range

#Given 2 numbers, make a Coord by adding 5 to x and subtracting 5 from y
What does the function do?

Give Examples

Write examples of your function in action

examples:

next-position (30, 250) is
the user types...

coord(30 + 5, 250 - 5)
...which should become

next-position (65, 800) is
the user types...

coord(65 + 5, 800 - 5)
...which should become

end

Function

Circle the changes in the examples, and name the variables.

Write the code, copying everything that isn't circled, and using names where you find variables!

fun next-position (x, y) :

coord(x + 5, y - 5)

end

Data Structure

```
# a Cake is a flavor, color, message, layers, & is-iceCream
data Cake:
| cake(____ flavor :: String,
|       _____ color :: String,
|             _____ message :: String,
|                   _____ layers :: Number,
|                         _____ is-iceCream :: Boolean
)
end
```

To make examples of this structure, I would write:

cake1 = cake("Vanilla", "white", "Happy wedding!", 4, false)

cake2 = cake("Red Velvet", "darkred", "I love cakes!", 2, true)

To access the fields of **cake2**, I would write:

cake2.flavor

cake2.color

cake2.message

cake2.layers

cake2.is-iceCream

Lesson 3

Data Structure

```
# a Party is a location, theme, and number of guests
data Party:
|   party(_____ location :: String,
|           _____ theme :: String,
|           _____ guests :: Number
| )
end
```

To make examples of this structure, I would write:

party1 = **party**("Downtown", "80s", 34)

party2 = **party**("bowling ally", "bowling", 20)

To access the fields of **party2**, I would write:

 party2.location

 party2.theme

 party2.guests

Word Problem: change-flavor

Write a function called `change-flavor`, which takes in a Cake and a flavor, and returns a new Cake that is almost the same as the original, but is now the given flavor.

Contract+Purpose Statement

```
# change-flavor : Cake, String -> Cake
# Given a Cake and a flavor, return a new Cake that is the same as the original, but with the
# given flavor
```

Give Examples

examples:

```
change-flavor(cake1, "strawberry") is
  cake("strawberry",
    cake1.color,
    cake1.message,
    cake1.layers,
    cake1.is-iceCream)
change-flavor(cake2, "vanilla") is
  cake("vanilla",
    cake2.color,
    cake2.message,
    cake2.layers,
    cake2.is-iceCream)
```

end

Function

```
fun change-flavor (a-cake, new-flavor) :
  cake(new-flavor,
    a-cake.color,
    a-cake.message,
    a-cake.layers,
    a-cake.is-iceCream)
```

end

Word Problem: will-melt

Write a function called `will-melt`, which takes in a Cake and a temperature, and returns true if the temperature is greater than 32 degrees, AND the Cake is an ice cream cake.

Contract+Purpose Statement

will-melt : Cake, Number -> Boolean

Given a Cake and a temperature, return true if the temp is greater than 32 degrees,
AND the Cake is an ice cream cake

Give Examples

examples:

will-melt (cake3, 75) is

cake3.is-iceCream and (75 > 32)

will-melt (cake4, 10) is

cake4.is-iceCream and (10 > 32)

end

Function

fun will-melt (a-cake, temp) :

a-cake.is-iceCream and (temp > 32)

end

Lesson 4

Lesson 5

Word Problem: keypress (Ninja World)

State the Problem

For each keypress in Ninja World, show how (keypress <world> <key>) should change the world.

Contract+Purpose Statement

keypress : World, String -> World

Given a world and a key, produce a new world with NinjaCat's position
moved by 10 pixels, depending on which arrow key was pressed

Give Examples

examples: **current-world** **key** **direction**

keypress(worldA, "up") is
world(worldA.dogX, worldA.coinX, worldA.catX, worldA.catY + 10)

keypress(worldB, "down") is
world(worldB.dogX, worldB.coinX, worldB.catX, worldB.catY - 10)

keypress(worldA, "left") is
world(worldA.dogX, worldA.coinX, worldA.catX - 10, worldA.catY)

keypress(worldB, "right") is
world(worldB.dogX, worldB.coinX, worldB.catX + 10, worldB.catY)

end

Function

```
fun keypress(current-world, key) :  
ask:  
| string-equal(key, "up") then:  
    world(current-world.dogX, current-world.coinX,  
           current-world.catX, current-world.catY + 10)  
  
| string-equal(key, "down") then:  
    world(current-world.dogX, current-world.coinX,  
           current-world.catX, current-world.catY - 10)  
  
| string-equal(key, "left") then:  
    world(current-world.dogX, current-world.coinX,  
           current-world.catX - 10, current-world.catY)  
  
| string-equal(key, "right") then:  
    world(current-world.dogX, current-world.coinX,  
           current-world.catX + 10, current-world.catY)  
  
| otherwise: current-world  
  
end  
end
```

Word Problem: next-world (Ninja World)

Given a world, return the next world by adding 10 to dogX, subtracting 5 from coinX, and subtracting 5 from catY only when the cat's y-coordinate is greater than 75.

Contract+Purpose Statement

next-world : World -> World

Given a World, check whether CatY is greater than 75. If so, create a world by
adding 10 to dogX and subtracting 5 from coinX and catY. Otherwise, create a world
whose catY is the same as the current world, with dogX and coinX changing as above

Give Examples

examples:

next-world (worldA) is

world(worldA.dogX + 10, worldA.coinX - 5, worldA.catX, worldA.catY - 5)

next-world (worldB) is

world(worldB.dogX + 10, worldB.coinX - 5, worldB.catX, worldB.catY)

end

Function

```
fun next-world (current-world) :  
    ask:  
        | current-world.catY > 75 then:  
  
            world(current-world.dogX + 10,  
             current-world.coinX - 5,  
             current-world.catX,  
             current-world.catY - 5)  
  
        | otherwise:  
  
            world(current-world.dogX + 10,  
             current-world.coinX - 5,  
             current-world.catX,  
             current-world.catY)  
  
    end  
end
```

Lesson 6

Word Problem: red-shape

Write a function `red-shape`, which takes in the name of a shape (such as “circle”, “triangle”, “star”, or “rectangle”), and draws that solid, red shape. Use 50 as the radius of the circle and star, and side-length of the triangle. Make the rectangle 99 pixels long by 9 wide.

`red-shape` : String -> Image

Consumes the name of a shape, and produces a solid, red image of that shape. Use 50 for size of the circle, star, and triangle, and make the rectangle 99 x 9

Give Examples

examples:

red-shape (“circle”) is circle(50, “solid”, “red”)

red-shape (“triangle”) is triangle(50, “solid”, “red”)

red-shape (“star”) is star(50, “solid”, “red”)

red-shape (“rectangle”) is rectangle(99, 9, “solid”, “red”)

end

Function

fun red-shape (shape) :

ask:

| string-equal(shape, “circle”) then:

circle(50, “solid”, “red”)

| string-equal(shape, “triangle”) then:

triangle(50, “solid”, “red”)

| string-equal(shape, “star”) then:

star(50, “solid”, “red”)

| string-equal(shape, “rectangle”) then:

rectangle(99, 9, “solid”, “red”)

end

end

Word Problem: strong-password

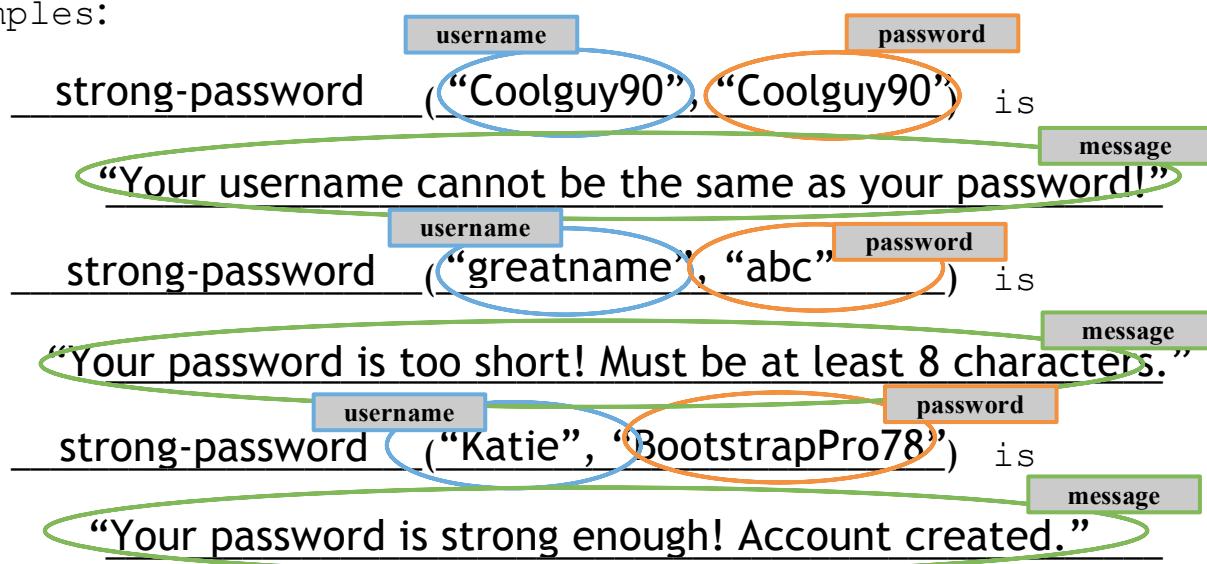
Websites have strict password requirements. Write a function `strong-password`, which takes in a username and password, and checks to make sure they aren't the same, and then checks the string-length of the password to make sure it is greater than 8 characters. The function should return a message to the user letting them know if their password is strong enough.

`strong-password` : String, String -> String

Given a username and password, check whether they are the same, then
check whether the string-length of the password is greater than 8

Give Examples

examples:



end

Function

fun `strong-password` (username, password) :

ask:

| `string-equal(username, password)` then:

"Your username cannot be the same as your password!"

| `string-length(password) < 8` then:

"Your password is too short! Must be at least 8 characters."

| otherwise: "Your password is strong enough! Account created."

end

end

Building Your Helper Functions

```
# is-off-right : Number -> Boolean
```

examples:

is-off-right (x-coordinate) is
320 > 690

is-off-right (x-coordinate) is
800 > 690

end

```
fun is-off-right (x-coordinate):
```

x-coordinate > 690

end

```
# is-off-left : Number -> Boolean
```

examples:

is-off-left (x-coordinate) is
77 < -50

is-off-left (x-coordinate) is
-400 < -50

end

```
fun is-off-left (x-coordinate):
```

x-coordinate < -50

end

```
# is-in-air : Number -> Boolean
```

examples:

is-in-air (y-coordinate) is
102 > 75

is-in-air (y-coordinate) is
30 > 75

end

fun is-in-air (y-coordinate):

y-coordinate > 75

end

```
#                    :                    ->                   
```

examples:

 () is

 () is

end

fun ():

end

Lesson 7

Word Problem: line-length

Write a function called *line-length*, which takes in two numbers and returns the difference between them. It should always subtract the smaller number from the bigger one.

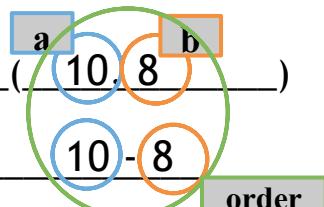
Contract+Purpose Statement

line-length : Number, Number -> Number
Consumes 2 numbers and produces the difference by subtracting the smaller
number from the larger

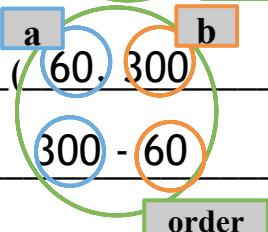
Give Examples

examples:

line-length (10, 8) is



line-length (60, 300) is



end

Function Header

fun line-length (a, b) :
function name variable names

ask :

$a > b$	then:	$a - b$
otherwise:		$b - a$

end

end

Distance:

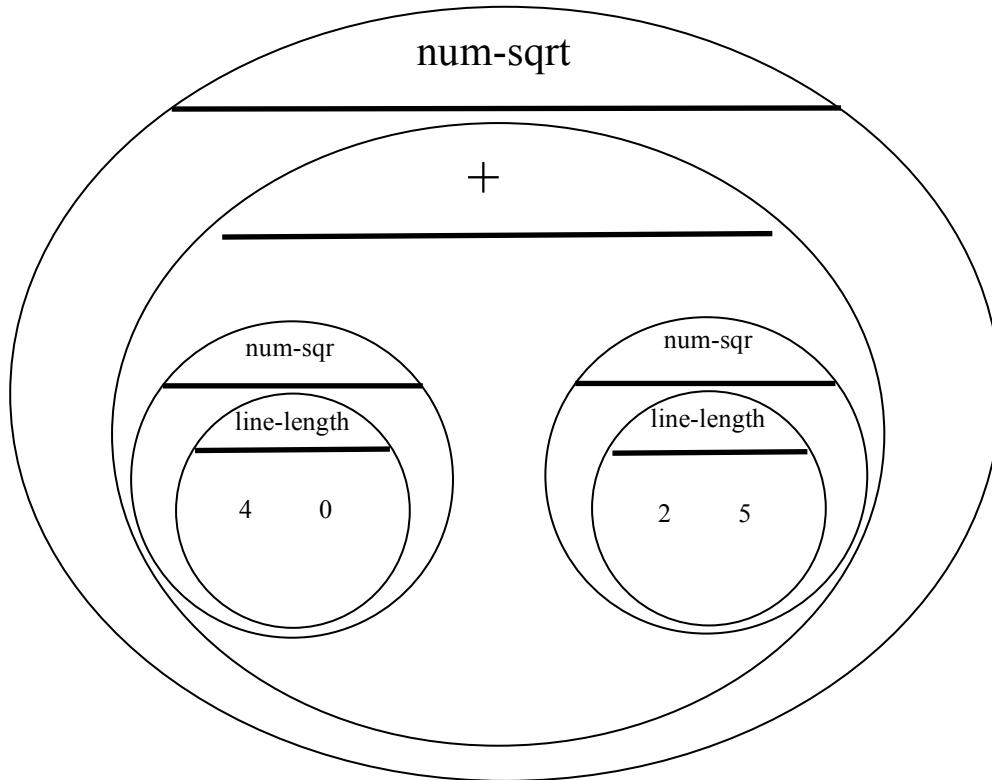
The Player is at (4, 2) and the Target is at (0, 5).

Distance takes in the player's x, player's y, character's x and character's y.

Use the formula below to fill in the EXAMPLE:

$$\sqrt{(line - length \ 4 \ 0)^2 + (line - length \ 2 \ 5)^2}$$

Convert it into a Circle of Evaluation. (We've already gotten you started!)



Convert it into Pyret code:

num-sqrt(num-sqr(line-length(4, 0)) + num-sqr(line-length(2, 5)))

Word Problem: distance

Write a function `distance`, which takes FOUR inputs:

- `px`: The x-coordinate of the player
- `py`: The y-coordinate of the player
- : The x-coordinate of another game character
- : The y-coordinate of another game character

It should return the distance between the two, using the Distance formula:

$$\text{Distance}^2 = (\text{line-length } px \text{ } cx)^2 + (\text{line-length } py \text{ } cy)^2$$

Contract+Purpose Statement

distance : Number, Number, Number, Number -> Number
Given the coordinates of 2 characters: `px`, `py`, `cx`, and `cy`, use the distance formula to calculate the distance between them

Give Examples

Write examples of your function in action

examples: distance (px, py, cx, cy) is
distance (4, 2, 0, 5)
num-sqrt(num-sqr(line-length(4, 0)) + num-sqr(line-length(2, 5)))

distance (px, py, cx, cy) is
distance (80, 33, 6, 50)
num-sqrt(num-sqr(line-length(80, 6)) + num-sqr(line-length(33, 50)))

end

Function

fun distance (px, py, cx, cy):

num-sqrt(num-sqr(line-length(px, cx)) + num-sqr(line-length(py, cy)))

end

Word Problem: is-collision

Write a function `is-collision`, which takes FOUR inputs:

- px: The x-coordinate of the player
- py: The y-coordinate of the player
- cx: The x-coordinate of another game character
- cy: The y-coordinate of another game character

It should return true if the coordinates of the player are within **50 pixels** of the coordinates of the other character. Otherwise, false.

Contract+Purpose Statement

is-collision : Number, Number, Number, Number -> Boolean

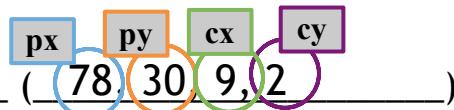
Given the coordinates of 2 characters: px, py, cx, and cy, return true if the # distance between them is less than 50 pixels

Give Examples

Write examples of your function in action

examples:

is-collision



is

distance(78, 30, 9, 2) < 50

is-collision



is

distance(20, 40, 60, 80) < 50

end

Function

fun is-collision (px, py, cx, cy) :

distance(px, py, cx, cy) < 50

end

GAME DESIGN: SAMPLE

"Start Simple, Get Complex"

Draw a rough sketch of your game when it begins, and another sketch just a moment later



A sketch at the *START* of the game...

A sketch for the very *NEXT* moment...

What images will you need for your game? Name them in the 1st column, and describe them in the 2nd column.

BACKGROUND	CITY STREET
PET- HAPPY	NEUTRAL PET
PET- EAT	EATING PET
PET- SAD	SAD PET
EMOTION METERS	GREEN RECTANGLES

List everything that has changed from one sketch to the other. What datatype will represent it?

Changed (position, score, color, costume...)	Datatype (Number, String, Image, Boolean...)
COSTUME	IMAGE
HAPPY METER	NUMBER
HUNGER METER	NUMBER
TIMER	NUMBER

Data Structures: SAMPLE

```
# a world is a costume, x-coord, happy, sleep, hunger
data World:
| world(_____ costume :: Image,
| _____ happy :: Number,
| _____ hunger :: Number,
| _____ timer :: Number,
| _____ )
end
```

To make example worlds that represent my sketches from page 31, I would write...

worldA = world(NEUTRAL, 12, 12, 7)

worldB = world(SAD, 3, 10, 10)

To access the fields of **worldA**, I would write:

worldA.costume

worldA.happy

worldA.hunger

worldA.timer

Lesson 8

Word Problem: draw-world (My game)

Contract

_____ : _____ -> _____

Definition

fun _____(_____) :

put-image(_____)

end

Word Problem: next-world (My game)

State the problem (What changes?):

Contract+Purpose Statement

_____ : _____ -> _____

Give Examples

examples:

_____ (_____) is

_____ (_____) is

end

Function

fun _____(_____):

end

Lesson 9

<i>When this key is pressed...</i>	<i>...this field of the new world...</i>	<i>...changes by...</i>

Word Problem: keypress (My game)

For each keypress in your game, show how `keypress(worldA, <key>)` should change your world.

: ->

#

Give Examples

examples:

`keypress(worldA, _____)` is

`keypress(worldA, _____)` is

`keypress(worldA, _____)` is

end

Function

fun _____(_____)

ask:

| _____ then:

| _____

end

end

Building Your Helper Functions

is-off-right : _____ -> _____

examples:

_____ (_____) is

_____ (_____) is

end

fun _____(_____) :

end

is-off-left : _____ -> _____

examples:

_____ (_____) is

_____ (_____) is

end

fun _____(_____) :

end

_____ : _____ -> _____

examples:

_____ (_____) is

_____ (_____) is

end

fun _____(_____) :

end

_____ : _____ -> _____

examples:

_____ (_____) is

_____ (_____) is

end

fun _____(_____) :

end

Using Helpers inside next-world:

How does the World structure change when....?

TEST	RESULT
	world(_____ _____ _____)

TEST	RESULT
	world(_____ _____ _____ _____)

Using Helpers inside draw-world:

What changes the appearance of your game?

TEST	RESULT
	put-image(_____ put-image(_____ put-image(_____ put-image(_____ put-image(_____
	put-image(_____ put-image(_____ put-image(_____ put-image(_____ put-image(_____
	put-image(_____ put-image(_____ put-image(_____ put-image(_____ put-image(_____
	put-image(_____ put-image(_____ put-image(_____ put-image(_____ put-image(_____

Lesson 10

Supplemental

DESIGN RECIPE

Contract+Purpose Statement

Every contract has three parts:

_____ : _____ -> _____
name Domain Range

What does the function do?

Give Examples

Write examples of your function in action

examples:

_____ (_____) is
the user types...

...which should become

_____ (_____) is
the user types...

...which should become

end

Function

Circle the changes in the examples, and name the variables.

fun _____ (_____) :

end

DESIGN RECIPE

Contract+Purpose Statement

Every contract has three parts:

_____ : _____ -> _____
name Domain Range

What does the function do?

Give Examples

Write examples of your function in action

examples:

_____ (_____) is
the user types...

...which should become

_____ (_____) is
the user types...

...which should become

end

Function

Circle the changes in the examples, and name the variables.

fun _____ (_____) :

end

Contracts

Contracts