Name: _____



Student Workbook

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('10100'			
1 1/100			
Class:			



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

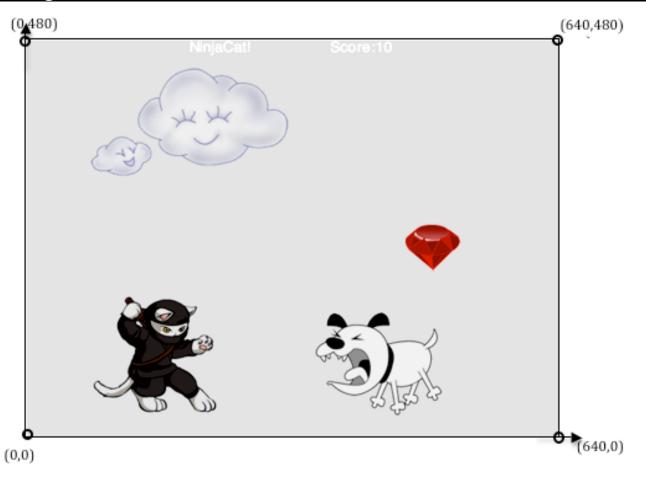


Lesson 1

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	
,,)	-)
)		
(define (
(4011110 (/
		->	
name	domain	range	
(EXAMPLE ())
(EXAMPLE ()		
			/
(deline (//		/
		->	
name	domain	/	
(EXAMPLE ()	runge)
(EXAMPLE (/
· · · · · · · · · · · · · · · · · · ·	/		′
(define ()		
;:		>	
name	domain	range	\
(EXAMPLE (/		/
(EXAMPLE ())
(define ())

Fast Functions			
; :		->	
name	domain	range	
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	:	>	-
name	domain	range	
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	:	>	_
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 'rocket-height' 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.

	and Purpose	Statement			
Every contract has	s three parts				
	:		\rightarrow		
function nam	пе	domain		range	
		what does the	function do?		
Examples					
Vrite some examp	oles, then circle and l	abel what changes			
EXAMPLE())
	function name	input(s)	what the function produces		
EXAMPLE())
	function name	input(s)	what the function produces		
Definition					
Vrite the definition	n, given variable nam	es to all your input values			
define()			
fu	Inction name	variables			
)	
		what the function does wit	h 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!)

Contract a	ind Purpose	Statement				
Every contract has	s three parts					
	:			\rightarrow		
function nam	ne	domain			range	
		what does t	he function do?			
Examples						
Vrite some examp	oles, then circle and la	abel what changes				
EXAMPLE())
	function name	input(s)		what the function produces		
EXAMPLE())
	function name	input(s)		what the function produces		
Definition						
Vrite the definition	n, given variable name	es to all your input values				
define()	1			
fu	nction name	variables				
)	
		what the function does	with those veriable			

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.

very contract has	three parts			
	:			\rightarrow
function nam	e	dor	nain	range
		what d	oes the function do?	
Examples				
Vrite some examp	oles, then circle and la	abel what changes		
EXAMPLE()	
	function name	input(s)	_	
		what the function produce	us	
EXAMPLE()	
	function name	input(s)		
		what the function prod	uces	
Definition				
Vrite the definition	, given variable name	es to all your input valu	es	
define()	
	nction name	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 a	and Purpose	Statement				
Every contract has	s three parts					
	:			\rightarrow		
function nam	ne	do	omain		range	
		what o	does the function o	lo?		
Examples						
Vrite some examp	oles, then circle and l	abel what changes				
(EXAMPLE())
	function name	input(s)		what the function produces		
EXAMPLE())
	function name	input(s)		what the function produces		
Definition						
Vrite the definition	n, given variable nam	es to all your input valu	ues			
define()			
fu	ınction name	variables				
)	
		what the function	n does with those v	ariables		

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.

Contract a	and Purpose	Statement				
Every contract has	s three parts					
	:			\rightarrow		
function nam	ne	do	omain		range	
		what o	does the function o	lo?		
Examples						
Vrite some examp	oles, then circle and l	abel what changes				
(EXAMPLE())
	function name	input(s)		what the function produces		
EXAMPLE())
	function name	input(s)		what the function produces		
Definition						
Vrite the definition	n, given variable nam	es to all your input valu	ues			
define()			
fu	ınction name	variables				
)	
		what the function	n does with those v	ariables		



"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

Contract a	and Purpose	Statement				
Every contract has	s three parts					
;	:			\rightarrow		
function nam	ne	dom	nain		range	
;						
		what do	oes the function d	0?		
Examples						
Write some examp	oles, 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 definition	n, given variable nam	es to all your input value	es			
(define())			
fu	unction name	variables				
)	
		what the function of	does with those v	ariables		

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.

Contract a	and Purpose	Statement				
Every contract has	s three parts					
•	:			\rightarrow		
function nan	ne	domai	in		range	
;						
		what doe.	es the function do?			
Examples						
Write some examp	ples, 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 definition	n, given variable nam	es to all your input values	5			
(define()				
fL	unction name	variables				
)	
_		what the function do	es with those varia	bles		

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 a	ind Purpose S	Statement			
Every contract has	s three parts				
· ,	:			\rightarrow	
function nam	ne	domain		range	
		what does to	the function do?		
Examples					
Nrite some examp	oles, then circle and la	bel what changes			
(EXAMPLE()		
	function name	input(s)	=		
)
		what the function	n produces		
EXAMPLE()		
	function name	input(s)	=		
)
		what the fund	ction produces		_
Definition					
Write the definition	n, given variable name	s to all your input values			
(define()			
fu	nction name	variables			
)	
		what the function does	with those variables		

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 a	ind Purpose	Statement			
Every contract has	s three parts				
	:			\rightarrow	
function nam	ne	dom	ain		range
		what do	es the function o	do?	
Examples					
Nrite some examp	oles, then circle and la	bel what changes			
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					
Write the definition	n, given variable name	es to all your input value	 ∌S		
define()			
fu	nction name	variables			
(cond					
[]
[]
[]
[_]
_					
[

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.

very contract ha	and Purpose S					
very contract ne						
	·			→ ———		
function na	ame	doma	ain		range	
		what doe	es the function	do?		
Examples	\$					
Vrite some exan	nples, then circle and lab	el 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		
Definition						
	on, given variable names	to all vour input value	S			
define(, g					
<u> </u>	function name	variables /				
,						
(
r						,
l						
<u> </u>						

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 a	and Purpose	Statement						
Every contract ha	s three parts							
	:					\rightarrow		
function nan	ne	doma	in				range	
		what doe	es the fun	nction a	lo?			
Examples								
Write some exam	ples, then circle and la	abel what changes						
(EXAMPLE(line-length	10 5)	(-	10	5))
_	function name	input(s)				what the function produces		
(EXAMPLE(line-length	2 8)	(-	8 2	2))
	function name	input(s)				what the function produces		
Definition								
Write the definition	n, given variable name	es to all your input value	S					
(define()						
fu	unction name	variables						
(cond								
[]
[]))

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!)

very contract has	three parts		
	:		\rightarrow
function name	e	domain	range
		what does the function do?	
xamples			
rite some examp	oles, then circle and labe	l what changes	
XAMPLE()	
	function name	input(s)	
)
		what the function produces	
XAMPLE()	
	function name	input(s)	
)
		what the function produces	<u> </u>
Definition			
	a givon variable names	to all your input values	
	i, giveri variable riarries	o ali your iriput values	
lefine()	
fui	nction 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?

Contract a	nd Purpose S	Statement				
Every contract has	three parts					
	:			\rightarrow		
function name	е	domain	1		range	
		what does	the function do?			
Examples						
Vrite some examp	les, then circle and lab	el what changes				
EXAMPLE()			
	function name	input(s)	 ;			
)
		what the function produces				
EXAMPLE()			
_	function name	input(s)				
)
		what the function produces				
Definition						
Write the definition	, given variable names	to all your input values.				
define()				
fur	nction name	variables				
)	
		what the function does	s 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 a	ind Purpose S	Statement		
Every contract has	s three parts			
	:		\rightarrow	
function nam	ne	domai	n	range
		what does	s the function do?	
Examples				
	oles, then circle and lab	pel what changes		
EXAMPLE(red-shape	"circle") (circle 50 "solid" "red")	١
	function name	input(s)	what the function produces	
EVANDIE/		7-4-7)	
(EXAMPLE(function name	input(s)	_ ′	
	randian name	pos.(e)		,
		what the function produces		<u>)</u>
EYAMDI E/	·		1	
(EXAMPLE(function name	input(s)	/	
	ranciion name	mpat(5)		,
		what the function produces)
(EVANADI E/		what the function produces		
(EXAMPLE(function name	input(a)		
	iunction name	input(s)		,
	-	that the Constitution of the)
		what the function produces		
Definition				
Write the definition	n, given variable names	to all your input values		
(define()		
fu	nction name	variables		
(cond				
[(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
,	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?	
- 41 4: 4: 1		
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 <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?	

•		->
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
•		^	
••	••	^	
••	••	^	
•	:	^	
•	:	*	
•	:	*	
•	:	↑	
•	:		
•	:	*	
•	:	↑	
•	:	*	
•	:	^	
•	:	*	
•	:	^	
••	:	↑	
••	:	↑	
••		^	
••	:	*	

Contracts

Name	Domain	Range	example
•		^	
••	••	^	
••	••	^	
•	:	^	
•	:	*	
•	:	*	
•	:	↑	
•	:		
•	:	*	
•	:	↑	
•	:	*	
•	:	^	
•	:	*	
•	:	^	
••	:	↑	
••	:	↑	
••		^	
••	:	*	