Contracts

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

Contracts

example																	
Range	1	1	1	1	^	↑	1	^	^	↑	↑	↑	↑	↑	^	1	↑
Domain			<u></u>	•	•	•	<u></u>	:	•	•	:	:	•	•	:	•	<u></u>
Name		••	••	••	••	••	••	••	••	••	••	•	••	••	••	:	••

Reverse-Engineering: How does NinjaCat work?

Thing in the game	What changes about it?	More specifically
cloud	position	x-coordinate
Cat	Position	X,y coordinates
Ruby	Position	x-coordinate
Dog	Position	Y-coordinate
Score	Value	
Background	Nothing	

Finding Coordinates



The coordinates for the PLAYER (NinjaCat) are: (150, 50) x-coordinate y-coordinate

The coordinates for the DANGER (Dog) are: (450 , 50)

The coordinates for the TARGET (Ruby) are: (550, 250)

Our Videogame

Created by (write your names):	
Background	
Our game takes place in: A zoo (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 Escaped gazelle	
The Target moves only to the left and right.	
The Danger	
Your player LOSES points when they hit the danger.	
The Danger is aZookeeper	
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	Pyret Code
5 x 10	5 10	5 * 10
8 + (5 × 10)	8	8 + (5 * 10)
(8 + 2) - (5 x 10)	- 8 2 5 10	(8+2) - (5 * 10)
<u>5 x 10</u> 8 - 2	* 5 10 8 2	(5 * 10) / (8 - 2)

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

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

Fas	t Functions			
#	gt	. Number	-> Image	
	name	domain	range	
exa	mples:			
_	gt (7	$_{}$) is $_{}$ triangle((7, "solid", "green")	
_	gt (500) istriangle(500, "solid", "green")	
end				
fun	gt(_size	_):triangle(size, "s	olid", "green")	end
	· · ·	,	-	
#_	bc	: Number	->Image	_
	name	domain	range	
exa	amples:			
_	gt (<u>19</u>) iscircle(1	9, "solid", "blue")	
_	gt (<u>43</u>) iscircle(4	3, "solid", "blue")	
end	d			
fur	າ bc (size):circle(_size, "sol	lid", "blue")	end
	,			
#_	dot	: String	->Image	_
	name	domain	range	
exa	amples:			
_	dot("blue") iscircle(2	0, "solid", "blue")	
_	dot ("red) iscircle(2	0, "solid", "red")	
end	d			
fur	_):	d". color)	end

Fast	Hiin	CTIOI	า c
IUSL	I GII	CLIVI	2

g : Number -> Number

name domain range

examples:

end

fun <u>g (q</u>): <u>20*q</u> end

_____ h : ____ Number ___ -> ____ Number ____ range

examples:

 $\frac{h}{H}$ ($\frac{10}{15}$) is $\frac{10/2}{15/2}$

end

fun h(x): x/2 end

______ -> _____ range

examples:

end

fun _____(___): _____ end

·		

Word Problem: 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.

π	Domain	>
name	Domain	Range
<i>‡</i>	What does the function do?	
	What does the function do?	
. Give Examples		
n the computer, write	an example of your function in action,	using EXAMPLE.
/=\/AND\ = /		`
(EXAMPLE (the user types)
	the user types	
	which should become)
	wnich should become	
(EXAMPLE ()
(the user types	,
		1
	which should become	
II. Definition		
Write the definiti	on, giving variable names to all your in	put values.
		•
(define ()
(name variable names	

Word Problem: red-square

Use the Design Recipe to write a function <u>red-square</u>, which takes in a number (the size of the square) and outputs a solid red rectangle whose length and width are the same size.

;		>
Name	Domain	Range
	What does the function do?	
Give Examples		
the computer, write an ex	ample of your function in action, us	sing EXAMPLE
KAMPLE()
the	user says	
)
	Racket replies	·
KAMPLE(user says)
the	user says	
)
	Racket turns that into	
Definition		
Write the definition, give	ving variable names to all your inpu	t values.
efine ()
eillet		

Word Problem: 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 !)

I. Contract+l	Purpose Statement	
Every contract has	s three parts:	
name	:>	Dange
name	Domain	Range
:		
,	What does the function do?	
II. Civo Evor	nloc	
II. Give Exam On the computer.	write an example of your function in action, using	FXAMPLF.
	white an example of your function in decion, doing	270 11 11 221
(EXAMPLE(_)
	Use the function here	•
		1
	find another way to get the same result her)
	initia another way to get the same result her	
(EXAMPLE(_)
	Use the function here	
		1
	find another way to get the same result her	/ ·e
III. Definition	efinition, giving variable names to all your input va	duec
write the de	ennition, giving variable names to all your input va	ilues.
(define ()
	nction name variable names	_'
		1
	and the computer does this	
	and the computer does tills	

DESIGN RECIPE

Word Problem: 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.

::		->
name	Domain	Range
	What does the function do?	
Give Examples		
	ample of your function in action, ເ	ısing EXAMPLE.
XAMPLE()
Use	e the function here	/
)
	find another way to get the same res	ult here
EXAMPLE()
Use	e the function here	
)
	find another way to get the same res	ult here
. Definition	ving variable names to all your inp	
		ut values.
	variable names)
define (,

Word Problem: update-target

Write a function $\underline{update-target}$, which takes in the target's x-coordinate and produces the next x-coordinate, which is 50 pixels to the right.

;::		->
name	Domain	Range
•		
·	What does the function do?	
II. Give Examples		
On the computer, write an exam	nple of your function in action, u	ising EXAMPLE.
(EXAMPLE ()
Use th	e function here	
	find another way to get the same resu	Ut hara
	Tind another way to get the same rest	лспеге
(EXAMPLE()
(EXAMPLE (Use th	e function here	
)
	find another way to get the same resu	ult here
III. Definition	g variable names to all your inp	ut values
	-	ut values.
(define (variable names)

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

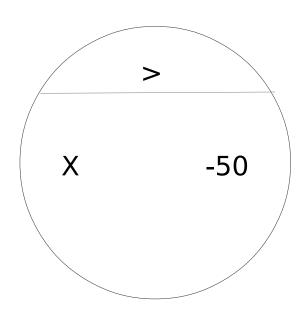
1. A piece of Sam is still visible on the left as long as...

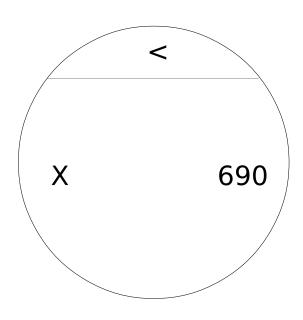
x > -50

2. A piece of Sam is still visible on the right as long as...

x < 690

3. Draw the Circle of Evaluation for these two expressions in the circles below:





Word Problem: safe-left?

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.

		->
name .	Domain	Range
	What does the function do?	
Give Examples		
n the computer, write an exa	mple of your function in action, u	ising EXAMPLE.
EXAMPLE()
Use	the function here	
)
	find another way to get the same resu	ult here
- V		,
EXAMPLE (the function here)
		\
	find another way to get the same resu	<i>)</i> ult here
I. Definition		
Write the definition, givi	ng variable names to all your inp	ut values.
dofina /		1
define (variable names)
function name	variable flames	

Word Problem: safe-right?

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

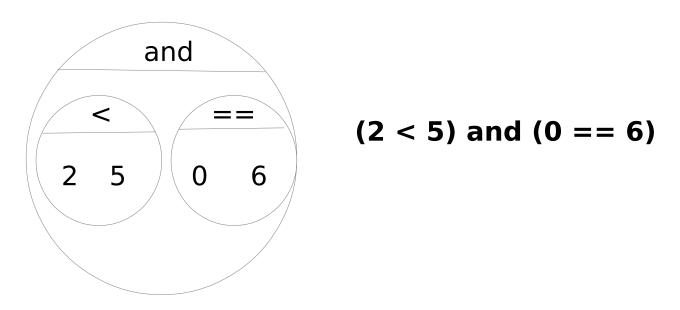
I. Contract+Purpo	se Statement	
Every contract has three	parts:	
		->
name •	Domain	Range
		-
· /		
	What does the function do?	
II. Give Examples		
On the computer, write a	an example of your function in action	n, using EXAMPLE.
(EXAMPLE()
(=/ 0 == (Use the function here	,
		,
	find another way to get the same	result here
(EXAMPLE(1
(EXAMPLE(Use the function here)
	End another way to get the ages)
	find another way to get the same	result here
III. Definition		innut value
write the definitio	n, giving variable names to all your	input values.
(define ()
function n	ame variable names	/
)
		······································

...and the computer does this

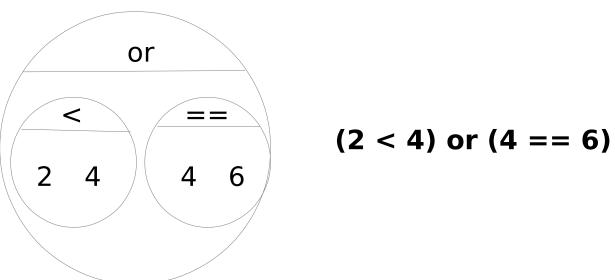
and / or

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

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?

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

;::		->
name	Domain	Range
/		
W	hat does the function do?	
II. Give Examples	o of your function in action	Ising EVAMPLE
On the computer, write an exampl		
(EXAMPLE ()
Use the fi	unction here	
	nd another way to get the same res)
	id another way to get the same res	uit nere
(EXAMPLE()
Use the fu	unction here	/
)
fir	nd another way to get the same res	ult here
III. Definition		
Write the definition, giving v	variable names to all your inp	out values.
(define ()
function name	variable names	/

DESIGN RECIPE

Word Problem: 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.

I. Contract-	+Purpose Stateme	nt	
			_
name	•	Domain	Range
II. Give Exar	nples		
On the computer	, write an example o	of your function for	each topping, using EXAMPLE.
(EXAMPLE (co	St "pe	epperoni") _	What should the function produce?
(EXAMPLE(Use the function here)	What should the function produce?
(EXAMPLE(Use the function here)	What should the function produce?
(EXAMPLE(Use the function here)) What should the function produce?
III. Definition	1		
(define (unction name	variable	names)

Word Problem: 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.

I. Contract-	+Purpose Stateme	ent		
				->
name	_ •		Domain	Range
II. Give Exar	mples			
Finish the two ex	amples we've starte	d for yo	u, and make	two more
(EXAMPLE(<u>up</u>	odate-player	128	<u>"up"</u>)	
	Use the function here	9		What should the function produce?
(EXAMPLE(<u>u</u> p	odate-player)	451	"down")	
	Use the function here	9		What should the function produce?
(EXAMPLE(Use the function here	2)) What should the function produce?
(EXAMPLE(Use the function here	5)) What should the function produce?
III. Definition	1			
(define (<u> </u>	unction name		variable na)
l	unction name		variable na	ines

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.

I. Contract+Purpose Statem	ent		
Every contract has three parts:			
			->
name •]	Domain	Range
II. Give Examples			
m Give Examples			
(EXAMPLE (line-length 10	5)	<u>(- 10 </u>
Use the function he	re		What should the function produce?
(EXAMPLE (line-length 2	8)	<u>(- 8 </u>
<u> </u>			
Use the function he	re		What should the function produce?
III. Definition Write the definition, giving va	riahle nan	nes to all v	our input values
Write the definition, giving va	mable nam	ics to an y	our impac values.
(define ()
function name		variable n	ames
)			

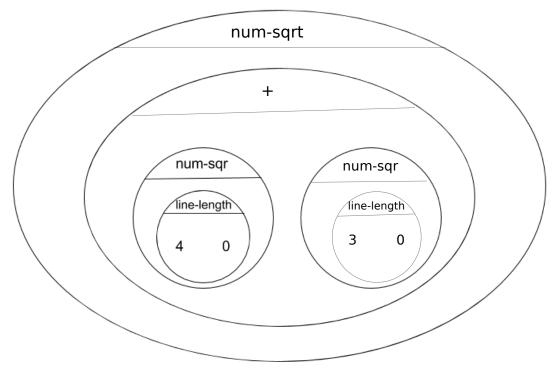
...and the computer does this

The Distance Formula (an example)

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

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

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



Convert the Circle of Evaluation into Pyret code:

num-sqr(line-length(4, 0)) + (num-sqr(line-length(3, 0)))

Write a function <u>distance</u>, which takes FOUR inputs:

(define (

function name

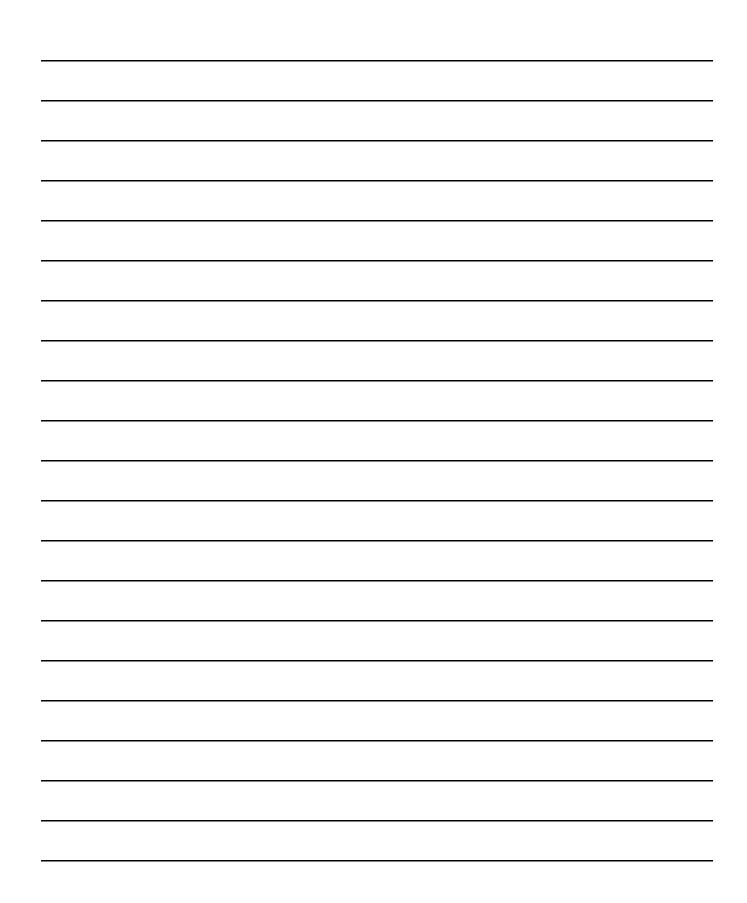
□ py: The y-cool □ cx: The x-cool	rdinate of the player rdinate of the player rdinate of another game charact rdinate of another game charact		
It should return the owner what you did on pag	distance between the two, using e 27!)	the Distance formu	ıla. (HINT: look at
I. Contract+Pu	rpose Statement		
;	:	>	
name	Domain		Range
;			
	What does the function	do?	
II. Give Exampl	es		
(EXAMPLE()	
, ,	Use the function here	,	
)
	find another way to get	the same result here	
(EXAMPLE()	
	Use the function here		
)
	find another way to get	the same result here	
III. Definition			

variable names

Write a function collide?,which takes FOUR inputs:

□ px: The □ py: The □ cx: The □ cy: The □ t should	x-coordinate of the py-coordinate of the px-coordinate of anothy-coordinate of anoth true if the coates of the other cha	player her game character her game character bordinates of the player are w hracter. Otherwise, false.	vithin 50 pixels of the	
I. Contrac	ct+Purpose Statem	nent		
name	:	 Domain	Range	
,	Wh	at does the function do?		
II. Give Ex	amples			
(EXAMPLE(Use the fu	nction here)	
_	finc	d another way to get the same resul	lt here	
(EXAMPLE(Use the fu	nction here)	
_		d another way to get the same resul) It here	
III. Definiti	on			
(define (_	function name	variable names)	
)	

Catchy Intro: Feel like you never get enough to eat? So does Leo. Come catch your prey,
and escape the zookeeper!
Name, Age, Grade: Elliee Programmer, 12, 7 th grade
Game Title: Run for your Supper
Back Story:One day, a young lion was sitting in his cage. He saw an escaped gazelle come
running past. It was lunch time, and he was hungry, so he leapt out to catch food. He has
to run fast to grab food and escape the evil zookeeper.
Characters: Player: Leo the lion.
Danger: Zoe Zookeeper.
Target: Gary Gazelle
Explain a piece of your code: My update-danger function takes in the current x coordinate of the gazelle, and adds 50 to it. This moves the gazelle 50 pixels to the right.



Presentation Feedback

For each question, circle the answer that 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!

Presentation Feedback

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Did they make eye contact? No way! A little. Definitely!

Word Problem: 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

I. Contract+Purpose State	ement	
•		
name	Domain	> Range
·	What does the function of	do?
II. Give Examples		
Write some examples of red-shap	e below. The first one	e has already been done for you.
(EXAMPLE <u>(red-shape</u> "red"))	"circle") (circle 50 "solid"
Use the function	here	What should the function produce?
(EXAMPLE (here)	What should the function produce?
(EXAMPLE (here)) What should the function produce?
(EXAMPLE (here) What should the function produce?
III. Definition		
(define (variable	e names
	(cir	rcle 50 "solid" "red")

Translating into Algebra

Value Definitions

Pyret Code	Algebra
x = 10	x = 10
y = x * 2	y = x*2
z = x / y	$z = x \div y$
w = num - sqrt(num - sqr(x) + 1)	$\mathbf{w} = \sqrt{x^2 + 1}$
days = (age * 12) * 30	days = (age * 12) * 30
y = (v * x) + x0	$y = (v * x) + x_0$
y = ((0.5 * a) * num-sqr(x)) + y0	$y = (0.5 * a) * x^2 + y_0$

Function Definitions

Pyret Code	Algebra
fun area(length, width): length * width end	area(length, width) = length * width
<pre>fun circle-area(radius): pi * num-sqr(radius) end</pre>	circle-area(radius) = pi * radius²
<pre>fun distance(x1, y1, x2, y2): num-sqrt(num-sqr(x1 - x2) + num-sqr(y1 - y2)) end</pre>	distance(x1, y1, x2, y2)= $\sqrt{(x1-x2)^2+(y1-y2)^2}$

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

	D	:	Number	->	Number	
	name		Domain	_	Range	
# (Given a nu	mbe	r of seconds, produces the heig	ght o	of a rocket	moving a
	80mi/s		What does the function do?			
II.	Give Exam	ples				
Write	an example	of you	r function for <u>some sample inputs</u>			
	D(1)	is	80 * 1			
Use the	function here		What should the function produce?			
		_				
	D(2)	is	80 * 2			
Use the	e function here		What should the function produce?			
	D(14)	is	80 * 14			
Use the	e function here		What should the function produce?			
	D(100)	:-	90 * 100			
lica the	e function here	is	80 * 100 What should the function produce?			
ose the	e fullction here		What should the function produce:			
III.	Definition					
Write	the function,	givin	g variable names to all your input valu	ues.		
_	D / ••	,				
tun	D(time	: (:	80 * time			
end						

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>.

time		Number	->	Number
name Given the di	— — stance	Domain traveled, produce the time trave	led if mov	Range /ing at 80mi/
# Given the di		What does the function do?		
II. Give Exam		function for some some in such		
write an example	or your	function for <u>some sample inputs</u>		
time(0)	is	0 / 80		
Use the function here		What should the function produce?	?	
time(10)	is	10 / 80		
Use the function here		What should the function produce?	?	
time(200)	is	200 / 80		
Use the function here		What should the function produce?	?	
time(560)	is	560 / 80		
Use the function here		What should the function produce?	?	
B. C'				
III. Definition	aivina	variable names to all your input va	ابیمد	
write the function	i, givilig	variable flames to all your input va	iues.	
fun time	(dis	stance): distance	/ 80	
end	,		, 00	
CIIU				

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?

I. Contract+ Every contract has		se Statement			
-	-			Necesia	
collide	: _	Number	>	Number	_
name		Domain		Range	
#Given the distance	e betw	een a rocket (moving at 80mi/sec) & aste	eroid (70	Omi/sec), when	will they
collide?		What does the function do?			
II. Give Exam	ples				
		r function for <u>some sample inputs</u>			
collide(0)	is	0 / 150			
Use the function here		What should the function produce?			
collide(2000)	is	2000 / 150			
Use the function here		What should the function produce?			
collide(5000)	is	5000 / 150			
Use the function here		What should the function produce?			
collide(15000)	is	15000 / 150			
Use the function here		What should the function produce?			
III. Definition					
	, giving	y variable names to all your input valu	es.		
fun collide end	(di	istance): distance /	150	0	

I. Contract+I Every contract has			
,			
	:	->	>
name		Domain	Range
#			
		What does the function do?	
II. Give Exam	ples		
Write an example	of your fu	nction for <u>some sample inputs</u>	
	is		
Use the function here		What should the function produce?	
	<u>is</u>		
Use the function here		What should the function produce?	
	io		
Use the function here	is	What should the function produce?	
ose the function here		what should the function produce:	
	is		
Use the function here		What should the function produce?	
III. Definition			
	giving va	riable names to all your input values.	
fun	1	١.	
fun	():	
end			