Contracts

••	Domain :	Range →	example
		Λ Λ	
••		↑	
••		^	
••		↑	
•		↑	
••		↑	
••		^	
••		↑	
•		↑	
•		↑	
•		^	
••		↑	
••		↑	
••		1	
••		↑	

Contracts

Name	Domain	Range	example
	••	1	
		^	
	:	↑	
	:	^	
	:	^	
	:	↑	
	:	^	
	:	↑	
	:	^	
	:	↑	
	:		
	:	↑	
	:	^	
	:	↑	
	:	↑	
	:	↑	
	•	^	

Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically



The background is a picture of:

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		

(draw Circles of Evaluation here if you need extra scratch paper)

	Circles Triathalon		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		

Fill out two examples for each	ch function, then try to write	the contract, function header	
and function body by yourse	lf.	,	
;	:	>	
name	domain	range	
(EXAMPLE ())
(EXAMPLE ()
(define ())
;	:	>	
name	domain	range	
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	:	->	
(EXAMPLE ())
(EXAMPLE ())

(EXAMPLE ())
(EXAMPLE ())
(define ())

(define (_____)

Fast Functions!	
two examples for each function	then try to write the contract



Fill out two examples for each and function body by yourself	h function, then try to write f.	the contract, function heade	T RACER
;	:	>	
name	domain	rang	е
(EXAMPLE ())
(EXAMPLE ())
(define ())
;	_:	>	
name	domain	rang	e
(EXAMPLE ())
(EXAMPLE ())
(define ())
; ;	:	->	
(EXAMPLE ())
(EXAMPLE ())
(define ())
; ;	<u>:</u>	->	
(EXAMPLE ())
(EXAMPLE ())
(define ()		,

DESIGN RECIPE: ROCKET-HEIGHT

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.

· •		->
name •	Domain	Range
	What does the function do?	
I. Give Examples On the computer, write an example	ple of your function in action, using E	EXAMPLE.
the	user types	 /
)
	which should become	
(EXAMPLE ()
	user types	,
)
	which should become	/
II. Function		
	er, giving variable names to all your ir	iput values.
(define ()
function name	variable names	

Design Recipe: red-square

Use the Design Recipe to write a function $\underline{red-square}$, which takes in a number (the size of the square) and outputs a solid red rectangle whose length and width are the same size.

. Contract+Purpose State	ment	
Every contract has three parts:		
•		
N		·>
Name	Domain	Range
	What does the function do?	
Circ Formula		
. Give Examples n the computer write an exam	nple of your function in action, using EXAMF	PI F
EXAMPLE ()
the	e user says	
)
	Racket replies	
EXAMPLE (1
•	e user says	/
	•	
		`
	Racket turns that into)
I. Function Header		,
Write the Function Heade	er, giving variable names to all your input v	alues.
define (1
function name	variable names	<i>)</i>
ranction name	variable names	
		
and the c	computer does this	

Design Recipe: yard-area

Use the Design Recipe to write a function <u>yard-area</u>, which takes in the width and length of a yard, and returns the area of the yard.

(Don't forget: area = length * width !)

_		
	 Domain	->
name	Domain	Range
	What does the function do?	
. Give Examples		
n the computer, write an e	example of your function in action, using	ng EXAMPLE.
EXAMPLE ()
	Use the function here	
	find another way to get the same res)
	find another way to get the same res	ut nere
EVAMBLE /		,
EXAMPLE (Use the function here)
		,
	find another way to get the same res	ult here
I. Function Header		
	eader, giving variable names to all you	r input values.
		`
define ()
function nan	ne variable names	

Design Recipe: update-danger

Use the Design Recipe to write a function <u>update-danger</u>, which takes in the danger's x-coordinate and produces the next x-coordinate, which is 50 pixels to the left.

ery contract has thr				
	_ •		>	
name		Domain	Range	
	What	t does the function do?		
. Give Examples				
	e an example of v	our function in action, using	EXAMPLE.	
EXAMPLE (Use the func	tion have)	
	use the func	tion nere		
)	
	find	another way to get the same result	here	
EXAMPLE ()	
,	Use the func	tion here	,	
)	
	find	another way to get the same result	here	
. Function Head	ler			
		g variable names to all your i	nput values.	
	, 5			
define ()	
	tion name	variable names	,	

Design Recipe: update-target

Use the Design Recipe to write a function <u>update-target</u>, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

•	 Domain	- > Range
name	Domain	Range
	What does the function do?	
Give Examples The computer, write an exa	mple of your function in action, using EXA	MPLE.
EXAMPLE (Jse the function here)
)
	find another way to get the same result her	e
EXAMPLE ()
	Jse the function here	/
)
	find another way to get the same result her	e
. Function Header	der, giving variable names to all your inpu	it values
write the runction riea	der, giving variable names to all your inpu	it values.
define ()
function name	variable names	

Protecting Sam

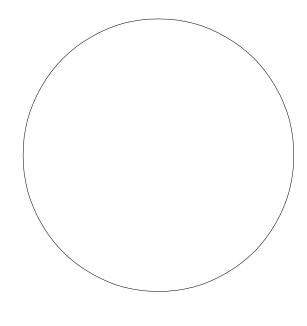
Sam is in a 640 x 480 yard. How far he can go to the left and right before he's out of sight?

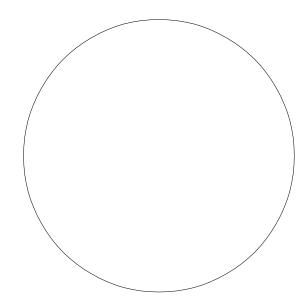
1. A piece of Sam is still visible on the left as long as...

(> 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:





Design Recipe: protect-left?

Use the Design Recipe to write a function protect-left?, which takes in the target's x-coordinate and checks to see if it is greater than -50.

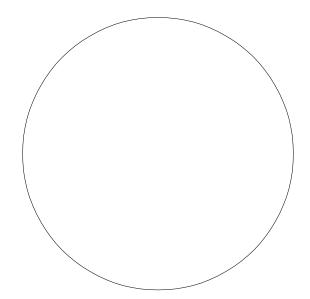
	rpose Statement			
Every contract has th	hree parts:			
•	•		->	
name	•	Domain		nge
				3-
• •				
	What	t does the function do?		
II. Give Example	es			
On the computer, wr	ite an example of y	our function in action, using	EXAMPLE.	
(EXAMPLE ()	
(L//A//// LL (Use the func	tion here	<i>,</i>	
)
	find	another way to get the same result	: here	
(EVAMDLE (`	
(EXAMPLE (Use the func)	
				`
	find	another way to get the same result	: here)
		, 5		
III. Function Hea		g variable names to all your i	nnut values	
Write the Full	iction ricadei, giving	s variable hames to all your r	input values.	
(define ()	
,	nction name	variable names		
)
		and the comput	er does this	

Design Recipe: protect-right?

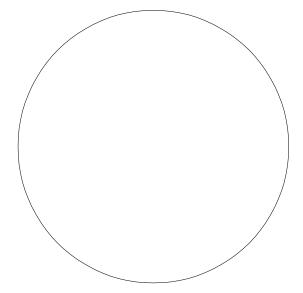
Use the Design Recipe to write a function <u>protect-right?</u>, which takes in the target's x-coordinate and checks to see if it is less than 690.

	·		->
name		Domain	Range
	Wh	at does the function do?	
l. Give Exar		at does the function do.	
		your function in action, using EXAM	MPLE.
EXAMPLE (_		action here)
	Use the fun	iction here	
_)
	Tinc	d another way to get the same result here	
EXAMPLE (_	Use the fun	action here)
	fino	d another way to get the same result here)
I. Function	Header		
		ng variable names to all your input	values.
define ()
`	function name	variable names	,

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.



Design Recipe: onscreen?

Use the Design Recipe to write a function <u>onscreen?</u>, which takes in the target's x-coordinate and checks to see if it Sam is protected on the left <u>and</u> protected on the right.

•		>
name	Domain	Range
	What does the function do?	
. Give Examples n the computer, write an ex	cample of your function in action, using EX	(AMPLE.
EXAMPLE (Use the function here)
\	Use the function here	,
)
	find another way to get the same result he	ere
EXAMPLE ()
	Use the function here	,
)
	find another way to get the same result he	ere
I. Function Header		
Write the Function He	eader, giving variable names to all your inp	out values.
define ()
function name	e variable names	

Design Recipe: cost

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

	what should the function produce? What should the function produce?
On the computer, write an example of your function for a (EXAMPLE (What should the function produce?
(EXAMPLE (What should the function produce?
Use the function here (EXAMPLE (What should the function produce?
Use the function here (EXAMPLE (What should the function produce? What should the function produce? What should the function produce?
Use the function here (EXAMPLE (What should the function produce?
Use the function here III. Function Header Write the Function Header, giving variable names (define (
Write the Function Header, giving variable names (define (to all your input values.
(define (to all your input values.
tunction name varia)
	able names

Design Recipe: update-player
Write a function called <u>update-player</u>, which takes in the player's y-coordinate and the name of the key pressed, and returns the new y-coordinate.

•	:		- ´
name		Domain	Range
I. Give Ex On the comput	camples er, write an example of y	our function for <u>each key</u> , using	EXAMPLE.
EXAMPLE	Use the function here)	ould the function produce?
EXAMPLE	(Use the function here)	ould the function produce?
II. Functio	on Header	g variable names to all your inpu	ut values
Write tl	he Function Header, giving	g variable names to all your inpu	ut values.
Write tl	on Header he Function Header, giving function name	-	ut values.
Write tl	he Function Header, giving		ut values.
Write tl	he Function Header, giving		ut values.
Write tl	he Function Header, giving		ut values.
II. Function Write the following the followi	he Function Header, giving		ut values.

Design Recipe: line-length
Write a function called <u>line-length</u>, which takes in two numbers and returns the difference between them. It should always subtract the smaller number from the bigger one.

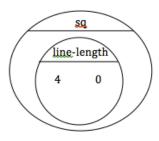
name	·			Domain	>	Range
. Give E	Examples					
EXAMPLE	(line-length Use the func	10 tion here	5)	(- 10 What should the fu	
EXAMPLE	(line-length Use the func		8)	(- 8 What should the fu	2) Inction produce?
ll. Funct		tion here		.	What should the fu	·
l . Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
ll. Funct	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
ll. Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
I. Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
l. Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
l. Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·
l . Funct Write	Use the function Header the Function Heade	tion here er, giving v	⁄ariable r	names to all	What should the fu	·

The Distance Formula, with Numbers

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

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

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



Convert it into Racket code:

	Design	n Recipe: dista	nce	
Write a function di		es FOUR inputs:		
□ px: The x-coordinat□ py: The y-coordinat				
cx: The x-coordinat	e of another game			
□ cy: The y-coordinat	e of another game	character		
It should return the	distance between	the two, using the D	istance formula:	
□ Dista	nce = sqrt(((li	ne-length px $cx)^2 + (1$	ine-length py cy) ²))	
I. Contract+Purpose	Statement			
•			>	
name		Domain	Range	
•				
,	What does t	he function do?		_
II. Give Examples				
(EXAMPLE (Use the function her	re)	
	ose the function her			
	find another	way to get the same res	ult have)
	Tind another	way to get the same resi	utt nere	
(E)(A)ADI E (•	
(EXAMPLE (Use the function her)	
	ose the rangelon her	· C		
)
	find another	r way to get the same res	ult here	
III. Function Header				
(dofine (`	
(define (variable names)	
TUNCTION TO	ше	variable names		
				`
)
		ne computer does this		

Design Recipe: collide

Write a function collide?, which takes FOUR inputs:

px: The x-coordinate of the playerpy: 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 75 pixels of the coordinates of the other character. Otherwise, false. Contract+Purpose Statement Domain What does the function do? Give Examples Use the function here (EXAMPLE (find another way to get the same result here find another way to get the same result here III. Function Header (define (variable names

....and the computer does this

Catchy Intro:	
Jame, Age, Grade:	
Same Title:	
eack Story:	
Characters:	
xplain a piece of your code:	

_

Presentation Feedback For each question, circle the answer that fits best. Definitely! No way! A little. Was the introduction catchy? Definitely! Did they talk about their characters? No way! A little. Did they explain the code well? No way! Definitely! A little. Did they speak slowly enough? Definitely! No way! 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!

Drosontation Foodback			
Presentation Feedback For each question, circle the answer the	at fits best.		
Was the introduction catchy?	No way!	A little.	Definitely!
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!	A little.	Definitely!
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!

Design Recipe Worksheet

Name (of the fun	ction)	Domain (the <i>types</i> of your inputs)	Range (type of the output
II. Exam	ples		
(EXAMPLE		with some <i>inputs</i>)
		that expands to	
(EXAMPLE	use your shortcut	with some <i>inputs</i>)
		that expands to	
III. Funct			
(define	function name	variable <i>names</i> for each yo	our inputs

Design Recipe Worksheet

(ef the function) (the types of your inputs) (type of the output) (EXAMPLE (, Name	·	 Domain	- > Range
(EXAMPLE () use your shortcut with some inputs that expands to (EXAMPLE () use your shortcut with some inputs that expands to (define ()		ion)		(type of the output)
(EXAMPLE () use your shortcut with some inputs that expands to (EXAMPLE () use your shortcut with some inputs that expands to (define ()				
that expands to (EXAMPLE () use your shortcut with some inputs that expands to that expands to (define ()	I. Example	es		
that expands to (EXAMPLE () use your shortcut with some inputs that expands to that expands to (define ()	(FXAMPLF (()
(EXAMPLE () use your shortcut with some inputs that expands to II. Function (define ()	(270 0711 22)	use your shortcut	with some <i>inputs</i>	/
(EXAMPLE () use your shortcut with some inputs that expands to III. Function (define ()				
(EXAMPLE () use your shortcut with some inputs that expands to (define ())
use your shortcut with some inputs that expands to III. Function (define (_		that expands to	/
use your shortcut with some <i>inputs</i> that expands to II. Function (define (
use your shortcut with some inputs that expands to III. Function (define ((E)(A)(B) E	,		
	(EXAMPLE (use your shortcut	with some <i>inputs</i>)
III. Function (define (
II. Function (define (
III. Function (define (_		that expands to)
(define (
(define (II. Functio	n		
\		•		,
runction name variable names for each your inputs	(define (_	function name	variable names for each vo	ur inputs
		runction name	variable hames for each yo	ur inputs
		and the comp	ונכו עטכן נווון	

Design Recipe: red-shape
Write a function called <u>red-shape</u>, which takes in the name of a shape ("circle", "triangle", "star" or "rectangle"), and draws that shape. All shapes should be solid and red, and can be whatever size you choose

On the compu	xamples		
On the compu	Adilipies		
		ion for <u>each s</u>	shape, using EXAMPLE. The first one
EXAMPLE	(red-shape "circle")	(circle 50 "solid" "red")
	Use the function here		What should the function produce?
EXAMPLE)	What should the function produce?
	Use the function here		What should the function produce?
EXAMPLE	Use the function here)	What should the function produce?
	Use the function here		What should the function produce?
EXAMPLE	()	
	Use the function here		What should the function produce?
	<mark>on Header</mark> he Function Header, giving variable	names to all	your input values.
(define (1
(define (function name	variable na	ames
(cond	[
		(ci	rcle 50 "solid" "red")
			,

Values: Translate the Racket Code into Algebra				
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 (* age 30))				
(define hours (* days 24))				
(define minutes (* hours 60))				

Functions: Translate the Racket Code into Algebra			
<pre>(define (double x) (* x 2))</pre>	double(x) = x*2		
<pre>(define (area length width) (* length width))</pre>	area(length, width) = length * width		
<pre>(define (circle-area radius) (* pi (sq radius)))</pre>			
(define (distance x1 y1 x2 y2) (sqrt (+ (sq (- x1 x2)) (sq (- y1 y2))))			

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

Every contract has	urpose Staten three parts:	nent		
; <u>D</u>	:	Domain	-> Range	
II. Give Examp Write an example o		on 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. Function He		What should the function produce?	nut values	
D() =	inction Heade	r, giving variable names to all your in	put values.	

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

•	•		->
name		Domain	Range
I. Give Examp	les		
Vrite an example o	f your func	tion for <u>some sample inputs</u>	
	=		
Use the function here		What should the function produce?	
	=		
Use the function here		What should the function produce?	
	=		
Jse the function here		What should the function produce?	
	=		
		What should the function produce?	

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
Give Examples		
te an example of your fu	nction 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?	
Frantisa Haadaa		
. Function Header	eader, giving variable names to all your input	values

I. Contract+Pu	rpose Statem	nent		
Every contract has t	hree parts:			
•	•		->	
name		Domain	Range	
II. Give Exampl	es			
		n for <u>some sample inputs</u>		
,	,			
	=			
Use the function here		What should the function produce?		
	=			
Use the function here		What should the function produce?		
	_			
Use the function here	=	What should the function produce?		
ose the function here		what should the function produce:		
	=			
Use the function here		What should the function produce?		
III. Function Hea				
Write the Fur	nction Header	r, giving variable names to all your inp	out values.	
	=			