Name:



BOOTSTRAP: REACTIVE

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Class:



Workbook v0.9

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	Unit ¹	
	Racket Code	Pyret Code
	(define AGE 14)	AGE = 14
	(define A-NUMBER 0.6)	A-NUMBER = 0.6
S	(define SPEED -90)	SPEED = -90
Numbers		Two of your own:
Ž		
	(define CLASS "Bootstrap")	CLASS = "Bootstrap"
	(define PHRASE "Coding is fun!")	PHRASE = "Coding is fun!"
	(define A-STRING "2500")	A-STRING = "2500"
ngs		Two of your own:
Strings		

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

Fast Functions!

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

# double :	Number → _	Number
examples: double (5) double (7) end) is 2 * 5 n) is 2 * 7	
fundouble(n):
end		
#:	domain ->	range
examples:		
() is	
end) is	
fun():
end		

Fast Functions!

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

#name	:	domain	>	range	
		domain		runge	
examples:					
	() is			
	,				
	() is			
end					
£	,		\		
fun	():		
and					
end					
#	<u>:</u> :		>		
#	:	domain	>	range	
name	:	domain	->	range	
	:	domain	>	range	
name	::	domain	>	range	
name	::::::		>	range	
name) is	>	range	
examples:	::		->	range	
name	·(() is	->	range	
examples: end	::::) is) is		range	
examples:) is) is		range	
examples: end) is) is		range	
examples: end) is) is		range	

Fast Functions!

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

#	name	• do	omain	→	range
example	es:				
	()	is		
	()	is		
end					
fun		_():	
end					
#		· -•		->	
	name	do	omain		range
example	es:				
	()	is		
end	()	is		
CIIG					
fun		_():	

Bug Hunting: Pyret Edition SECONDS = (7)#1 STRING = my string SHAPE1 = circle(50 "solid" "blue") #2 SHAPE2 = triangle(75, outline, yellow) # triple : Number -> Number # Multiply a given number by # 3 to triple it #3 examples: triple(5) = 3 * 5triple(7) = 3 * 7end fun triple(n): 3 * n #4 # 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") #5 ys(size): star(size "solid" "yellow") end

Unit 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.

	•		`
name	•	Domain	>
xamples		the function do?	
	unction in action		
mples:			
	()	is
the user	types		
	which should beco	ome	
	1	,	is
the user t)	15
		which should become	
		which should become	
on			
	examples, and name verything that isn't c	e the variables. ircled, and using names wh	ere you find variables!
	, 5	0	, , , , , , , , , , , , , , , , , , , ,
		() :

Word Problem: double-width

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

• <u> </u>		-	
name	Domain		Range
	What does the function	ı do?	
xamples			
examples of your func	tion in action		
mples:			
	_() is	
the user types.			
the aser types.	••		
	.which should become		
	1) is	
the user types	_ (
the user types			
	which should bec	ome	
on			
	nples, and name the variables. thing that isn't circled, and usir		d variabl
ie code, codvilia evelv		ig names where you line	a vanabi
	(

Word Problem: next-position
Write a function next-position, which takes in two numbers (an x and ycoordinate) and returns a JumperState, increasing the x-coordinate by 5 and decreasing the y-coordinate by 5.

Every contract has				
#	:		\rightarrow	
name		Domain	Ranç	je
#				
		oes the function do?		
Give Examples Write examples of v	our function in actio	n		
examples:				
F =	() is	
	·		<i>,</i>	
tne	e user types			
	which should b	pecome		
	() is	
tl	he user types		·	
end		which should become		
end				
unction				
	n the examples, and no vina everythina that isn'		ames where you find variat	oles!
fun	3 - 7 - 3	_)	:
		`	,	
end				

Data Structure

# A CakeType is a flavor , layers , & is-iceCrea	ım
data CakeType:	
cake(
)
end	
To make instances of this structure, I would w	rite:
cake1 =	
cake2 =	
To access the fields of cake2, I would write:	
	·

Word Problem: taller-than

Write a function called *taller-than*, which consumes two CakeTypes, and produces true if the number of layers in the first CakeType is greater than the number of layers in the second.

Contract+Pı	urpose Statement	
#	:	→
#		
Give Examp	les.	
	oles of your function in action	
exampl	es:	
	() is
	the user types	
<u> </u>	which should become	
	() is
	the user types	
end	whic	h should become
- ı•		
	anges in the examples, and name the	e variables. d, and using names where you find variables!
fun		
		,, ·
_		,
end		

Word Problem: will-melt

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

Contrac	ct+Purpose Statement	
#	·	→
#		
Give Exc	amples	
	kamples of your function in action	
exam	mples:	
	() is
	the user types	
	which should become	
	wnich should become	
	() is
	the user types	
end	which sho	ould become
Function Circle the	n e changes in the examples, and name the va	riables.
	e code, copying everything that isn't circled, a	
fun	() :
_		
end		

Unit 3

Identifying Animation Data Worksheet: Sunset

Draw a sketch for three distinct moments of the animation							
Sketch A	Sketch B	Sketch C					

What things are changing?						
Thing	Describe how it changes					

What fields do you need to represent the things that change?						
Field name (dangerX, score, playerIMG)	Datatype (Number, String, Image, Boolean)					

(worksheet continues on the next page)

Define the Data Structure

# a	_ State is	
data	State:	
I	(
)	
end		
Maka a ramplo instanc	ce for each sketch from the previous page:	

Nake a sample i	instance for each sketch from the previous page:
	=
	_ =

Word Problem: draw-state

Write a function called *draw-state*, which takes in a SunsetState and returns an image In which the sun (a circle) appears at the position given in the SunsetState. The sun should be behind the horizon (the ground) once it is low in the sky.

ontract+Purpose Sto				`
# draw-state	e :		<u> </u>	→ Image
rite an expression fo	or each piece of y	our final image		
UN =				
GROUND =				
SKY =				
			·	
rite the draw-state t	function, using pu	t-image to combine	your pieces	
		t-image to combine) :
) :
) :
) :
) :
) :
) :
) :
) :
) :
) :

Word Problem: next-state-tick

Write a function called *next-state-tick*, which takes in a SunsetState and returns a SunsetState in which the new x-coordinate is 8 pixels larger than in the given SunsetState and the y-coordinate is 4 pixels smaller than in the given SunsetState.

ontract+Purpos	e Statement		
<u></u>	·	·	→
<u>-</u>			
Give Examples			
•	of your function in act	tion	
examples:			
	() is
	the user types		
	which should	d become	
	() is
	the user types		,
 end		which should bec	come
CIIG			
unction			
	s in the examples, and		ng names where you find variables!
) :
		\	, ·
end			

Identifying Animation Data Worksheet

Sketch A	Sketch B	Sketch C
t things are changing? Thing	Describe ho	ow it changes
at fields do vou need to r	epresent the things that cho	ange?
eld name (dangerX, score,		e (Number, String, Image, Boolean

(worksheet continues on the next page)

Define the Data Structure

# a	State is	
data	State:	
	(
)
end		<i>,</i>
Make a sample ins	stance for each sketch from the previous page:	
	=	
	=	

Identifying Animation Data Worksheet

aw a sketch for three di	stinct moments of t	he animation	
Sketch A	Ske	etch B	Sketch C
hat things are changing Thing	ś	Describe how it o	hanaes
9			
nat fields do you need t			
Field name (dangerX, sco	ore, playerIMG)	Datatype (Nui	mber, String, Image, Boolean)

(worksheet continues on the next page)

Define the Data Structure

# a	_ State is	_
data	State:	
	(_
		_
		_
)
end		

Make	a sar	nple	ınstan	ce to	r each	sketch	trom	the	previo	US	cage:

Identifying Animation Data Worksheet

w a sketch for three	e distinct moments of	the animation	
Cl. I.I. A	CI	- I - I - D	Cl L. L. C
Sketch A	3K	etch B	Sketch C
ıt things are chang	ing?		
Thing		Describe how it ch	hanges
		:	
eld name (dangerX,	ed to represent the the score, playerIMG)		nber, String, Image, Boolean)
tera manne (eren genn)	σσιο, βια, σι		nser, ennig, miage, zeeream,
_			
		ĺ	

(worksheet continues on the next page)

Define the Data Structure

# a	State is	
data	State:	
[_(
)
end		
Make a sample instan	ce for each sketch from the previous page:	
= _		
=		

Identifying Animation Data Worksheet

w a sketch for three	e distinct moments of	the animation	
Cl. I.I. A	CI	- I - I - D	Cl L. L. C
Sketch A	3K	etch B	Sketch C
ıt things are chang	ing?		
Thing		Describe how it ch	hanges
		:	
eld name (dangerX,	ed to represent the the score, playerIMG)		nber, String, Image, Boolean)
tera manne (eren genn)	σσιο, βια, σι		nser, ennig, miage, zeeream,
_			
		ĺ	

(worksheet continues on the next page)

Define the Data Structure

# a	State is	
data	_State:	
(
)	
end		

Make a sample instance for each sketch from the previous page:				
=				
=				
=				

Unit 4

Word Problem: location

Write a function called *location*, which consumes a JumperState, and produces a String representing the jumper's location: either "cliff", "beach", "water", or "air".

Contract+Purpose Stateme	nt	
#	:	
#		
Give Examples examples:		
()	is

end

(worksheet continues next page)

Functi	ion				
fun		(_) :	
	if	 	 		:
	else if				_;
	else if				:
	else: _				-
end	end				

Piecewise Bug-Hunting **Buggy Code** Correct Code / Explanation fun piecewisefun(n): if (n > 0): n else: 0 fun cost(topping): if string-equal(topping, "pepperoni"): 10.50 else string-equal(topping, "cheese"): 9.00 else string-equal(topping, "chicken"): 11.25 else string-equal(topping, "broccoli"): 10.25 else: "That's not on the menu!" end end fun absolute-value(a b): **if** a > b: a - b b - a end end fun best-function(f): if string-equal(f, "blue"): "you win!" else if string-equal(f, "blue"): "you lose!" else if string-equal(f, "red"): "Try again!" else: "Invalid entry!" end end

Animation Extension Worksheet

Describe the goal of your change: what new feature or behavior will it add to your animation?

Draw a sketch	for three distinc	ct moments of the animation		
Draw a skeren	ior infee distinc	r moments of the animation		
Sketo	ch A	Sketch B Sketch	C	
What things are Thing	e changing?	Describe how it changes		
		-		
What fields do	you need to re	present the things that change?		
Field name (c	dangerX, score, p	DlayerIMG) Datatype (Number, String, Image, Bo	oolean.)
Make a To-Do I	List, and check	off each as "Done" when you finish each one.		
Component		·	To-Do	Done
Data Structure	If any new field	(s) were added, changed or removed		
draw-state	If something is c	something is displayed in a new way or position		
next-state-tick	If the Data Struc	he Data Structure changed, or the animation happens automatically		
next-state-key	If the Data Struc	cture changed, or a keypress triggers the animation		
reactor	If either next-stc	ate function is new		

Make a sample	instance for ec	ach sketch from	n the previous p	oage:	
	=				
					-
	=				
					_
	=				
					_
Write at least on	ne NEW exampl	e for one of the	e functions on	vour To-Do list	
				,	
If you have ano	ther function or	n your To-Do list	t , write at leas	t one NEW examp	le

Word Problem: draw-sun

Write a function called *draw-sun*, which consumes a SunsetState, and produces an image of a sun (a solid, 25 pixel circle), whose color is "yellow", when the sun's y-coordinate is greater than 225, "orange", when its y-coordinate is between 150 and 225, and "red" otherwise.

Contract+Purp	ose Statement		
#	:		
#			
Give Examples			
examples			
	() is	
_			

end

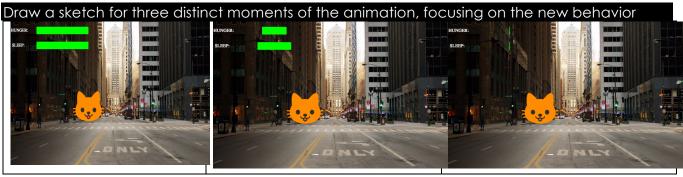
(worksheet continues next page)

Function fun		() :	•
	if			:
	else if			_ _ :
	else if			:
	else:			-
end	end			

Unit 5

Describe the goal of your change: what new feature or behavior will it add to your animation?

Decrease the cat's hunger level by 2 and sleep level by 1 on each tick.



Sketch A Sketch B Sketch C

What things are ch	anging?
Thing	Describe how it changes

What fields do you need to represent the thi	ings that change?
Field name (dangerX, score, playerIMG)	Datatype (Number, String, Image, Boolean)

Make a To-Do	List, and check off each as "Done" when you finish each one.		
Component	When is there work to be done?	To-Do	Done
Data Structure	If any new field(s) were added, changed or removed		
draw-state	If something is displayed in a new way or position	V	
next-state-tick	If the Data Structure changed, or the animation happens automatically	ď	
next-state-key	If the Data Structure changed, or a keypress triggers the animation	V	
reactor	If either next-state function is new		

Make a samp	ole instance for each sketch from the previous page:
FULLPET =	pet(100, 100)
MIDPET =	pet(50, 75)
LOSEPET =	=pet(0, 0)
Write at least	one NEW example for one of the functions on your To-Do list
n <u>ext-state</u>	-tick(FULLPET) is pet(FULLPET.hunger - 2, FULLPET.sleep - 1
next-state	e-tick(MIDPET) is pet(MIDPET.hunger - 2, MIDPET.sleep - 1)
next-state	e-tick(LOSEPET) is LOSEPET
	-
If you have a	rnother function on vour To De list, write at least one NEW example
II you have a	nother function on your To-Do list , write at least one NEW example

Draw a sketch	for three distinc	ct moments of the animation		
Sketo	≏h A	Sketch B Sketch	C	
What things are		OKOTOTT OKOTOTT		
Thing	e changing ?	Describe how it changes		
What fields do	vou need to re	present the things that change?		
	langerX, score, p		oolean.)
		off each as "Done" when you finish each one.	To Do	Dono
Data Structure		(s) were added, changed or removed	To-Do	Done
draw-state		displayed in a new way or position		
next-state-tick	If the Data Struc	cture changed, or the animation happens automatically		
next-state-key	If the Data Struc	cture changed, or a keypress triggers the animation		
reactor	If either next-sto	ate function is new		

Make a sample insta	ance for each sketc	h from the previou	us page:	
·		•		
=				_
=				_
_				
-				_
Write at least one NE	EW example for one	of the functions o	on your To-Do list	
If you have another	function on your To	-Do list , write at le	east one NEW examp	ole

Draw a sketch	for three distinc	t moments of the animation		
Sketo	ch A	Sketch B Sketch	С	
What things are	e changing?			
Thing		Describe how it changes		
What fields do	you need to re	oresent the things that change?		
	langerX, score, p		olean.)
Make a To-Do I Component		off each as "Done" when you finish each one. work to be done?	To-Do	Dono
-			סם-טו	Dolle
Data Structure	It any new field	(s) were added, changed or removed		
draw-state	If something is c	displayed in a new way or position		
next-state-tick	If the Data Struc	cture changed, or the animation happens automatically		
next-state-key	If the Data Struc	cture changed, or a keypress triggers the animation		
reactor	If either next-stc	ate function is new		

Make a sample	instance for each sketch from the previous page:	
·		
	_ =	
	_ =	
		
	=	
	-	
Write at least on	ne NEW example for one of the functions on your To-Do list	
15		
If you have ano	other function on your To-Do list , write at least one NEW example	

Build Your Own Animation

Draw a sketch	for three distinc	t moments of the animation		
Skot	ch A	Sketch B Sketch	<u> </u>	
		Skeich B Skeich	<u></u>	
What things are Thing	e changing?	Describe how it changes		
		present the things that change?		
Field name (c	dangerX, score, p	Datatype (Number, String, Image, Bo	oolean.)
Make a To-Do	List, and check	off each as "Done" when you finish each one.		
Component			To-Do	Done
Data Structure	If any new field	(s) were added, changed or removed		
draw-state	If something is o	displayed in a new way or position		
next-state-tick	If the Data Struc	cture changed, or the animation happens automatically		
next-state-key	If the Data Struc	cture changed, or a keypress triggers the animation		
reactor	If either next-sto	ate function is new	П	

a	State is	
ata	State:	
	(
_)
ıd		
	e instance for each sketch from the previous pag	
	_ =	
	_ =	
	_ =	
	ple for one of the functions on the previous pag	e:
	ple for one of the functions on the previous pag	e:
	ple for one of the functions on the previous pag	e:

Collision

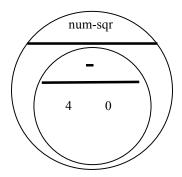
Distance:

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:

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

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



Convert it into Pyret code:

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 cx: The x-coordinate of another game character

☐ cy: The y-coordinate of another game character

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

	D	istance² = (рх -	$(-cx)^2 + (py - cy)^2$			
	ict+Purpose Statement						
					>		
#							
Give Ex Write e	kamples examples of your functi	on in action					
exar	mples:						
	(_)	is			
-							
	(_)	is			
- ام مدما							
end Functio	on						
fun		():			
							_
							_

end

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

<u> </u>	px: The x-coordinate of the py: The y-coordinate of the cx: The x-coordinate of a cy: The y-coordinate of a lt should return true if the coordinates of the other	ne player nother game charae nother game chara coordinates of the p character. Otherwi	cter cter blayer are within 50 se, false.	pixels 0	f the	
	act+Purpose Statement					
#	• •		->	>		
#						
	zamples					
	examples of your function	in action				
exa	mples:					
		(_)	is	
		()	is	
end						
Functi	on					
fun		():			
end						

DESIGN RECIPE

Cont	ract+Purpose Statemer	nt			
Every	contract has three par	ts:			
,,					
#	·			>	
	name		Oomain	Range	
#					
<i>''</i>		What does the fun	ction do?		
	Examples				
Write	examples of your funct	ion in action			
037	mmlog•				
exc	amples:	`			
	()	is		
	the user types	•			
	•••	which should become			
	()	is		
	the user types	,			
		which should bec			
enc	1	willen should bec	ome		
Funct					
	the changes in the exam	ples, and name the	variables.		
fur	l	():		
enc	f				

DESIGN RECIPE

Contract+	+Purpose Statement				
Every con	tract has three parts:				
#	:			->	
nam		Dom		Range	
#					
	W	hat does the function	on do?		
Give Exan	nples mples of your function in	action			
,,,,,,		Gener.			
examp	oles:				
)	is		
	the user types				
	which sh	nould become			
	,	`			
	((the user types)	is		
	circ door cyposiii				
end	\	which should become	е		
Function					
	changes in the examples, a	nd name the var	iables.		
fun		():		
_ 5.11 _		\	, ·		
end					

Draw a sketch	for three distinc	t moments of the animation		
Sket	ch A	Sketch B Sket	tch C	
What things are	e changing?	Describe how it changes		
9				
What fields do	you need to re	present the things that change?		
Field name (c	dangerX, score, p	olayerIMG) Datatype (Number, String, Imag	e, Boolean.)
Make a To-Do Component		off each as "Done" when you finish each one. work to be done?	To-Do	Done
Data Structure		(s) were added, changed or removed		
draw-state	If something is a	displayed in a new way or position		
next-state-tick	If the Data Stru	cture changed, or the animation happens automati	cally \Box	
next-state-key	If the Data Stru	cture changed, or a keypress triggers the animation		
reactor	If either next-sto	ate function is new		

a	State is	
ata	State:	
	(
)
ıd		
	instance for each distance from the province	v (1 C)
	e instance for each sketch from the previous po =	
	=	
	_	
	ole for one of the functions on the previous pag	ge:
	ole for one of the functions on the previous pag	ge:
	ble for one of the functions on the previous pag	ge:

Draw a skatab	for throo disting	at mamants of the animation		
Diaw a skeich	for inree distinc	ct moments of the animation		
Sket	ch A	Sketch B Sketch		
		SKCTCT D SKCTCT		
What things are	e changing?	Describe how it changes		
Thing		Describe how it changes		
What fields do	vou pood to ro	present the things that change?		
	dangerX, score, p		oolean.)
·	· · · · · · · · · · · · · · · · · · ·			
Make a To-Do	List, and check	off each as "Done" when you finish each one.		
Component	When is there	work to be done?	To-Do	Done
Data Structure	If any new field	I(s) were added, changed or removed		
draw-state	If something is	displayed in a new way or position		
next-state-tick	If the Data Stru	cture changed, or the animation happens automatically		
next-state-key	If the Data Stru	cture changed, or a keypress triggers the animation		
reactor	If either next-sta	ate function is new		

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Data Structure	If any new field	I(s) were added, changed or removed		
draw-state	If something is	displayed in a new way or position		
next-state-tick	If the Data Stru	cture changed, or the animation happens automatically		
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Contracts

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