Name: _____

Bootstrap:Reactive

_____

www.bootstrapworld.org

Class: _____

Workbook v0.9

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Unit 1

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

Images	```(define SHAPE
  (triangle 40 "outline" "red"))

(define OUTLINE
  (star 80 "solid" "green"))

(define SQUARE
  (rectangle 50 50 "solid" "blue"))``` | ```SHAPE =
  triangle(40, "outline", "red")

OUTLINE =
  star(80, "solid", "green")

SQUARE =
  rectangle(50, 50, "solid", "blue")```

One of your own: |
| **Booleans** | ```(define BOOL true)

(define BOOL2 false)``` | ```BOOL = true```

One of your own: |
| **Functions** | ```; 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))``` | ```# 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``` |

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:

_____double____ (___5___) is ___2 * 5_____

_____double____ (___7___) is ___2 * 7_____

end

fun _____double_____ (____n_____):

_____2 * n_____

end

\# _____ : _____ -> _____
   name   domain   range

examples:

_____(_____) is _____

_____(_____) is _____

end

fun _____(_____):

_____

end

3

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`

\# _____:_____ -> _____
      name   domain   range

`examples:`

_____(_____) is _____

_____(_____) is _____
`end`

`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

```
examples:

        _____(_____) is _____

        _____(_____) is _____

end

fun _____(_____):


        _____


 end
```

\# _____:_____ -> _____
                name   domain   range

```
examples:

        _____(_____) is _____

        _____(_____) is _____
end

fun _____(_____):


        _____


 end
```

Bug Hunting: Pyret Edition

| **#1** | ```
SECONDS = (7)


STRING = my string
``` | _____<br><br>_____ |
| **#2** | ```
SHAPE1 = circle(50 "solid" "blue")



SHAPE2 = triangle(75, outline, yellow)
``` | _____<br><br>_____ |
| **#3** | ```
# triple : Number -> Number
# Multiply a given number by
# 3 to triple it

examples:
    triple(5) = 3 * 5
    triple(7) = 3 * 7
end
``` | |
| **#4** | ```
fun triple(n):
    3 * n
``` | |
| **#5** | ```
# 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
``` | |

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:

\# _____ : _____ → _____

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

```
fun  _____(_____) :
```

_____

```
end
```

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.

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...

_____

end   ...which should become

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 _____(_____) :

_____

end

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Word Problem: next-position

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

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…

_____
```
end
```
…which should become

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   _____(_____) :


        _____

end
```

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+Purpose Statement

\# _____ : _____ → _____

\# _____

Give Examples

Write examples of your function in action

```
examples:
      _____(_____) is
```
              the user types…

_____
              …which should become

```
      _____(_____) is
```
         the user types…

_____
```
end
```
              …which should become

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    _____(_____) :


      _____

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 Statement

\# _____ : _____ → _____

\# _____

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

```
fun    _____(_____) :


        _____


end
```

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
```

_____ = _____

_____ = _____

_____ = _____

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 Statement

```
# draw-state : _____  → Image


# _____
```

Write an expression for each piece of your final image

Sun	
Ground	
Sky	

Write the draw-state function, using put-image to combine your pieces

```
fun _____(_____) :


        _____


        _____


        _____

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 Statement

\# _____ : _____ → _____

\# _____

Give Examples

Write examples of your function in action

examples:

_____(_____) is

the user types...

_____

...which should become

_____(_____) is

the user types...

_____

end

...which should become

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 _____(_____) :

_____

end

Identifying Animation Data Worksheet

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

_____ = _____

_____ = _____

_____ = _____

Identifying Animation Data Worksheet

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

_____ = _____

_____ = _____

_____ = _____

Identifying Animation Data Worksheet

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

_____ = _____

_____ = _____

_____ = _____

Identifying Animation Data Worksheet

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

_____ = _____

_____ = _____

_____ = _____

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 Statement

\# _____ : _____ → _____

\# _____

Give Examples

```
examples:
        _____(_____) is _____

        _____(_____) is _____

        _____(_____) is _____

        _____(_____) is _____


   end
```

```
fun  _____(_____) :

        if _____:

           _____

        else if _____:

           _____

        else if _____:

           _____

        else: _____


        end
end
```

Piecewise Bug-Hunting

	Buggy Code	Correct Code / Explanation
Round 1	```fun piecewisefun(n): if (n > 0): n else: 0```	
Round 2	```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```	
Round 3	```fun absolute-value(a b): if a > b: a - b b - a end end```	
Round 4	```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 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…)

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	☐	☐
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	☐	☐

_____ = _____

_____ = _____

_____ = _____

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.

_____ : _____ → _____

_____

```
examples:
    _____(_____) is _____

    _____(_____) is _____

    _____(_____) is _____

    _____(_____) is _____


    end
```

(worksheet continues next page)

```
fun _____(_____) :

        if _____:

        _____

        else if _____:

        _____

        else if _____:

        _____

        else: _____

    end
end
```

Unit 5

Animation Extension Worksheet

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. Make the green bars get smaller based on hunger and sleep levels.

Draw a sketch for three distinct moments of the animation, focusing on the new behavior

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…)

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	☑	☐
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	☐	☐

FULLPET = ___pet(100, 100)_____

MIDPET = ___pet(50, 75)_____

LOSEPET = ___pet(0, 0)_____

_____

next-state-tick(FULLPET) is pet(FULLPET.hunger – 2, FULLPET.sleep – 1)

next-state-tick(MIDPET) is pet(MIDPET.hunger – 2, MIDPET.sleep – 1)

next-state-tick(LOSEPET) is LOSEPET

_____

_____

_____

_____

_____

_____

_____

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 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…)

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	☐	☐
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	☐	☐

_____ = _____

_____ = _____

_____ = _____

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

_____

_____

_____

_____

_____

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 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...)

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	☐	☐
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	☐	☐

_____ = _____

_____ = _____

_____ = _____

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

_____

_____

_____

_____

_____

Animation Design Worksheet

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…)

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
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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-state function is new	☐	☐

a _____**State** is _____

data _____**State:**

| _____(_____

_____

_____

_____)

end

_____ = _____

_____ = _____

_____ = _____

_____

_____

_____

_____

_____

_____

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:

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

Contract+Purpose Statement

\# _____ : _____ -> _____

\# _____

Give Examples

Write examples of your function in action

```
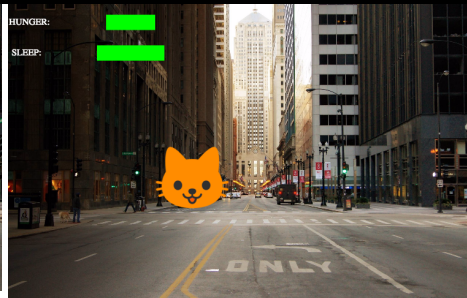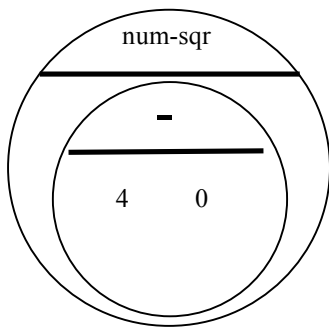examples:
        _____(_____)          is


        _____


        _____(_____)          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:
        _____(_____)        is


        _____

        _____


        _____(_____)        is


        _____

        _____

end
```

Function

```
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

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
```

Animation Design Worksheet

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…)

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	☐	☐
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	☐	☐

```
# a _____State is _____

data _____State:

 | _____(_____

            _____

            _____

            _____)
 end
```

_____ = _____

_____ = _____

_____ = _____

_____

_____

_____

_____

_____

Animation Design Worksheet

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…)

Make a To-Do List, and check off each as "Done" when you finish each one.

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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-state function is new	☐	☐

```
# a _____State is _____

data _____State:

| _____(_____

          _____

          _____

          _____)
end
```

_____ = _____

_____ = _____

_____ = _____

_____

_____

_____

_____

_____

Animation Design Worksheet

Draw a sketch for three distinct moments of the animation

<div align="center">

Sketch A   Sketch B   Sketch C

</div>

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…)

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*	☐	☐
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*	☐	☐

a _____**State** is _____

data _____**State:**

| _____(_____

_____

_____

_____)

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 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…)

Make a To-Do List, and check off each as "Done" when you finish each one.

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next-state-key	If the Data Structure changed, or a keypress triggers the animation	☐	☐
reactor	If either next-state function is new	☐	☐

_____ = _____

_____ = _____

_____ = _____

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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_____

_____

_____

Contracts

Name	Domain	Range	example
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	

Contracts

Name	Domain	Range	example
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
#	..	↑	
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