Name: _____



BOOTSTRAP: 2

www.bootstrapworld.org

Class:



Workbook v0.9

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| | Racket Code | Pyret Code |
|---------|----------------------------------|---------------------------|
| | (define AGE 14) | AGE = 14 |
| | (define A-NUMBER 0.6) | A-NUMBER = 0.6 |
| 8 | (define SPEED -90) | SPEED = -90 |
| Numbers | | Two of your own: |
| | | |
| | | |
| | | |
| | (define CLASS "Bootstrap") | CLASS = "Bootstrap" |
| | (define PHRASE "Coding is fun!") | PHRASE = "Coding is fun!" |
| | (define A-STRING "2500") | A-STRING = "2500" |
| ığs | | Two of your own: |
| Strings | | |
| | | |
| | | |
| | | |
| | | |

```
(define SHAPE
                                         SHAPE =
      (triangle 40 "outline" "red"))
                                           triangle(40, "outline", "red")
    (define OUTLINE
                                         OUTLINE =
                                           star(80, "solid", "green")
      (star 80 "solid" "green"))
    (define SQUARE
                                         SQUARE =
      (rectangle 50 50 "solid" "blue"))
                                           rectangle(50, 50, "solid", "blue")
                                                    One of your own:
                                         BOOL = true
    (define BOOL true)
Booleans
    (define BOOL2 false)
                                                    One of your own:
    ; double : Number -> Number
                                         # double : Number -> Number
    ; Given a number, multiply by
                                         # Given a number, multiply by
    ; 2 to double it
                                         # 2 to double it
    (EXAMPLE (double 5) (* 2 5)
                                         examples:
Functions
    (EXAMPLE (double 7) (* 2 7))
                                              double(5) is 2 * 5
                                              double(7) is 2 * 7
    (define (double n) (* 2 n))
                                         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 range

examples:
 double (5) is 2 * 5

 double (7) is 2 * 7

end

fun double (n):

2 * n

end

_______ -> _____ name domain range

examples:

end

fun _____(____);

end

| _ | | | | ı |
|------|-----|------|-----|---|
| Fast | ınc | `TIC | าทร | ı |

| F*11 | 1 11 | | 1 6 11 | | | | | 1 6 11 | 10 |
|--------|---------|--------------|----------------|-----------|--------------|-------------|---------|--------------|-------------|
| FIII (| out the | contract for | each function, | . then tr | y to write t | wo examples | and the | definition b | y yourselt. |

| #name | : | domain | > | range | - |
|-----------|----------|----------|------|--------|---|
| examples: | | | | | |
| | (|) is | | | |
| | (|) is | | | |
| end | | | | | |
| fun | (| |): | | |
| | | | | | |
| end | | | | | |
| # | :_ | domain | -> _ | range | _ |
| | | donium | | Turise | |
| examples: | , | \ | | | |
| | (| · | | | |
| | (|) is | | | |
| end | | | | | |
| fun | (| |): | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Fast | Hι | JN | CI | O | nsi |
|------|----|----|----|---|-----|

| Fill out the contract for each function, then try to write two examples and the definition by yourse | Fill | out the | contract | for each | function, | then | try to | write t | wo exc | amples | and t | he d | efinition | by y | yourse | lf. |
|--|------|---------|----------|----------|-----------|------|--------|---------|--------|--------|-------|------|-----------|------|--------|-----|
|--|------|---------|----------|----------|-----------|------|--------|---------|--------|--------|-------|------|-----------|------|--------|-----|

| # | : | | -> | | |
|-----------|---|--------|------|-------|---|
| name | | domain | | range | _ |
| examples: | | | | | |
| | (|) is | | | |
| | (|) is | | | |
| end | | | | | |
| un | (| |): | | |
| | | | | | |
| - | | | | | |
| end | | | | | |
| name | ; | domain | -> _ | range | _ |
| examples: | | | | | |
| | (|) is | | | |
| | (|) is | | | |
| nd | | | | | |
| un | (| |): | | |
| | | | | | |
| | | | | | |
| end | | | | | |

| | Bug Hunting: Py | ret Edition |
|----|--|-------------|
| #1 | SECONDS = (7) | |
| | STRING = my string | |
| #2 | SHAPE1 = circle(50 "solid" "blue") | |
| "" | SHAPE2 = triangle(75, outline, yellow) | |
| #3 | <pre># triple : Number -> Number # Multiply a given number by # 3 to triple it examples: triple(5) = 3 * 5 triple(7) = 3 * 7 end</pre> | |
| #4 | <pre>fun triple(n): 3 * n</pre> | |
| #5 | <pre># 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</pre> | |

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.

| Contrac | t+Purpose Statement | | | |
|------------|------------------------------|-------------------------------|----------------|-----------------|
| | ontract has three parts: | | | |
| # | : | | _ | > |
| | ame | Domain | | Range |
| # | | | | |
| " | Wh | nat does the function do | ? | |
| Give Exa | mples | | | |
| | amples of your function in a | action | | |
| exam | ples: | | | |
| _ | (|) | is | |
| | the user types | , | | |
| | | | | |
| _ | which sh | nould become | | |
| | , | , | | |
| - | (the user types |) | is | |
| | | | | |
| _ | | vhich should become | | |
| end | •••• | | | |
| Function | | | | |
| Circle the | e changes in the examples, a | | | |
| Write the | code, copying everything the | at isn't circled, and using n | ames 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.

| | ose Statement has three parts: | | | |
|---------------|---|-------------------------------|----------------|-----------------|
| | : | | - | -> |
| name | | Domain | | Range |
| | | | | |
| | Wh | at does the function do | ? | |
| e Examples | | | | |
| e example: | s of your function in c | action | | |
| xample | S: | | | |
| | (|) | is | |
| | the user types | | | |
| | | | | |
| | which sho | ould become | | |
| | | | | |
| | ((the user types |) | is | |
| , | the user types | | | |
| | | | | |
| nd | W | hich should become | | |
| .10. | | | | |
| nction | actin the eventual of | ad name the variables | | |
| ite the code, | ges in the examples, ar copying everything tho | at isn't circled, and using n | ames where you | find variables! |
| un | 1 | | ١. | |
| uii | | | _) : | |
| | | | | |
| | | | | |
| nd | | | | |

Word Problem: next-position

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

| | Purpose Statement | | | |
|-------------------------|---------------------------------------|-------------------------------|----------------|-----------------|
| ery contr | act has three parts: | | | |
| : | • | | _ | > |
| name | · · · · · · · · · · · · · · · · · · · | Domain | | Range |
| | | | | |
| | | hat does the function do | ? | |
| | | | | |
| ive Exampl | es ples of your function in (| action | | |
| ille exam | pies of your fortenor in t | action | | |
| exampl | Les: | | | |
| | (|) | is | |
| | the user types | | | |
| | | | | |
| | which sh | nould become | | |
| | | | | |
| | |) | is | |
| | the user types | | | |
| | | | | |
| | ۷ | which should become | | |
| end | | | | |
| | | | | |
| unction ircle the ch | nanges in the examples, a | nd name the variables | | |
| | | at isn't circled, and using n | ames where you | find variables! |
| īun | | (| ١. | |
| .un | | | _) : | |
| | | | | |
| | | | | |
| -nd | | | | |

Data Structure

| # a Cake is | a flavor, | color, | message, | layers, | & is-i | ceCream |
|---------------------------|----------------|-------------|-----------|---------|--------|---------|
| data Cake: | | | | | | |
| cake(| | | | | | |
| _ | | | | | | |
| _ | | | | | | |
| _ | | | | | | |
| _ | | | | | |) |
| end | | | | | | |
| | | | | | | |
| To make exam _l | oles of this s | tructure, I | would wri | te: | | |
| cake1 = | | | | | | _ |
| | | | | | | |
| cake2 = | | | | | | _ |
| | | | | | | |
| To access the f | elds of cake | e2, I woul | d write: | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Data Structure

| # a Party i | s a location, theme, and number of guests | |
|---------------|---|---|
| data Party: | | |
| par | cty (| |
| | | |
| | |) |
| end | | |
| To make exar | mples of this structure, I would write: | |
| party1 = | | |
| party2 = | | |
| To access the | e fields of party2, I would write: | |
| | | |
| | | |
| | | |
| | _ | |

Word Problem: change-flavor
Write a function called *change-flavor*, which takes in a Cake and a flavor, and returns a new Cake that is almost the same as the original, but is now the given flavor.

| Contract+Purpose S | Statement | | | |
|--------------------|-----------|---|-----|----|
| # | : | | | -> |
| # | | | | |
| Give Examples | | | | |
| examples: | | | | |
| | (|) | is | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | (|) | is | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| a = d | | | | |
| end Function | | | | |
| fun | (| |) • | |
| Luii | | | , . | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| end | | | | |

Word Problem: will-melt

Write a function called will-melt, which takes in a Cake and a temperature, and returns true if the temperature is greater than 32 degrees, AND the Cake is an ice cream cake.

| Contro | act+Purpose Statement | | | | |
|---------|-----------------------|---|----|----|--|
| # | · | | | -> | |
| # | | | | | |
| Give Ex | kamples ples: | | | | |
| Czam | (|) | is | | |
| | |) | is | | |
| end | | | | | |
| functio | | |): | | |
| end | | | | | |

Word Problem: keypress (Ninja World)

State the Problem

For each keypress in Ninja World, show how (keypress <world > <key>) should change the world.

- # Given a world and a key, produce a new world with NinjaCat's position
- # moved by 10 pixels, depending on which arrow key was pressed

Give Examples

```
examples:
```

keypress(worldA, "up") is

world(worldA.dogX, worldA.coinX, worldA.catX, worldA.catY + 10)

keypress(worldB, "down") is

world(worldB.dogX, worldB.coinX, worldB.catX, worldB.catY - 10)

keypress(worldA, "left") is

world(worldA.dogX, worldA.coinX, worldA.catX - 10, worldA.catY)

keypress(worldB, "right") is

world(worldB.dogX, worldB.coinX, worldB.catX + 10, worldB.catY)

end

Function

```
fun keypress(current-world, key):
     ask:
      | string-equal(key, "up") then:
            world(current-world.dogX, current-world.coinX,
                  current-world.catX, current-world.catY + 10)
      | string-equal(key, "down") then:
            world(current-world.dogX, current-world.coinX,
                  current-world.catX, current-world.catY + 10)
      | string-equal(key, "left") then:
            world(current-world.dogX, current-world.coinX,
                   current-world.catY - 10, current-world.catY)
      | string-equal(key, "right") then:
            world(current-world.dogX, current-world.coinX,
                   current-world.catX + 10, current-world.catY)
      otherwise: current-world
     end
end
```

Word Problem: next-world (Ninja World)

Given a world, return the next world by adding 10 to dogX, subtracting 5 from coinX, and subtracting 5 from catY *only* when the cat's y-coordinate is greater than 75.

| Contract+Purpose | Statement | | | |
|-------------------------|-----------|---|----|--------------|
| # | : | | | > |
| # | | | | |
| Give Examples examples: | | | | |
| | (|) | is | |
| | | | | _ |
| | | | | - |
| | | | | - - |
| | (|) | is | |
| | | | | - - |
| | | | | - |
| | | | | - |

end

| |): | |
|------|-------------|----|
| sk: | | |
| 1 | the | n: |
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| 1 01 | therwise: | |
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| | | |
| enc | d | |
| end | a | |
| | | |

Word Problem: red-shape

Write a function red-shape, which takes in the name of a shape (such as "circle", "triangle", "star", or "rectangle"), and draws that solid, red shape. Use 50 as the radius of the circle and star, and side-length of the triangle. Make the rectangle 99 pixels long by 9 wide. Give Examples examples: is _____ is _____) is _____) is _____ end **Function** fun ____(___): ask:

end

end

Word Problem: strong-password

Websites have strict password requirements. Write a function strong-password, which takes in a username and password, and checks to make sure they aren't the same, and then checks the string-length of the password to make sure it is greater than 8 characters. The function should return a message to the user letting them know if their password is strong enough.

| # | | | : -> | |
|-------|------------------|---|------------|-------|
| # | | | | |
| | | | | |
| | Example mples | | | |
| | | | () is | 3 |
| | | | | 3 |
| | | | | 3 |
| end | | _ | | |
| Funct | ion | | | |
| fun | | | | |
| | ask: | I | | then: |
| | | I | | then: |
| | | ı | otherwise: | |
| end | end | | | |

Building Your Helper Functions

| # is-off-right | <u></u> : | > | |
|----------------|------------|----------|--|
| examples: | | | |
| | (|) is | |
| | | | |
| | (|) is | |
| | | | |
| end | , | \ | |
| fun | (|): | |
| end | | | |
| #_is-off-left | _ : | > | |
| examples: | | | |
| | (|) is | |
| | | | |
| | (|) is | |
| | | | |
| end | | | |
| fun | (|): | |
| | | | |
| end | | | |

| # | ;; | > | |
|-----------|----|------|--|
| examples: | | | |
| | (|) is | |
| | | | |
| | (|) is | |
| | | | |
| end | | | |
| fun | (|): | |
| | | | |
| end | | | |
| ,, | | | |
| # | :: | > | |
| examples: | | | |
| | (|) is | |
| | | | |
| | (|) is | |
| end | | | |
| fun | (|): | |
| | | J• | |
| end | | | |

Word Problem: line-length

Write a function called *line-length*, which takes in two numbers and returns the difference between them. It should always subtract the smaller number from the bigger one.

| Contrac | ct+Purpose Statement | | | | |
|------------|----------------------|------------|-------|---|---|
| # | · | | | > | _ |
| # | | | | | |
| | | | | | |
| Give Exc | amples | | | | |
| | ples: | | | | |
| _ | (|) | is | | |
| _ | |) | is | | |
| _ | | | | | |
| end | | | | | |
| Function | ı Header | | | | |
| TOTICIIOI | THEAGE | | | | |
| fun | | (|): | | |
| | function name | variable r | names | | |
| _ | : | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | _ |
| | | | | | _ |
| | | | | | |
| | | | | | |
| | | | | | |
| ϵ | end | | | | _ |
| end | | | | | |

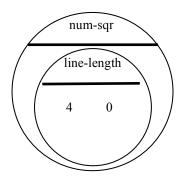
Distance:

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:

$$\sqrt{\left(line-length~~4~~0~\right)^{~2}~+~\left(line-length~~2~~5~\right)^{~2}}$$

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 playerpy: The y-coordinate of the playercx: The x-coordinate of another game charactercy: The y-coordinate of another game character |
|----------|---|
| It shoul | ld return the distance between the two, using the Distance formula: |
| | Distance ² = $(line-length px cx)^2 + (line-length py cy)^2)$ |
| Contro | act+Purpose Statement |
| # | > |
| # | |
| | camples |
| | examples of your function in action |
| exar | mples: () is |
| | () is |
| end | |
| Functio | n |
| fun | (): |
| | |
| end | |

Word Problem: is-collision Write a function is-collision, which takes FOUR inputs:

 $f \square$ px: The x-coordinate of the player

| | y: The y-coordinate of the player x: The x-coordinate of another game character y: The y-coordinate of another game character should return true if the coordinates of the player are within 50 pixels of the oordinates of the other character. Otherwise, false. | |
|----------|---|--|
| Contra | t+Purpose Statement | |
| # | > | |
| # | | |
| π | | |
| | mples | |
| Write ex | amples of your function in action | |
| exan | ples: | |
| - | () is | |
| | | |
| - | | |
| - | | |
| | | |
| - | () is | |
| | | |
| - | | |
| - | | |
| end | | |
| Function | | |
| fun | | |
| Lull | (): | |
| | | |
| | | |
| end | | |

GAME DESIGN "Start Simple, Get Complex"

| Draw a rough sketch of your game | e when it begins, ar | nd another sketch just a moment later | |
|--|----------------------|--|------------------------|
| | | | |
| A sketch at the START of the game | e | A sketch for the very NEXT moment | |
| What images will you need for you BACKGROUND | ur game? Name th | em in the 1st column, and describe them | in the 2 nd |
| | | | |
| | | | |
| | | | |
| | | | |
| List everything that has changed f | rom one sketch to t | the other. What datatype will represent it | Ś |
| Changed (position, score, col | or, costume) | Datatype (Number, String, Image, Boo | lean) |
| | | | |
| | | | |
| | | | |
| | | | |

Data Structures

| # a world | is a | |
|--------------------|--|-----|
| data World | | |
| world | L (| |
| | | |
| | | _ |
| | | |
| | |) |
| end | | |
| | | |
| To make examp | le worlds that represent my sketches from page 31, | . 1 |
| would write | | |
| worldA = | | , |
| worldB = | | |
| | | |
| To access the fiel | ds of worldA, I would write: | |
| - | | |
| - | | |
| - | | |
| - | | |
| - | | |

Word Problem: draw-world (My game)

Contract

| # | : | | > | |
|------------|----------|------|---|----|
| | | | | |
| fun | (| | |): |
| put-image(| | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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| | | | | |
| | | | | |

end

Word Problem: next-world (My game)

State the problem (What changes?):

| Contra | ct+Purpose S | tatement | | | |
|---------|--------------|----------|--------|-----------|--|
| # | | | | -> | |
| # | | | | | |
| Give Ex | amples | | | | |
| examp | | , | ` | | |
| | | (| _) | is | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | (| _) | is | |
| | | | | | |
| | - | | | | |
| | | | | | |
| | | | | | |
| | - | | | <u></u> . | |
| end | | | | | |
| Functio | n | | | | |
| fun _ | | (|): | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| end | | | | | |

Lesson 9

| When this key is pressed | this field of the new world | changes by |
|--------------------------|-----------------------------|------------|
| | | |
| | | |
| | | |
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| | | |

| Word Problem: keypress | (My game |
|------------------------|----------|
|------------------------|----------|

| For ec | | n your game, | show how key | press(worl | dA, <key>) sho</key> | uld change your |
|--------|-----------------------|--------------|--------------|------------|----------------------|-----------------|
| # | | • | | | -> | |
| | | | | | | |
| # | | | | | | |
| | | | | | | |
| | xamples | | | | | |
| exam | mples: .kovpross(w | orld A | ` | i | | |
| | keypress(w | ortua, |) | is | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | keypress(v | vorldA, |) | is | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | kevnress(w | /orldA, |) | is | | |
| | (1) | | / | 10 | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| 1 | | | | | | |
| end | | | | | | |

| fun | (|) |
|------------|---|-------|
| ask: | | then: |
| | | |
| end end | | |

Building Your Helper Functions

| # is-off-right | :> |
|----------------|-------|
| examples: | |
| | () is |
| | |
| | () is |
| | |
| end | |
| fun | (): |
| | |
| end | |
| | |
| # is-off-left | ·> |
| examples: | |
| | () is |
| | |
| | () is |
| | |
| end | |
| fun | (): |
| | |
| end | |

| # | : | > | |
|-----------|---|------|--|
| examples: | | | |
| | (|) is | |
| _ | (|) is | |
| | | | |
| end | | | |
| fun | (|): | |
| end | | | |
| # | : | -> | |
| examples: | | | |
| | (|) is | |
| | (|) is | |
| end | | | |
| fun | (|): | |
| end | | | |

Using Helpers inside next-world:

How does the World structure change when...?

| TEST | | RESULT | |
|------|---------|----------|---|
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | <u> </u> |) |
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | · |) |
| | vvonld(| | |
| | world(_ | | |
| | | | |
| | | | |
| | | |) |
| | | | |
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | |) |

| TEST | | RESULT | |
|------|---------|--------|---|
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | |) |
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | |) |
| | world(_ | | |
| | | | |
| | | | |
| | | | |
| | | |) |
| | world(_ | | |
| | | | |
| | | | • |
| | | | |
| | | |) |
| | | | , |

Using Helpers inside draw-world:

What changes the appearance of your game?

| TEST | RESULT |
|------|------------|
| | put-image(|
| | |
| | put-image(|
| | |
| | put-image(|
| | |
| | put-image(|
| | |

| TEST | RESULT |
|------|------------|
| | put-image(|
| | |
| | put-image(|
| | |
| | put-image(|
| | |

Lesson 10

Supplemental

DESIGN RECIPE

| Contract+Purpo | | | | | |
|---------------------------------------|-------------------------|-----------------------|------------|-------|--|
| very contract h | as three parts: | | | | |
| <i>t</i> | • | | | -> | |
| name | · | | nain | Range | |
| , | | | | J | |
| <u></u> | | | | | |
| | wnai | t does the function | on do? | | |
| Sive Examples | | 1. | | | |
| √rite examples o | of your function in ac | tion | | | |
| examples | • | | | | |
| , , , , , , , , , , , , , , , , , , , | (|) | is | | |
| | the user types | / | 10 | | |
| | | | | | |
| - | which shou | Id hecome | | | |
| | willen shou | ta become | | | |
| | (|) | is | | |
| the | e user types | / | 10 | | |
| | | | | | |
| - | whi | ch should becom | | | |
| end | ٧٧111 | cii siloutu becoiii | C | | |
| <i>7</i> 11 01 | | | | | |
| unction | | a a a a a bla a a a a | vi adala a | | |
| ircie ine change | es in the examples, and | name me va | nables. | | |
| fun | (| |): | | |
| | | | | | |
| | | | | | |
| | | | | | |
| end | | | | | |

DESIGN RECIPE

| | pose Statement | | | | |
|---------------------------------------|---------------------------|----------------------|----------|-------|--|
| very contrac | ct has three parts: | | | | |
| <u> </u> | • | | | -> | |
| r name | : | | nain | Range | |
| , | | | | J | |
| <u></u> | | | | | |
| | wna | at does the function | on do? | | |
| Sive Examples | | | | | |
| √rite example | es of your function in a | ction | | | |
| example | es: | | | | |
| , , , , , , , , , , , , , , , , , , , | (|) | is | | |
| | the user types | / | _~ | | |
| | | | | | |
| | which show | | | | |
| | willen snot | ata become | | | |
| | (|) | is | | |
| - | the user types | / | | | |
| | | | | | |
| | | ich should becom | | | |
| end | | icii siioata becom | | | |
| | | | | | |
| unction | nges in the examples, and | d name the va | righles | | |
| ilcie ille cilai | iges in the examples, and | andine me vai | iidbies. | | |
| īun | (_ | |): | | |
| | | | | | |
| | | | | | |
| _ | | | | | |
| end | | | | | |

Contracts

| example | | | | | | | | | | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----------|
| Range | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | ^ |
| Domain | | | | | | | | | | | | | | | | | | |
| Name | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # | # |

Contracts

| Name | Domain | Range | example |
|------|--------|----------|---------|
| # | | • | |
| # | • | • | |
| # | • | • | |
| # | | → | |
| # | | • | |
| # | | → | |
| # | | → | |
| # | | → | |
| # | | ^ | |
| # | | → | |
| # | : | → | |
| | | | |