Contracts

| Name | Domain | Range | example |
|------|--------|----------|---------|
| • | : | ^ | |
| : | : | ↑ | |
| • | : | ↑ | |
| • | : | ↑ | |
| •• | : | ↑ | |
| • | : | ↑ | |
| ; | : | ↑ | |
| • | : | ↑ | |
| • | : | ↑ | |
| ; | : | ↑ | |
| ; | : | ↑ | |
| •• | : | ↑ | |
| •• | : | ^ | |
| •• | : | ↑ | |
| •• | : | ↑ | |
| •• | | ↑ | |
| •• | •• | 1 | |

Contracts

| Name | Domain | Range | example |
|------|--------|----------|---------|
| • | : | ^ | |
| : | : | ↑ | |
| • | : | ↑ | |
| • | : | ↑ | |
| •• | : | ↑ | |
| • | : | ↑ | |
| ; | : | ↑ | |
| • | : | ↑ | |
| • | : | ↑ | |
| ; | : | ↑ | |
| ; | : | ↑ | |
| •• | : | ↑ | |
| •• | : | ^ | |
| •• | : | ↑ | |
| •• | : | ↑ | |
| •• | | ↑ | |
| •• | •• | 1 | |

| Circle | es Competition | Ti | me: 5 minutes |
|---------|-------------------|----------------------|---------------|
| | Math | Circle of Evaluation | Scheme Code |
| Round 1 | (1 + 2) - (3 * 7) | | |
| Round 2 | 3 - (1 + 2) | | |
| Round 3 | 3 - (1 + (5 * 6)) | | |
| Round 4 | (1 + (5 * 6)) - 3 | 3 | |

| Fast Functions! Fill out the contract for each function, | then try to write two examples and | the definition by yourself. | |
|--|------------------------------------|-----------------------------|---|
| ; _double | | | |
| name | domain | range | |
| (EXAMPLE (<u>double</u> | 5 (* 2 5 |)) | |
| (EXAMPLE (<u>double</u> | 7 (* 2 7 |))) | |
| (define (<u>double</u> | _n) _(* 2 n | ı)) | |
| ; | · | > | |
| name | domain | range | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| ; | • | > | _ |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |
| ; | : | > | |
| (EXAMPLE (|) | |) |
| (EXAMPLE (|) | |) |
| (define (|) | |) |

DESIGN RECIPE: SAMPLE

State the problem:

Make a circle (spot) of size 100, with the provided color

Contract+Purpose Statement Every contract has three parts: spot100 String Image Domain Range Makes a size 100 circle in a color Give Examples On the computer, write an example of your function in action, using EXAMPLE.)(circle 100 "solid" (EXAMPLE (reen the user types. ...which should become color "blu<u>e</u> (EXAMPLE ("blue")(circle 100 spot100 the user types.. ...which should become Function

Circle the changes in the EXAMPLEs, and name the variables.

Write the code, copying everything that isn't circled, and using names where you find variables!

DESIGN RECIPE: DOUBLE-RADIUS

| Contract+Purpose Statement | | | | | |
|---|-------------------------|----------------|----------------------|------------|---|
| Every contract has three par | ts: | | | | |
| | | | | | |
| ;:_ | | | | -> | |
| name | | Doma | in | Range | |
| • | | | | | |
| , | What doe | s the function | n do? | | |
| Give Examples | | | | | |
| On the computer, write an e | example of your | function ir | n action, using E | XAMPLE. | |
| (EVAMDLE (| | ` | | | ` |
| (EXAMPLE (the use | er types | <i>)</i> | which should | become |) |
| | | | | | |
| (EXAMPLE (| |) | | |) |
| the user | r types | | which should | become | |
| | | | | | |
| Function Circle the changes in the EXAMPI | | | | | |
| Write the code, copying everything | g that isn't circled, a | and using nam | nes where you find v | variables! | |
| (define (| |) | | |) |

DESIGN RECIPE: DOUBLE-WIDTH

| Contract+Purpose State | ement | | | | |
|-----------------------------------|--|---------------------|--------------------------|-------|---|
| Every contract has th | ree parts: | | | | |
| | | | | | |
| : | • | | -> | | |
| name | | Domain | | Range | |
| • | | | | | |
| , | What doe | es the function do? | | | |
| Civo Evamples | | | | | |
| Give Examples On the computer, wr | ite an example of your | function in act | ion, using EXAMPLE. | | |
| (E)(AAAB) | | | _ | | , |
| (EXAMPLE (| the constant | | | |) |
| | the user types | •• | which should become | | |
| (EVAMDLE (| | , | | | ` |
| (EXAMPLE (| the user types | / | which should become | |) |
| | | | | | |
| Function | | | | | |
| | EXAMPLEs, and name the verything that isn't circled, a | | para you find variables! | | |
| write the code, copying e | verytining that ish t cheled, a | ing using names wi | iere you mid variables! | | |
| (define (| |) | | |) |

DESIGN RECIPE: PAINT-JOB

| name | Domain | Range |
|---|------------------------------------|---------------|
| | What does the function do? | |
| | what does the function do: | |
| ive Examples In the computer, write an exa | mple of your function in action, u | sing EXAMPLE. |
| | | |
| | | |
| | | |
| | | |
| | | |
| | |) |
| EXAMPLE (| |) |
| (| | , |
| | | |
| | | |
| | | |
| | | |
| | | , |
| unction | | |
| define (| |) |
| | | |
| | | |
| | | |
| | | |
| | | ` |

DESIGN RECIPE: TURBO-CHARGE

| Contract+Purpose Statement | | |
|---|---------------------------------------|-------------|
| · | | -> |
| name | Domain | Range |
| · · · · · · · · · · · · · · · · · · · | | |
| | What does the function do? | |
| Give Examples On the computer, write an exam | mple of your function in action, usir | ng EXAMPLE. |
| | | |
| EXAMPLE (| |) |
| | | |
| | | |
| | | |
| | | |
| | |) |
| EXAMPLE (| |) |
| | | , |
| | | |
| | | |
| | | |
| | | |
| | |) |
| unction | | |
| | |) |
| define (| |) |
| | | |
| | | |
| | | |
| | | |
| | |) |

DESIGN RECIPE: PIMP

| name | Domain | Range |
|---|-------------------------------------|---------------|
| | What does the function do? | |
| - F | what does the function do: | |
| e Examples the computer, write an exan | mple of your function in action, us | sing EXAMPLE. |
| KAMPLE (| |) |
| \ | | , |
| | | |
| | | |
| | | |
| | | |
| | |) |
| KAMPLE (| |) |
| | | |
| | | |
| | | |
| | | |
| | |) |
| | | |
| ction | | |
| efine (| |) |
| | | |
| | | |
| | | |
| | | |
| | | |

DEFINE-STRUCT

Autos:

| ; an auto is a | | |
|----------------------|---|---|
| (define-struct auto | | |
| | | • |
| | | |
| ; a party is a | | |
| (define-struct party | (| |
| | | |

DESIGN RECIPE: RSVP

| ntract+Purpose Stateme | ent | |
|------------------------------------|--|----------|
| | | |
| | • | > |
| name | Domain | Range |
| | What does the function do? | |
| T 1 | | |
| ve Examples the computer, write | e an example of your function in action, using E | XAMPLE. |
| • | | |
| XAMPLE (| |) |
| _ | | |
| _ | | |
| | |) |
| | | • |
| XAMPLE (| |) |
| _ | | |
| _ | | |
| | |) |
| | | |
| nction | | |
| efine (| | , |
| erine (| | <i>)</i> |
| _ | | |
| _ | | |
| | |) |

DESIGN RECIPE: RELOCATE

| ontract+Purpose S | atement | |
|--------------------------------|--|--------------|
| | | |
| | • · | > |
| name | Domain | Range |
| | What does the function do? | |
| | | |
| ve Examples n the computer. | write an example of your function in action, usi | ing EXAMPLE. |
| - | | |
| EXAMPLE (| |) |
| | | |
| | | |
| | | |
| | · | , |
| EXAMPLE (| |) |
| | | |
| | | |
| | | ` |
| | |) |
| inction | | |
| inction | | |
| define (| |) |
| | | |
| | | |
| | | |

| Dissecting a Demo: Ninja World | |
|--|--|
| What changes? | |
| | |
| , | |
| | |
| | |
| | |
| Ninja World: | |
| ; a world is a | |
| | |
| (define-struct world ()) | |
| | |
| My constructor function is: | |
| 1) (How do you make a world?) | |
| What is its contract? | |
| My accessor function is: | |
| 2) (How do you get the dogX out of the world?) | |
| | |
| What is its contract? | |

DESIGN RECIPE: UPDATE-WORLD (NINJA WORLD)

| name | : | Domain | Range | |
|----------------------------------|-----------------------|--------------------------------|------------|---|
| , | What | t does the function do? | | |
| Give Examples On the computer, v | vrite an example of y | your function in action, using | g EXAMPLE. | |
| (EXAMPLE | (| | |) |
| (EXAMPLE | (| | |) |
| | | | |) |
| (define (| | | | \ |
| (define (| | | |) |
| | | | |) |

| D . | 1 (* | |
|-------------|---------|-------------|
| Review: | define. | -etruct |
| ICC VIC VV. | acmi | SHUC |

Last week we talked about a function that created new structs. For the structs below, what function would you use for each of the following?

| ; an auto is a String Number (define-struct auto (model hp rims color value) | |
|---|---|
| Make an auto? | |
| Get the model out of an auto? | |
| Get the hp out of an auto? | |
| ; a party is a String Number (define-struct team (location theme guests)) | |
| Make a party? | _ |
| Get the location out of the party? | |
| Get the theme out of the party? | _ |
| Get the guests out of the party? | |
| ; a world is a Number | |
| (define-struct world (dogX)) | |
| What function would you use to: | |
| Make a world? | |
| Get the dogX out of the world? | |

GAME DESIGN

"Start Simple, Get Complex"

| Draw a rough sketch of | your game in | action | | |
|--------------------------|-----------------|---------------|------------------------------|------------------------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| What images will you ne | | | | |
| Background | | T | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| List everything that has | | | | |
| Changed (position | on? score? colo | or? costume?) | Datatype (number? str | ring? image? boolean?) |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| · a world is a | | | | |

| (define-struct world | | |
|----------------------------|--------|---------|
| |)) | |
| My constructor function is | | |
| ; make-world : | | → World |
| My accessor functions are | | |
| · ? | | |
| · · | | |
| • | | |
| | | |
| | | |
| , | | |

| (0, 480) | START | (640,480) |
|------------------------|-------------------------------------|-----------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| (0,0) | arri a arri | (640, 0) |
| | game, this is where everything is: | |
| Object (top | to bottom of stack) Position (x, y) | |
| | | |
| | | |
| | | |
| D1 1 | | |
| Background (define STA | ART(make-world | |
| | | _ |
| | | _ |
| | | _ |
| | | _)) |

| (0, 480) | NEXT | (640,480) |
|----------------------------|----------------------------------|-----------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| (0, 0) | | (640, 0) |
| A split second later, this | s is where everything is: | |
| Object (top to | bottom of stack) Position (x, y) | |
| | | |
| | | |
| | | |
| | | |
| D 1 1 | | |
| Background | | |
| (define NEXT) | (make-world | - |

| | DRAW-WORLI | |
|-----------------|--|---------------------|
| Contract | | |
| · • | · | > |
| | | |
| Using put-image | | \ |
| derine (| ······································ | |
| put-image | | |
| | | |
| | | |
| | (put-image | |
| | | |
| | | (put-image |
| | | |
| | | |
| | | |
| | | (put-image |
| | | |
| | | |
| | | - . - |
| | | BACKGROUND |

DESIGN RECIPE: UPDATE-WORLD

State the problem (What changes?):

| name • | Domain | Range |
|---|---------------------------------------|----------------|
| | What does the function do? | |
| | what does the function do: | |
| live Examples In the computer, write an exam | mple of your function in action, ι | using EXAMPLE. |
| | · · · · · · · · · · · · · · · · · · · | |
| | | |
| | | |
| | | |
| | | |
| | |) |
| EXAMPLE (| |) |
| _ | | , |
| | | |
| | | |
| | | |
| | |) |
| | | , |
| unction | | |
| define (| |) |
| | | |
| | | |
| | | |
| | | |
| | | |

| When the user presses | this part | Changes by |
|-----------------------|-----------|------------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

DESIGN RECIPE

State the Problem

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

| Contract+Purpose Statement | | |
|--------------------------------|--------|-------------|
| • • • | Domain | -> |
| name | Domain | Ranges |
| Give Examples | | |
| (EXAMPLE (keypress START | |) |
| (Eza ivii EE (Reypiess 51711ci | | / |
| (make-world | | |
| <u></u> | | |
| | | |
| | | |
| | | |
| | | |
| | |)) |
| | | |
| (EXAMPLE (keypress START | |) |
| (Eztivii EE (Reypiess 51711ci | | |
| (make-world | | |
| <u></u> | | |
| | | |
| | | |
| | | |
| | | |
| | |)) |
| | | |

| (define (|) |
|-----------|---------|
| (cond | |
| | |
| | |
| | |
| | |
| |] |
| [(|) |
| L(| |
| | |
| | |
| | |
| | |
| |])) |

DESIGN RECIPE

| ntract+Purpose Statement | | -> |
|--------------------------|--------|--------|
| name | Domain | Ranges |
| ve Examples | | |
| XAMPLE (keypress START | |) |
| (make-world | | |
| | | |
| | | |
| | | |
| | |)) |
| XAMPLE (keypress START | | |
| (make-world | | |
| | | |
| | | |
| | | |
| | |)) |

| (EXAMPLE | (keypress START (make-world | | | | _ |
|---------------|-----------------------------|--|---|-------------|---|
| | - | | | | _ |
| | | | | | |
| (define (cond | (| | |) | |
| | | | | _ | |
| | - | | | - | |
| [(| - | |) |] | |
| | | | | _ | |
| | _ | | | - -] | |
| [(| | |) | | |
| | - | | | _ | |
| | _ | | |])) | |

Lesson 7 **Extended update-world:** ; __off-right?___:___ -> _____ domain range

| (EXAMPLE (|) |) |
|---------------|----------|----|
| (EXAMPLE (|) |) |
| (define (|) |) |
| ; _off-left?: | -> | |
| (EXAMPLE (|) |) |
| (EXAMPLE (|) |) |
| (define (|) |) |
| ; | : | -> |
| (EXAMPLE (|) |) |
| (EXAMPLE (|) |) |
| |) | |
| ; | ; | -> |
| (EXAMPLE (|) |) |
| (EXAMPLE (|) |) |
| (define (|) |) |

| TEST | | RESULT |
|------|---------------|--------|
| | (make-world | |
| | | |
| | - | |
| | | |
| | | |
| | - | |
| | _ | |
| | (make-world | |
| | | |
| | - | |
| | - | |
| | | |
| | |) |
| | _ | , |
| | (make-world | |
| | | |
| | | |
| | | |
| | | _ |
| | _ |) |
| | (make-world | |
| | (iiiake world | |
| | | |
| | | |
| | | |
| | - | |
| | _ | |

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.

| Contract+Purpose Statement | | |
|-------------------------------------|---|-------|
| Every contract has three part | s: | |
| | | -> |
| name • | Domain | Range |
| Give Examples | | |
| Give Examples | | |
| (EXAMPLE (| ` | 1 |
| (LXAMIF LL <u>(</u> | | |
| (EVAMBLE (| , | , |
| (EXAMPLE (| |) |
| Function Header | | |
| Write the Function Header, giving v | rariable names to all your input values that chan | ge. |
| (define (| | |
| function name | variable names | / |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
|) | | |
| , | | |

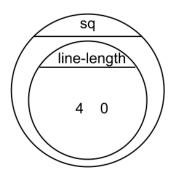
Distance:

The Player is at (4, 2) and the Target is at (0, 5). Distance takes in the player-x, player-y, character-x and character-y.

Use the formula below to fill in the EXAMPLE:

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

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



Convert it into Racket code:

(EXAMPLE (______)

(_____)

| Design Recipe | e: distance | | | | |
|---|--|------------------------------------|-----------------------------|------------|----|
| □ px: The x-coo □ py: The y-coo □ cx: The x-coo | stance, which takes Fordinate of the player ordinate of the player ordinate of another galardinate of another galardinate of another galardinate | me character | | | |
| It should return the | distance between the | two, using the Distance | formula: | | |
| Dist | ance = ((line-len | gth px cx) ² + (line-lo | ength py cy) ²) | | |
| Contract+Purpose Statem | ent | | | | |
| : | : | | -> | | |
| name | | Domain | Range | | |
| ; | What do | es the function do? | | | |
| Give Examples | what do | es the function do: | | | |
| | | | | | |
| (EXAMPLE (| | | |) | |
| \ | | | | — / | |
| | | | | | _) |
| (EXAMPLE | | | | | |
| (| | | |) | |
| \ | | | | —, | |
| | | | | | _) |
| Function Header | | | | | |
| (define (| | |) | | |
| fund | ction name | variable names | | | |
| | | | |) |) |

DESIGN RECIPE: COLLIDE?

| ☐ cy: The y-coordinate It should return true | e of the player e of another game character e of another game character e if the coordinates of the player are withing other character. Otherwise, false. | in 75 pixels of the |
|--|---|----------------------------|
| name | Domain | Range |
| ; | | |
| Give Examples | What does the function do? | |
| (EXAMPLE | |) |
| (EXAMPLE (| |) |
| Function Header | |) |
| (define (| |) |

| TEST | | RESULT |
|------|-------------|--------|
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ |) |
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ | |
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ | |
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ | |
| | 1 | |

Supplemental

DESIGN RECIPE

| Conti | ract+Purpose S | tatement | | | |
|-------------|----------------|---|--|----------------|---|
| Ever | y contract ha | s three parts: | | | |
| | | | | | |
| • | | · | | -> | |
| , | name | | Domain | Range | |
| | | | | | |
| , | | What de | oes the function do? | | |
| Give | Examples | | | | |
| | | , write an example of you | ur function in action, usir | ng EXAMPLE. | |
| (-\/ | 444DLE (| | , | | ` |
| (EXA | AMPLE (| the user types |) | ould become |) |
| | | the user types | willen siid | outu pecome | |
| (FY | AMPLE (| |) | | , |
| (L// | H///IF LL (| the user types |) | ould become | / |
| | | | | | |
| Funct | | | | | |
| | | the EXAMPLEs, and name the ng everything that isn't circled | e variables. I, and using names where you f | ind variables! | |
| (de | efine (| |) | |) |

DESIGN RECIPE

| Contract+Purpose S | Statement | | | |
|---|-----------------------------------|--|-----------------|---|
| Every contract ha | as three parts: | | | |
| | | | | |
| | | | | |
| · , | · | | | |
| name | | Domain | Range | |
| | | | | |
| ; | | | | |
| | What o | does the function do? | | |
| Civa Evamples | | | | |
| On the computer | write an example of vo | our function in action, usin | σ ΕΧΔΜΡΙ Ε | |
| on the compater | , write an example or yo | ranceion in action, asin | 5 1/7/11/11 11: | |
| (EXAMPLE (_ | |) | |) |
| (====================================== | the user types | which sho | ould become | / |
| | | | | |
| (EXAMPLE (_ | | 1 | | \ |
| (LXAMPLL (_ | the user types |) which sho | | / |
| | the user types | Willen 3110 | ata become | |
| | | | | |
| Function | the EVAMPI Ear and name th | | | |
| | the EXAMPLEs, and name the | ne variables. d, and using names where you fi | nd variables! | |
| Title the code, copy | ing overything that isn't ellered | a, and asing names where you in | iid variables: | |
| (define (| | 1 | | 1 |
| 14CIIIC (| | | | / |

| TEST | | RESULT |
|------|-------------|-------------|
| | (make-world | |
| | , | |
| | | |
| | | |
| | | |
| | _ |) |
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ |) |
| | (make-world | |
| | | |
| | | |
| | | |
| | | |
| | _ | |
| | (make-world | - <u></u> - |
| | | |
| | | |
| | | |
| | | |
| | _ |) |