#### **Bootstrap Units**

01	Videogames and Coordinate Planes	06	Comparing Functions
02	Contracts, Strings, and Images	07	Conditional Branching
03	Intro to Definitions	08	Collision Detection
04	Design Recipe	09	Prepping for Launch
05	Game Animation	10	Additional Material

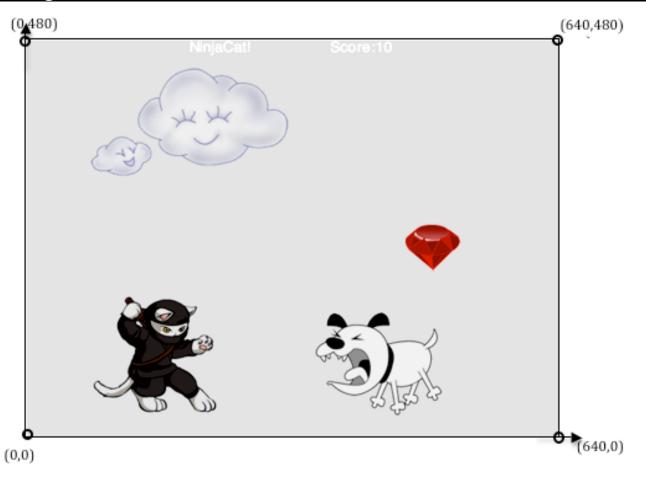


### Lesson 1

#### Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically
cloud	position	x-coordinate

#### Finding Coordinates



The coordinates for the PLAYER (NinjaCat) are	ə:	( ,	)	
		x-coordinate	y-coordinate	
The coordinates for the DANGER (Dog) are:	(	,	)	
The coordinates for the TARGET (Ruby) are:	(	,	)	

#### Our Videogame

Created by (write your names):	
Background	
Our game takes place in:(space? the desert? a mall?)	
The Player	
The player is a	
The player moves only up and down.	
The Target Your player GAINS points when they hit the target.	
The Target is a	
The Target moves only to the left and right.	
The Danger Your player LOSES points when they hit the danger.	
The Danger is a	
The Danger moves only to the left and right	

### Circle of Evaluation Practice Time: 5 minutes Don't forget to use the computer's symbols for things like multiply and divide!

Math	Circle of Evaluation	Racket Code
5 x 10		
8 + (5 x 10)		
(8 + 2) - (5 x 10)		
<u>5 x 10</u> 8 - 2		



	Circles Co	mpetition	Time: 5 minutes
	Math	Circle of Evaluation	Racket Code
Round 1	(3 * 7) - (1 + 2)		
Round 2	3 - (1 + 2)		
Round 3	3 - (1 + (5 * 6))		
Round 4	(1 + (5 * 6)) - 3		



Fast Functions			
:		->	
name	domain	range	
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	)		
(define (			
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		->	
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name	domain	range	\
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(EXAMPLE (	)		)
(define (	)		)

Fast Functions			
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(define (	)		)
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name	domain	range	
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(EXAMPLE (	)		)
(define (	)		)
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name	domain	range	
(EXAMPLE (	)		)
(EXAMPLE (	)		)
(define (	)		)
;	<u>:</u>	>	-
name	domain	range	
(EXAMPLE (	)		)
(EXAMPLE (	)		)
(define (	\		1



#### Word Problem: rocket-height

**Directions:** A rocket blasts off, traveling at 7 meters per second. Write a function called 'rocketheight' that takes in the number of seconds that have passed since the rocket took off, and which produces the height of the rocket at that time.

Contract	and Purpose S	tatement		
Every contract h	as three parts			
;	:		$\rightarrow$	
function no	ame	domain	range	
;				
		what does the funct	iion do?	
Examples				
Write some exan	nples, then circle and I	abel what changes		
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
Definition				
Write the definiti	on, given variable nan	nes to all your input values		
(define(		)		
	function name	variables		
				)

what the function does with those variables

#### Word Problem: lawn-area

**Directions:** Use the Design Recipe to write a function 'lawn-area', which takes in the width and length of a lawn, and returns the area of the lawn. (Don't forget: area = length \* width!)

	and Purpose S			
ry contract h	nas three parts			
	:		$\rightarrow$	
function n	ame	domain	range	
		what does the functi	ion do?	
camples	;			
e some exar	mples, then circle and	abel what changes		
XAMPLE(		)		)
	function name	input(s)	what the function produces	
XAMPLE(		)		)
_	function name	input(s)	what the function produces	
efinition				
e the definiti	ion, given variable nan	nes to all your input values		
		`		
efine(		)		

what the function does with those variables

#### Word Problem: red-square

**Directions:** Use the Design Recipe to write a function 'red-square', which takes in a number (the length of each side of the square) and outputs a solid red rectangle whose length and width are the same size.

Contract	and Purpose S	Statement			
Every contract h	nas three parts				
;	:			$\rightarrow$	
function n	ame	dor	nain	range	
;					
		what do	oes the function do?		
Examples	<b>3</b>				
Write some exar	mples, then circle and	label what change:	S		
(EXAMPLE(			)		)
	function name	input(s)		what the function produces	
(EXAMPLE(			)		)
	function name	input(s)		what the function produces	
Definition					
Write the definiti	ion, given variable na	mes to all your input	values		
(define(			)		
	function name	variables	<del>_</del>		
					)
		what the funct	ion does with those	variables	

# target



Game Animation

#### Word Problem: update-danger

**Directions:** Use the Design Recipe to write a function 'update-danger', which takes in the danger's x-coordinate and produces the next x-coordinate, which is 50 pixels to the left.

Contract	and Purpose S	tatement		
Every contract h	nas three parts			
;	:		$\rightarrow$	
function no	ame	domain	range	
;				
		what does the	function do?	
Examples	;			
Write some exar	mples, then circle and	abel what changes		
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
Definition				
Write the definiti	ion, given variable nan	nes to all your input value	S	
(define(		)		
	function name	variables		
				)

what the function does with those variables

#### Word Problem: update-target

**Directions:** Write a function 'update-target', which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

	and Purpose S	tatement		
Every contract h	nas three parts			
;	:		$\rightarrow$	
function no	ame	domain	range	
;				
		what does the fund	otion do?	
Examples				
Write some exan	mples, then circle and	label what changes		
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
(EXAMPLE(		)		)
	function name	input(s)	what the function produces	
Definition				
Write the definiti	ion, given variable nar	nes to all your input values		
(define(		)		
	function name	variables		
				)

what the function does with those variables



"safe-left?"

Comparing Functions

Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

- 1. A piece of Sam is still visible on the left as long as...
- (> x -50)
- 2. A piece of Sam is still visible on the right as long as...
- \_\_\_\_
- 3. Draw the Circle of Evaluation for these two expressions in the circles below:





#### Word Problem: safe-left?

**Directions:** Use the Design Recipe to write a function 'safe-left?', which takes in an x-coordinate and checks to see if it is greater than -50

	and Purpose S	idiememi			
Every contract h	nas three parts				
;	:			$\rightarrow$	
function no	ame	dom	ain	range	9
• •					
		what doe	es the function do?	?	
Examples					
Write some exan	mples, then circle and	label what changes.			
(EXAMPLE(			)		)
_	function name	input(s)		what the function produces	
(EXAMPLE(			)		)
_	function name	input(s)		what the function produces	
Definition					
Write the definiti	ion, given variable nar	mes to all your input v	values		
(define(			)		
	function name	variables	=		
					)
		what the function	on does with those	variables	

#### Word Problem: safe-right?

**Directions:** Use the Design Recipe to write a function 'safe-right?', which takes in an x-coordinate and checks to see if it is less than 690.

as three parts				
:			$\rightarrow$	
nme	domaii	า	range	
	what does	the function do?	?	
nples, then circle and	label what changes			
		)		)
function name	input(s)		what the function produces	
		)		)
function name	input(s)		what the function produces	
on, given variable nan	nes to all your input vo	ılues		
		)		
function name	variables			
				)
	as three parts : me  inples, then circle and influenction name  function name  on, given variable name	what does  what does  apples, then circle and label what changes  function name input(s)  function name input(s)	as three parts  imme domain  what does the function dose the function name input(s)  function name input(s)	ime domain range  what does the function do?  what does the function do?  function name input(s) what the function produces  function name input(s) what the function produces  on, given variable names to all your input values  )

what the function does with those variables

#### and / or

#### Write the Circles of Evaluation for these statements, and then convert them to Racket

1. Two is less than five, <u>and</u> zero is equal to six.



2. Two is less than four <u>or</u> four is equal to six.



#### Word Problem: onscreen?

**Directions:** Use the Design Recipe to write a function 'onscreen?', which takes in the x-coordinate and checks to see if Sam is safe on the left AND safe on the right.

Contract	and Purpose S	statement				
Every contract h	has three parts					
;	:			$\rightarrow$		
function n	name	do	main		range	
;						
		what c	loes the function do?			
Examples	5					
Write some exa	mples, then circle and	label what change	es			
(EXAMPLE(			)			
_	function name	input(s)				
						)
	W	hat the function produce:	S			
(EXAMPLE(			)			
_	function name	input(s)				
						)
		what the function produc	ces			
Definition						
Write the definit	tion, given variable nai	mes to all your inpu	t values			
(define(			)			
	function name	variables				
						)
		what the func	tion does with those varia	bles		

## 7 Conditional Branching



#### **Word Problem: cost**

**Directions:** Luigi's Pizza has hired you as a programmer. They offer Cheese (\$9.00), Pepperoni (\$10.50), Chicken (\$11.25) and Broccoli (\$10.25). Write a function called cost which takes in the name of a topping and outputs the price of a pizza with that topping.

Contract of	and Purpose	Statement			
Every contract h	as three parts				
;	:			$\rightarrow$	
function na	me	dor	main		range
;					
		what do	oes the function do?	?	
Examples					
	nples, then circle and	d label what change.	S		
(EXAMPLE(	cost	"cheese"	)		)
_	function name	input(s)		what the function produces	
(EXAMPLE(			)		)
_	function name	input(s)		what the function produces	
(EXAMPLE(			)		)
	function name	input(s)		what the function produces	
(EXAMPLE(			)		)
	function name	input(s)		what the function produces	
Definition					
	on, given variable no	ames to all your input	values		
(define(			)		
	function name	variables	<u> </u>		
(cc	ond				
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[					1)

#### Word Problem: update-player

**Directions:** Write a function called update-player, which takes in the player's y-coordinate and the name of the key pressed, and returns the new y-coordinate.

	·			<i></i>	
function	n name	dom	ain	range	
		what doe	es the function do?		
Example	25				
/rite some ex	amples, then circle and l	abel what changes.			
EXAMPLE (	update-player	320 "up"	)		)
	function name	input(s)		what the function produces	
EXAMPLE(	update-player	100 "up"	)		)
	function name	input(s)		what the function produces	
EXAMPLE(			)		)
	function name	input(s)		what the function produces	
EXAMPLE(			)		)
	function name	input(s)		what the function produces	
Definitio	n				
rite the defir	nition, given variable nam	es to all your input v	values		
define(			)		
_	function name	variables	_		
(					
	_				
	[				]
	Γ				1

## **O8** Collision Detection

## collision



#### Word Problem: line-length

**Directions:** Write a function called 'line-length', which takes in two numbers and returns the \*positive difference\* between them. It should always subtract the smaller number from the bigger one, and if they are equal it should return zero.

Contract	t and Purpose S	tatement							
Every contract	has three parts								
;	:						$\rightarrow$		
function	name	dom	nain					range	
;									
		what do	es the fund	ction d	οŝ				
Example	es								
Write some exc	amples, then circle and	label what changes							
(EXAMPLE(	line-length	10 5	)	( –	10	5)			)
<del>-</del>	function name	input(s)					what the function produces		
(EXAMPLE(	line-length	2 8	)	( –	8	2)			)
_	function name	input(s)					what the function produces		
Definition	n								
Write the defin	ition, given variable nar	mes to all your input	values						
(define(			)						
	function name	variables	_						
( (	cond								
1	[								]
I	[								]))

#### The Distance Formula (an example)

The distance between the points (0, 0) and (4, 3) is given by:

$$\sqrt{(line-length \ 4\ 0)^2 + (line-length \ 3\ 0)^2}$$

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



Convert the Circle of Evaluation into Racket code:

#### Word Problem: distance

**Directions:** 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. (HINT: look at what you did on the previous page!)

Contract	and Purpose S	statement		
every contract h	as three parts			
;	:		_	$\rightarrow$
function no	ame	do	main	range
;				
		what c	loes the function do?	
Examples				
Vrite some exan	nples, then circle and	label what change	es	
(EXAMPLE(			)	
	function name	input(s)		
				)
		what the	function produces	
(EXAMPLE(			)	
	function name	input(s)		
				)
		wha	t the function produces	<u> </u>
Definition				
	on, given variable naı	mes to all your inpu	t values	
(define(	on, given vandele na	nes re all year lines	1	
(	function name	variables	/	
	function name	variables		
				)

#### Word Problem: collide?

**Directions:** Write a function collide?, 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

Are the coordinates of the player within 50 pixels of the coordinates of the other character?

t and Purpose S	Statement		
ct has three parts			
:		$\rightarrow$	
on name	domain	range	
	what does the fu	nction do?	
es			
xamples, then circle and	label what changes		
(	)		)
function name	input(s)	what the function produces	
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function name	input(s)	what the function produces	
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inition, given variable nai	mes to all your input values.		
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function name	variables		
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	thas three parts  in name  es  kamples, then circle and function name  function name  nnition, given variable nai	tunction name input(s)  function name input(s)  function, given variable names to all your input values.	th has three parts  in name domain range  what does the function do?  Seamples, then circle and label what changes  function name input(s) what the function produces  function name input(s) what the function produces  nnition, given variable names to all your input values  )

what the function does with those variables



## Presentation Preparation



## Lesson 9

Catchy Intro:
Name, Age, Grade:
Game Title:
Back Story:
Characters:
Explain a piece of your code:

#### Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy? No way! Definitely! A little. Did they talk about their characters? No way! A little. Definitely! Did they explain the code well? No way! A little. Definitely! Did they speak slowly enough? No way! Definitely! A little. Did they speak loudly enough? No way! A little. Definitely! Were they standing confidently? No way! A little. Definitely! Did they make eye contact? No way! A little. Definitely!

#### Presentation Feedback

For each question, circle the answer that fits best.

Was the introduction catchy? No way! Definitely! A little. Did they talk about their characters? No way! A little. Definitely! Did they explain the code well? No way! A little. Definitely! Did they speak slowly enough? No way! Definitely! A little. Did they speak loudly enough? No way! A little. Definitely! Were they standing confidently? No way! A little. Definitely! Did they make eye contact? No way! A little. Definitely!

#### Word Problem: red-shape

**Directions:** Write a function called red-shape, which takes in the name of a shape and draws that shape (solid and red). Add an else clause that produces a sensible output.

Contract	and Purpose	Statement						
Every contract I	has three parts							
;	:					$\rightarrow$		
function n	name	dor	main				range	
;								
		what do	oes the fu	nction do?				
Examples	S							
	mples, then circle and	d label what change:	S					
(EXAMPLE(	red-shape	"circle"	)	(circle	50	"solid"	"red")	)
	function name	input(s)			wh	at the function pr	oduces	
(EXAMPLE(			)					)
	function name	input(s)			wh	at the function pr	oduces	
(EXAMPLE(			)					)
_	function name	input(s)			wh	at the function pr	oduces	
(EXAMPLE(			)					)
	function name	input(s)			who	at the function pr	oduces	
Definition								
	tion, given variable na	ames to all your input	values.					
(define(			)					
	function name	variables						
(c	ond							
[				(circle	50 "	solid" '	'red")	]
]								]
]								]
[								]
]								])

#### Translating into Algebra

#### **Value Definitions**

Racket Code	Algebra
(define x 10)	x = 10
(define y (* x 2))	y = x*2
(define z (+ x y))	
(define age 14)	
(define months (* age 12))	
(define days (* months 30))	
(define hours (* days 24))	
(define minutes (* hours 60))	

#### **Function Definitions**

Racket Code	Algebra
<pre>(define (area length width)   (* length width))</pre>	area(length, width) = length * width
(define (circle-area radius) (* pi (sqr radius)))	
(define (distance x1 y1 x2 y2) (sqrt (+ (sqr (- x1 x2))	

A rocket is flying from Earth to Mars at 80 miles per second. Write a function that describes the **distance** D that the rocket has traveled, as a function of **time** t.

I. Contract+Purpose S  Every contract has three p		
Every communities p	, can 5.	
; <u>D</u> :		>
name	Domain	Range
<b>,</b>	What does the function do?	
II. Give Examples		
Write an example of your t	function for <u>some sample inputs</u>	
D(1) =		
Use the function here	What should the function produce?	
D(2)=		
Use the function here	What should the function produce?	
D( ) =		
Use the function here	What should the function produce?	
=		
Use the function here	What should the function produce?	
III. Definition		
Write the formula, giving v	ariable names to all your input values.	
D( ) =		

A rocket is traveling from Earth to Mars at 80 miles per second. Write a function that describes the <u>time</u> the rocket has been traveling, as a function of <u>distance</u>.

Contract+Purpose S		
very contract has three p	parts:	
•		
•		
name	Domain	Range
	What does the function do?	
Give Examples		
-	function for <u>some sample inputs</u>	
, ,	· · · · · · · · · · · · · · · · · · ·	
=		
se the function here	What should the function produce?	
=		
se the function here	What should the function produce?	
- 40 - 4 4		
e the function here	What should the function produce?	
=		
e the function here	What should the function produce?	
e me fortenon nero	What should the folleholf produce:	
. Definition		
rite the Formula, giving v	variable names to all your input values.	
=		

A rocket leaves Earth, headed for Mars at 80 miles per second. **At the exact same time**, an asteroid leaves Mars traveling towards Earth, moving at 70 miles per second. If the distance from the Earth to Mars is 50,000,000 miles, how long will it take for them to meet?

:		·>
name	Domain	Range
	What does the function do?	
Give Examples	function for <u>some sample inputs</u>	
=		
e the function here	What should the function produce?	
=		
e the function here	What should the function produce?	
=		
e the function here	What should the function produce?	
=		
e the function here	What should the function produce?	
. Definition		

	•	>
name	Domain	Range
	What does the function do?	
Give Examples		
	ur function for some sample inputs	
=		
the function here	What should the function produce?	
=		
the function here	What should the function produce?	
=		
the function here	What should the function produce?	
=		
	What should the function produce?	

•		->
name	Domain	Range
	What does the function do?	
Give Examples	unction for <u>some sample inputs</u>	
=	sinction for <u>some sample inputs</u>	
the function here	What should the function produce?	
=		
the function here	What should the function produce?	
the function here		
=		
	What should the function produce?	
=	What should the function produce?	
= the function here	What should the function produce?  What should the function produce?	
= the function here		

# Contracts

Name	Domain	Range	example
•		<b>^</b>	
••	••	<b>^</b>	
••	••	<b>^</b>	
•	:	<b>^</b>	
•	:	<b>*</b>	
•	:	<b>*</b>	
•	:	<b>↑</b>	
•	:	<b>*</b>	
•	:	<b>*</b>	
•	:	<b>↑</b>	
•	:	<b>*</b>	
•	:	<b>^</b>	
•	:	<b>*</b>	
•	:	<b>^</b>	
••	:	<b>↑</b>	
••	:	<b>↑</b>	
••		<b>^</b>	
••	:	<b>*</b>	

# Contracts

Name	Domain	Range	example
•		<b>^</b>	
••	••	<b>^</b>	
••	••	<b>^</b>	
•	:	<b>^</b>	
•	:	<b>*</b>	
•	:	<b>*</b>	
•	:	<b>↑</b>	
•	:	<b>*</b>	
•	:	<b>*</b>	
•	:	<b>↑</b>	
•	:	<b>*</b>	
•	:	<b>^</b>	
•	:	<b>*</b>	
•	:	<b>^</b>	
••	:	<b>↑</b>	
••	:	<b>↑</b>	
••		<b>^</b>	
••	:	<b>*</b>	