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
Ş	(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"
sgı		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	:	Numb	er →	Number
end	mples:double_(double_(_	5 n 7 n n	is is	2 * 5 n 2 * 7	
fun -	2 * n	('):	
#	name	:	domain	->	range
exar	mples:	(_) 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	do	omain		range
example	es:				
	()	is		
	()	is		
end					
fun		_():	
end					
#					
	name	do	omain		range
example	es:				
	()	is		
	()	is		
end	()			
	()		_):	
	(()	is	_):	

Fast Functions!

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

#	:			
name		domain		range
examples:				
	() is		
	() is		
end				
fun	():	
end				
#	• <u>-</u>	domain	>	range
examples:				
	() is		
	1) is		
end	(
fun	():	
end				

Syntax and Style 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 * 5
         triple(7) = 3 * 7
     end
     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.

amples amples of your function in ac ples:	at does the function do?		Range
mples amples of your function in act ples:	at does the function do?		
amples amples of your function in ac ples:			
amples of your function in a	ction		
ples: (CHOH		
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· ,)	
		/	
the user types			
S			
which show			
()	
the user types			
S			
	which should become		
1			
e changes in the examples, and			
code, copying everything that	r isn't circled, and using no	imes where you	u find variables!
	() :

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.

	·			>
name		Domain		Range
-		at does the function do	?	
e Exampl	es les of your function in a	ction		
example	•	onon		
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	()	
	· · · · · · · · · · · · · · · · · · ·		/	
	the user types			
is				
	which should become	me		
	1		١	
	the user types		/	
	,			
is				
end		which should become		
ınction				
	inges in the examples, and			
			auaa a a la a	, find wariable
	e, copying everything tha	_	arnes where you	

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

ery contract has	·		
	•		
			→
	•	 Domain	Range
·	573	d	
ive Examples	What	does the function do?	
	your function in action	on	
examples:			
-	()
	,		•
th	e user types		
is			
±5	which should		
	,		
			_)
	the user types		
is			
end		which should become	
zna			
unction			
	in the examples, and n		
_		n't circled, and using names w	
TIIN		() :

Data Structure

A CakeType is a flavor, layers, & is-iceCream data CakeType: cake(_____ end To make instances of this structure, I would write: 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+Pu	rpose Statement			
<u> </u>	:			
<u> </u>				
Give Exampl Vrite examp	es les of your function in a	ction		
example				
-	()	
	the user types			
is				
	which should beco	me		
	()	
	the user types			
is				
end		which should become		
unction	anges in the examples, an	d name the variables		
			names where you find variables!	
rite the cod				

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.

Contract+Purpose Statemen	t	
#:		→
#		
Give Examples		
Write examples of your funct	ion in action	
examples:		
	(_)
the user types		
is		
• • • • • • • • • • • • • • • • • • • •	which should become	
	_()
the user types		
is		
end	which should become	
Function Circle the alexander in the		
Circle the changes in the exam Write the code, copying everyt	pies, and name the variables. ning that isn't circled, and using names	where you find variables!
fun	() :
	· -	,

end

Vocabulary Practice

Below is a new structure definition:

```
data MediaType:
   book (
      title :: String,
      author :: String,
      pubyear :: Number)
end
# an example book:
book1 = book("1984", "Orwell", 1949)
Fill in the blanks below with the vocabulary term that applies to each
name. Here are the terms to choose from:
          - contract - example
          - header
                   - field
          - datatype - instance
          - constructor - data block
          - name
                    - purpose
  author is a _____
  book is a _____
  MediaType is a
  book1 is a _____
  title is a
  data ... end is a _____
```

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)

# a	State is	
data	State:	
	(
,)
end		
Make a sample in	nstance for each sketch from the previous page:	
	. =	
	_	
	_ =	

Define the Data Structure

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.

Contract+Purpose State	ment			
<pre># draw-state</pre>	:			→ Image
#				
Write an expression for e				
		75.		
SUN =				
GROUND =				
SKY =				
Write the draw-state fund	ction using put	imaga ta sambi	ing your piacos	
wille the diaw-state forth	chon, using pui-	inage to combi	ine your pieces	
fun		() :
				<u> </u>
·				

end

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.

Contract+Purpose	e Statement			
#	:		→	
ve Examples	f your function in a	action		
examples:	your fortenor in a			
_	1		1	
			/	
t	he user types			
•				
is		ould become		
	willen sile	did become		
	()	
	the user types			
•				
		which should bec	ome	
end		willen should bee	ome	
unction				
ircle the changes		d name the variables		
•			ng names where you find	
fun		() :
-				
end				

Identifying Animation Data Worksheet

Draw a sketch for thre	ee distinct moments	of the animation	
Skotob A		katab B	Skotob C
Sketch A		ketch B	Sketch C
What things are char Thing	iging ¢	Describe how it ch	anges
What fields do you ne			
	eed to represent the X, score, playerIMG)		ber, String, Image, Boolean)
			ber, String, Image, Boolean)

(worksheet continues on the next page)

# a	State is	
data	State:	
	(
,)
end		
Make a sample ir	nstance for each sketch from the previous page:	
	_ =	
	=	
	_ =	
		

Define the Data Structure

Identifying Animation Data Worksheet

		t moments of the animation	
Sketch	A	Sketch B	Sketch C
at things are ch	nanging?		
Thing		Describe how it	t changes
	1		
at fields do you	need to rep	present the things that chang	ieś
at fields do you Field name (dang			e? Number, String, Image, Boolean)

(worksheet continues on the next page)

# a	State is	
data	State:	
	(
,)
end		
Make a sample ir	nstance for each sketch from the previous page:	
	_ =	
	=	
	_ =	
		

Define the Data Structure

Identifying Animation Data Worksheet

Diaw a sketch for it	nree distinc	t moments of the animation	
Sketch /	A	Sketch B	Sketch C
What things are cho	anging?		
Thing		Describe how it	changes
What fields do you	need to rep	present the things that change	ş
What fields do you			? Imber, String, Image, Boolean)

(worksheet continues on the next page)

# a	State is	
data	State:	
	(
•)	
end		
Make a sample in:	stance for each sketch from the previous page:	
	_	
	=	
	=	
	=	
	=	

Define the Data Structure

Identifying Animation Data Worksheet

Draw a sketch for th	nree distinc	t moments of the animation	
Sketch	Ą	Sketch B	Sketch C
What things are cho	anging?		
Thing		Describe how i	t changes
What fields do you	need to rep	present the things that chang	e?
What fields do you Field name (dange			e? Jumber, String, Image, Boolean)

(worksheet continues on the next page)

# a	State is	
data	State:	
	(
,)
end		
Make a sample ir	nstance for each sketch from the previous page:	
	_ =	
	=	
	_ =	

Define the Data Structure

Unit 4

Word Problem: location

Write a function called *location*, which consumes a DeliveryState, and produces a String representing the location of a box: either "road", "delivery zone", "house", or "air".

Cont	tract+Purpose Statement		
# _	·		······ >
# _			
Give	Examples		
	amples:		
	() is	S
	() is	
	() is	
	() is	

end

(worksheet continues next page)

Function		() :
			:
	else if		
	else if		:
	else: _		
end	end		

Syntax and Style Bug Hunting: Piecewise Edition

```
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	t moments of	the animation			
Sket	ch A	Ske	etch B	Sketch	С	
What things are	a chanaina?					
Thing	e changing ?		Describe how it ch	anges		
What fields do	vou need to re	nresent the thi	ngs that change?			
	dangerX, score, p			ber, String, Image, Bo	oolean.)
			one'' when you fir			
Component	When is there	work to be do	ne?		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					
next-state-tick	If the Data Structure changed, or the animation happens automatically					
next-state-key	If the Data Structure changed, or a keypress triggers the animation					
reactor	If either next-sto	ate function is ne	ew			
	· · · · · · · · · · · · · · · · · · ·	-				

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

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+Purpose	Statement		
#	:		→
#			
Give Examples			
examples:			
	() is	
	() is	
	() is	
and			

ena

(worksheet continues next page)

Funct	tion		
fu	n	() :
	if		:
	else if		:
	else:		
	end		
end	l		

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.

Draw a sketch for three distin	ct moments of the animation, foo	cusing on the new behavior
HUNGER:	HUNGER:	HUNGER:
SLEE: W	SI,EEP-	SLEEP
Sketch A	Sketch B	Sketch C

What things are changing?		
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		
next-state-key	If the Data Structure changed, or a keypress triggers the animation		
reactor	If either next-state function is new		

Make a sample instance for each sketch from the previous page:	
FULLPET =pet(100, 100)	<u> </u>
$MIDPET = \underline{pet(50, 75)}$	<u> </u>
$LOSEPET = \underline{pet(0, 0)}$	
Write at least one NEW example for one of the functions on your To-D	o list
next-state-tick(FULLPET) is pet(FULLPET.hunger - 2	, FULLPET.sleep - 1)
next-state-tick(MIDPET) is pet(MIDPET.hunger - 2, I	MIDPET.sleep - 1)
next-state-tick(LOSEPET) is LOSEPET	
If you have another function on your To-Do list , write at least one NEV	V example

Draw a sketch	for three distinc	t moments of the animation			
Sket	ch A	Sketch B	Sketch	С	
What things are	a chanaina?				
Thing	e changing v	Describe how it chang	jes		
What fields do	vou need to re	present the things that change?			
	dangerX, score, p		, String, Image, Bo	olean.)
		off each as "Done" when you finish			
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 a	lisplayed in a new way or position			
next-state-tick	If the Data Stru	ture changed, or the animation happe	ens automatically		
next-state-key	If the Data Stru	ture changed, or a keypress triggers the	e animation		
reactor	If either next-sto	te function is new			
	· · · · · · · · · · · · · · · · · · ·				

Make a sample	e 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	
If you have anot	other function on your To-Do list , write at least one NEW example	

Draw a sketch	for three distinc	t moments of the animation		
Sket	oh A	Sketch B Sketch	\overline{C}	
3KE10	CHA	Skeich B Skeich	C	
What things are	e changing?			
Thing		Describe how it changes		
What fields do	you pood to re	present the things that change?		
	dangerX, score, p		olean.)
				,
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		
	,	(4)	Ш	Ш
draw-state	If something is a	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	e 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	
If you have anot	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		
Sket	ch A	Sketch B Sketch	С	
What things are	e changing?			
Thing		Describe how it changes		
	you need to re dangerX, score, p	oresent the things that change? Datatype (Number, String, Image, Bo	olean)
Tiela fiame (c	anigerx, score, p	Daidiype (Normber, Smillig, image, Be	olcuii.	•••
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 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-sto	ate function is new		

	State is	
ı	State:	
	(
		,
sample inst	ance for each sketch from the previous pag	ge:
=		
=	:	
	:	
example fo	or one of the functions on the previous page	e:

Collision

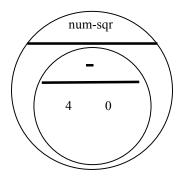
Distance:

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: \Box 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: Distance² = $(px - cx)^2 + (py - cy)^2$ Contract+Purpose Statement #_____:___-> _____ Give Examples Write examples of your function in action examples: is end Function fun _____(___):

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 #_____--> _____ Give Examples Write examples of your function in action examples: end Function fun _____(____):

end

DESIGN RECIPE

•		->
name	Domain	Range
	What does the function do?	
e Examples e examples of your function	in action	
amples:	\	
(()	
is	h should become	
()	
the user types		
is		
	which should become	
.d		
ction		
le the changes in the examples	s, and name the variables.	
n	() •

DESIGN RECIPE

ntract+Purpose Statement ery contract has three parts:		
ery contract has three parts:		
		>
name	Domain	Range
	What does the function do?	
ve Examples rite examples of your function	in action	
xamples:		
()	
the user types		
is		
which	h should become	
()	
the user types		
is		
	which should become	
end		
unction		
circle the changes in the examples	s, and name the variables.	
īun	()	:
 end		

Draw a sketch	for three distinc	t moments of the animation		
Sket	ch A	Sketch B Sketch	С	
What things are	e changing?			
Thing		Describe how it changes		
What fields do	vou need to re	present the things that change?		
	dangerX, score, p		oolean.)
Make a 10-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	10-20	Done
Daia silociole	II dily new neid	(s) were daded, changed or removed		
draw-state	If something is a	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

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ta	State:	
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	ince for each sketch from the previous po	
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Draw a sketch	for three distinc	et moments of the animation		
Sket	ch A	Sketch B Sketch	С	
What things are	e chanaina?			
Thing		Describe how it changes		
	you need to re dangerX, score, p	present the things that change? Datatype (Number, String, Image, Bo	oolean	
rieid fidille (d	adilgerx, score, p	balarype (Normber, Shiring, image, be	Joican.	•••)
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 a	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		

a	State is	
ta	State:	
_	(
_)
d		
	ance for each sketch from the previous po	
=		
=		
=		
=		

Draw a sketch	for three distinc	et moments of the animation		
Sket	ch A	Sketch B Sketch	С	
What things are	e chanaina?			
Thing	9 91191191191	Describe how it changes		
	you need to red dangerX, score, p	present the things that change? Datatype (Number, String, Image, Bo	alaga)
rieid fidille (C	adilgerx, score, p	buildype (normber, sining, image, bo	Joiedi I.	••)
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 a	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		

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	ance for each sketch from the previous po	
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Draw a sketch	for three distinc	t moments of the animation		
Sketo	ch A	Sketch B Sketch	C	
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What things are Thing	enanginge	Describe how it changes		
	you need to re langerX, score, p	present the things that change? Datatype (Number, String, Image, Bo	olean)
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		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 a	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-sto	ate function is new		

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

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What things are Thing	e changing?	Describe how it changes		
	you need to re langerX, score, p	oresent the things that change? Datatype (Number, String, Image, Bo	oolean.)
Make a Te De l	list and shock	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 a	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 instance for each sketch from the previous page: = = = Write at least one NEW example for one of the functions on your To-Do list
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If you have another function on your To-Do list , write at least one NEW example

Contracts

Range example	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Domain																		
Name	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	

Contracts

example																		
Range	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^	^
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