Picture Language Part 2

•••

So far...

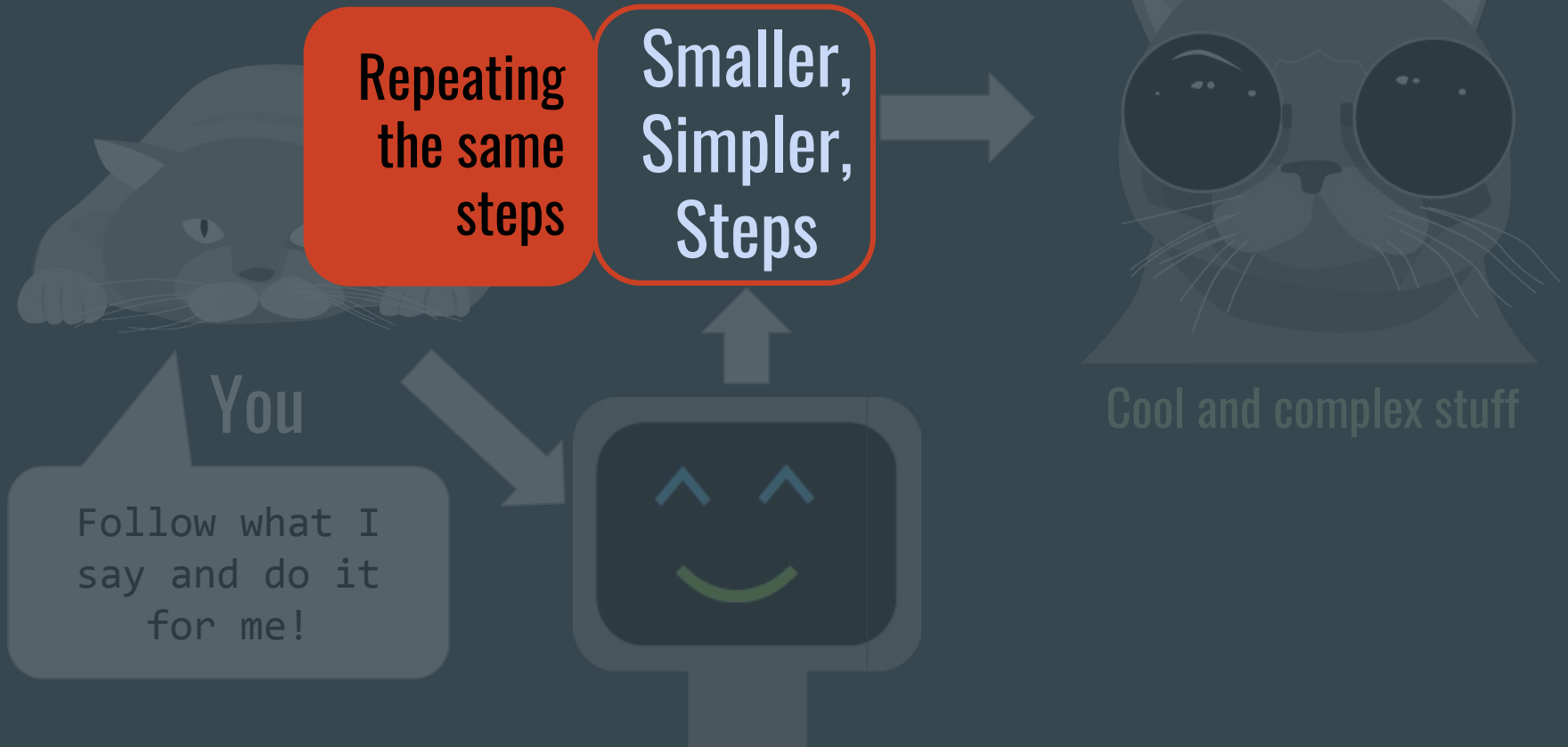
You

Follow what I say and do it for me!

Smaller, Simpler, Steps

Cool and complex stuff

In the lecture earlier...



In the lecture earlier...

Repeating the same steps

Smaller, Simpler, Steps

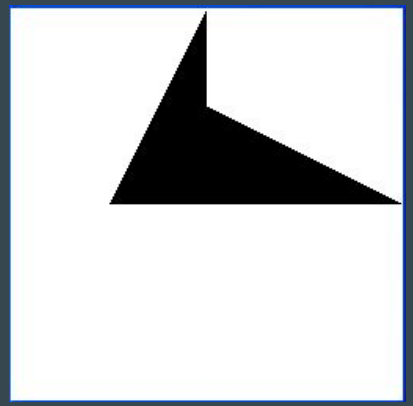
Cool and complex stuff

You

Loops

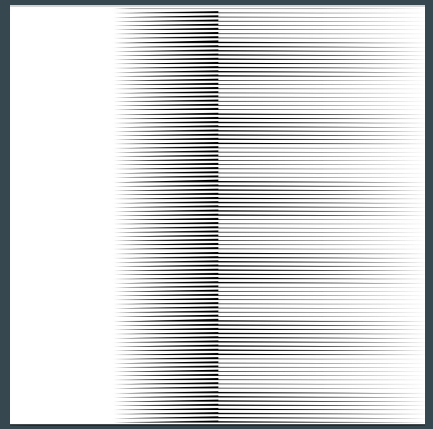
In this video...

How do we use loops to repeat the same runes to create complex patterns?



nova_bb

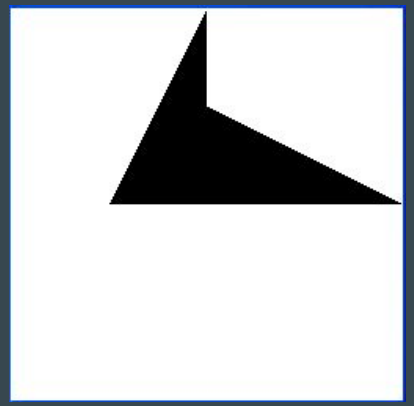
Repeat using loops



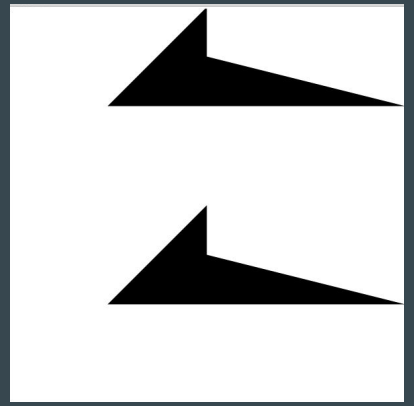
99 rows of nova_bb

Let’s start with this first...

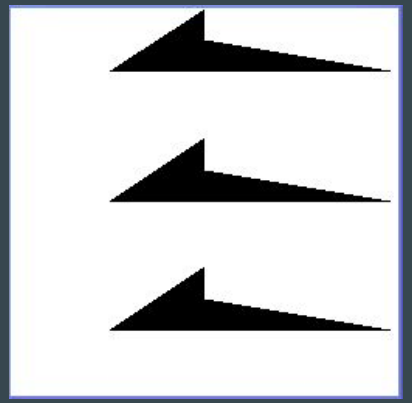
1 row



2 rows



3 rows



n rows?

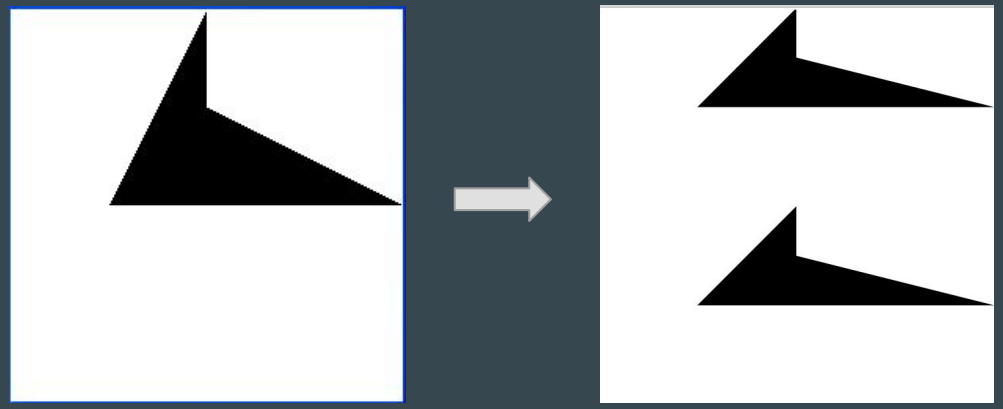
?

Let’s use an example to make the complex simpler

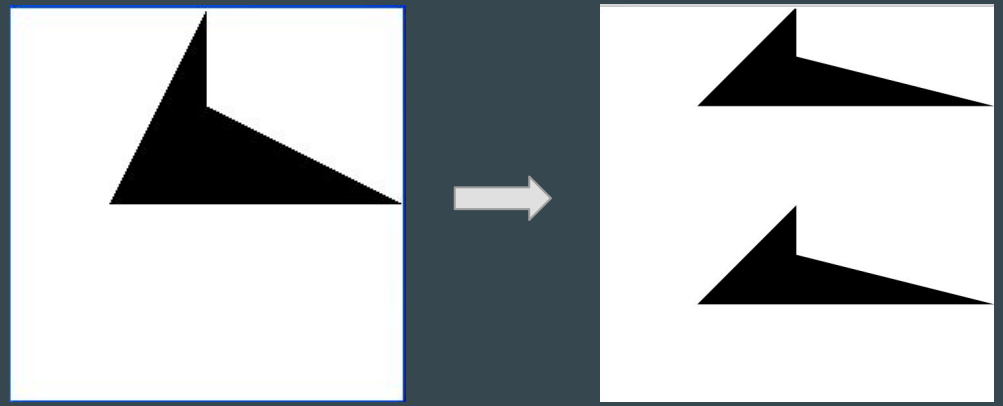
Smaller,
Simpler,
Steps

Cool and complex stuff

Example: How do we create 2 equal rows with nova_bb?

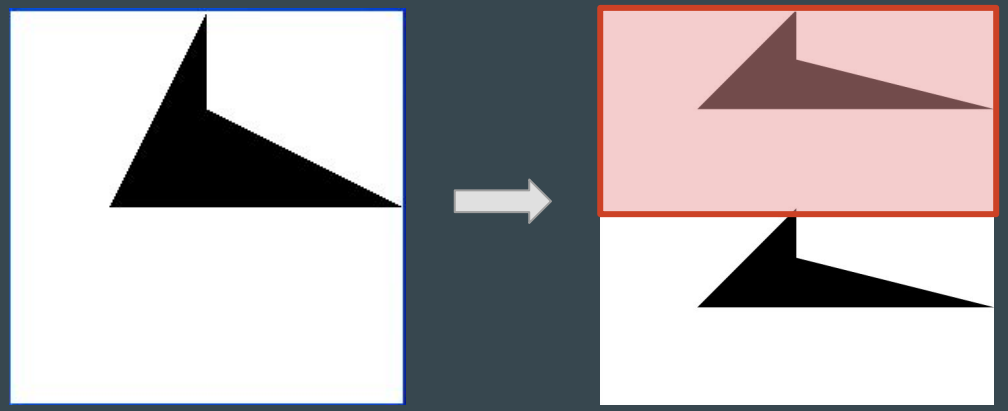


Example: How do we create 2 equal rows with nova_bb?



Use two identical nova_bb

Example: How do we create 2 equal rows with nova_bb?



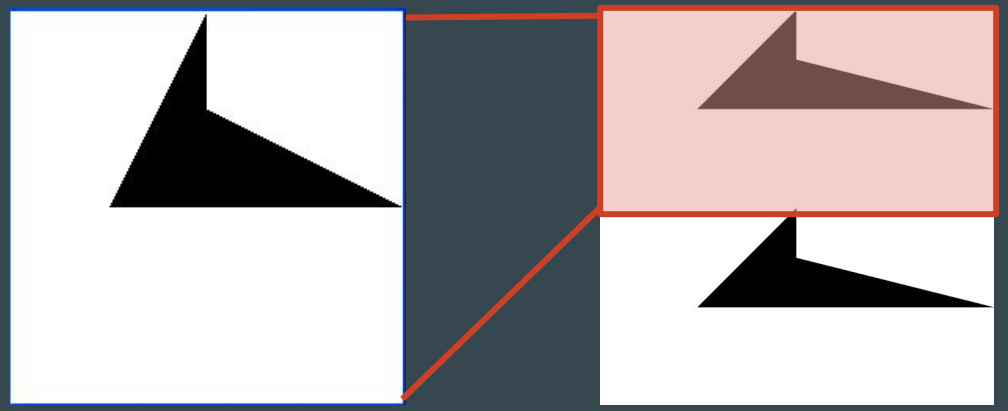
First nova_bb takes up top half the space

Use two identical nova_bb

2nd nova_bb takes up the remaining bottom

We already know this!

```
stack_frac(1/2, nova_bb, nova_bb)
```



First nova_bb takes up top half the space

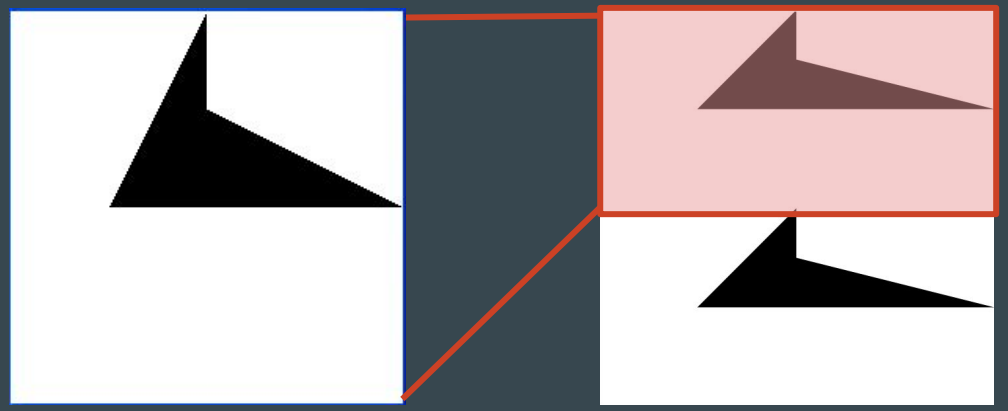
Use two identical nova_bb

2nd nova_bb takes up the remaining bottom

We already know this!

```
stack_frac(1/2, nova_bb, nova_bb)
```

Stack blocks



First nova_bb takes up top half the space

Use two identical nova_bb

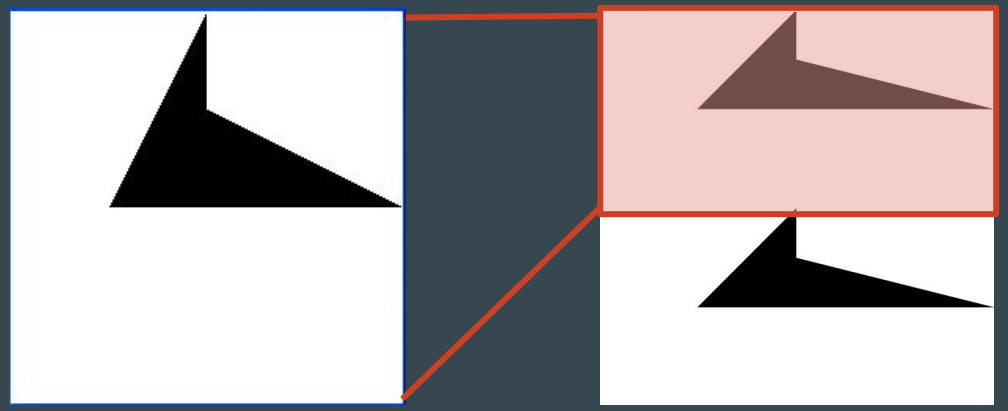
2nd nova_bb takes up the remaining bottom

We already know this!

```
stack_frac(1/2, nova_bb, nova_bb)
```

Stack blocks

Top block takes up ½ of the space



First nova_bb takes up top half the space

Use two identical nova_bb

2nd nova_bb takes up the remaining bottom

We already know this!

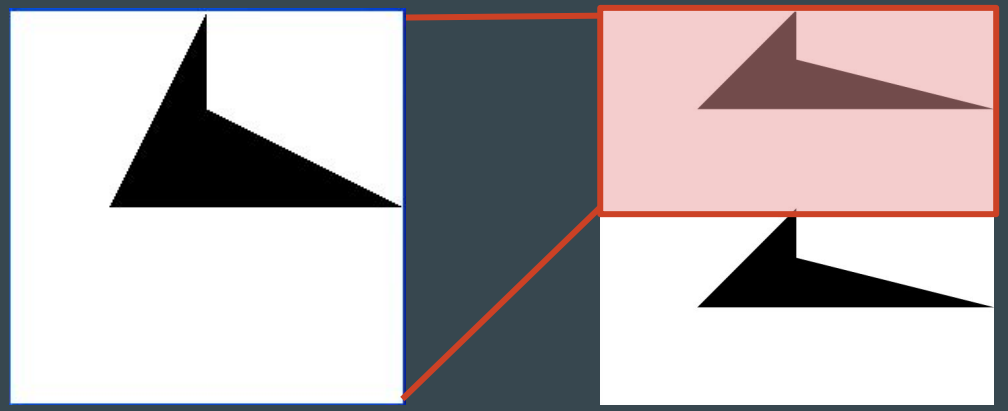
```
stack_frac(1/2, nova_bb, nova_bb)
```

Stack blocks

Top block takes up ½ of the space

Top block

Bottom block

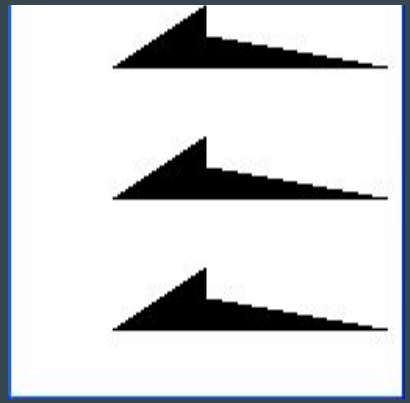


First nova_bb takes up top half the space

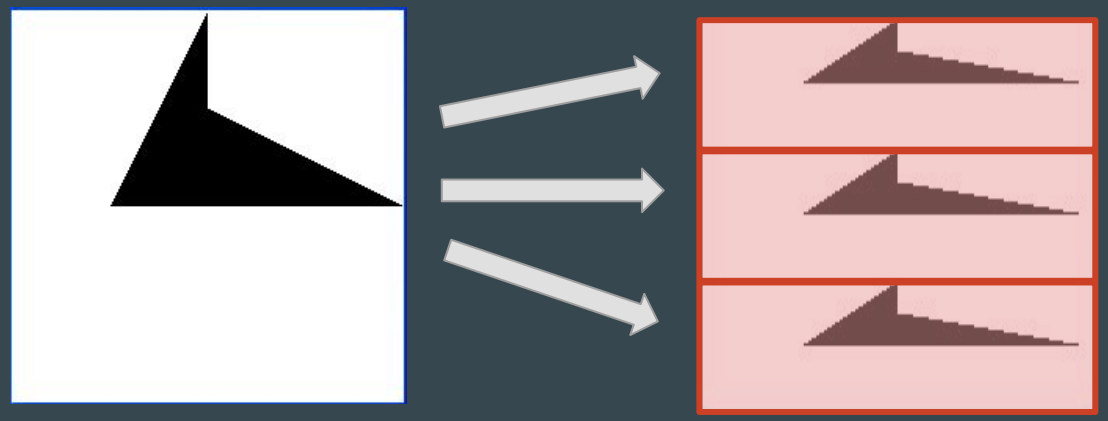
Use two identical nova_bb

2nd nova_bb takes up the remaining bottom

How do we make this into 3 rows then?

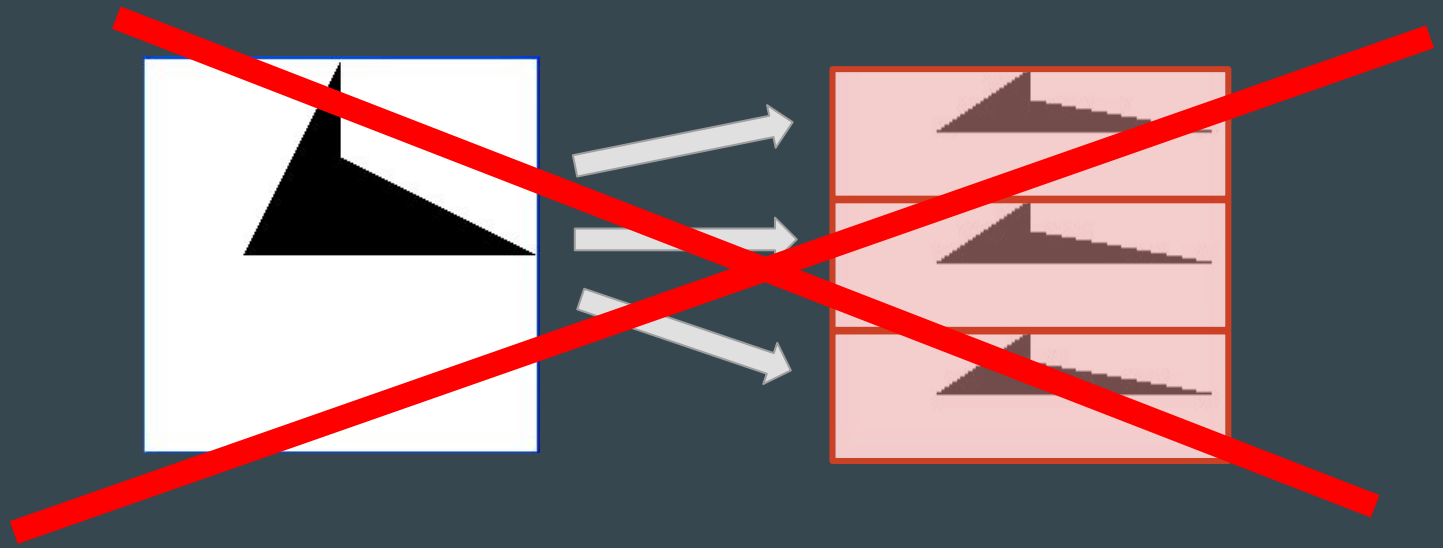


How do we make this into 3 rows then?



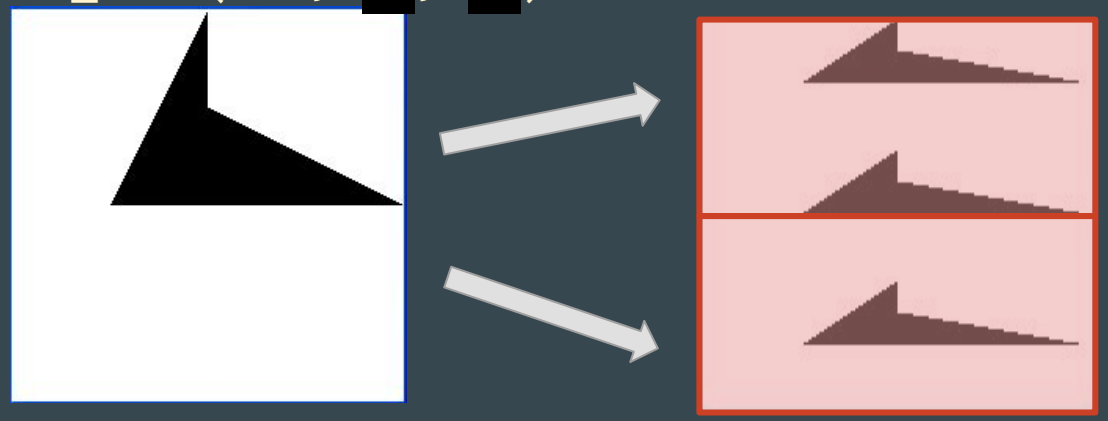
How do we make this into 3 rows then?

Hmm, but stack_frac only allows me to deal with 2 blocks...



How do we make this into 3 rows then?

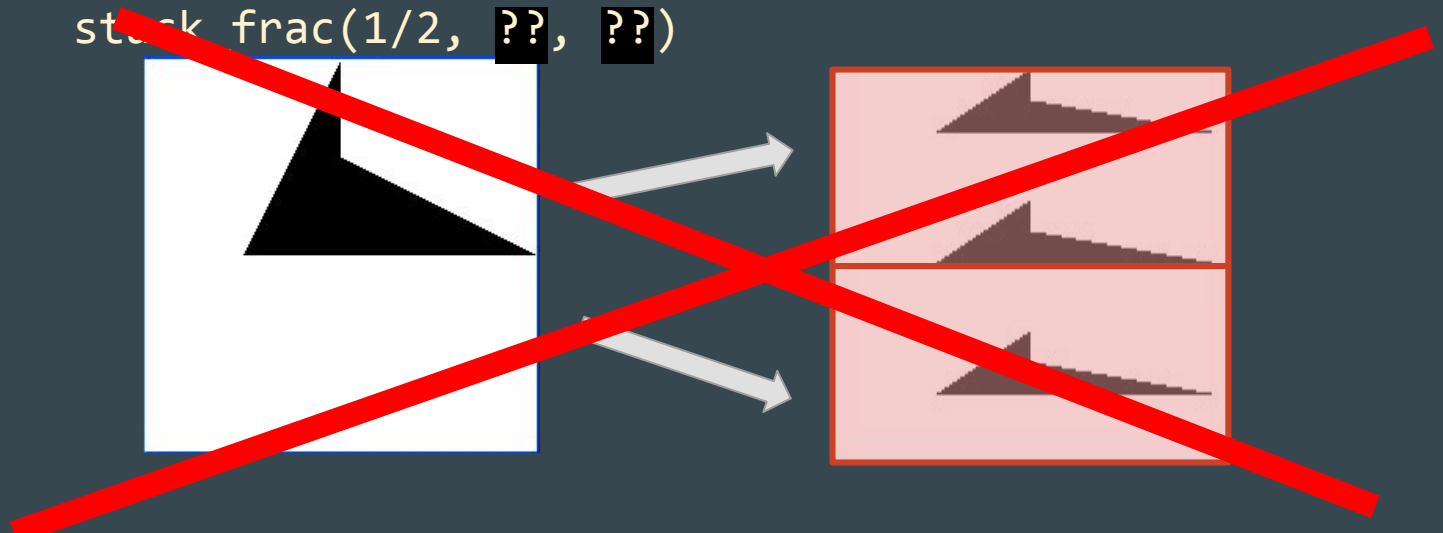
```
stack_frac(1/2, ??, ??)
```



How do we make this into 3 rows then?

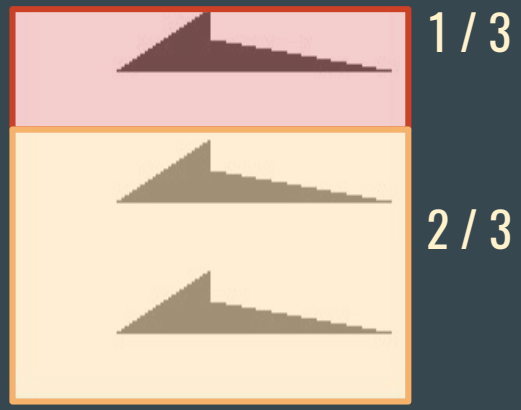
How am I going to create two of such patterns?

```
stack frac(1/2, ??, ??)
```



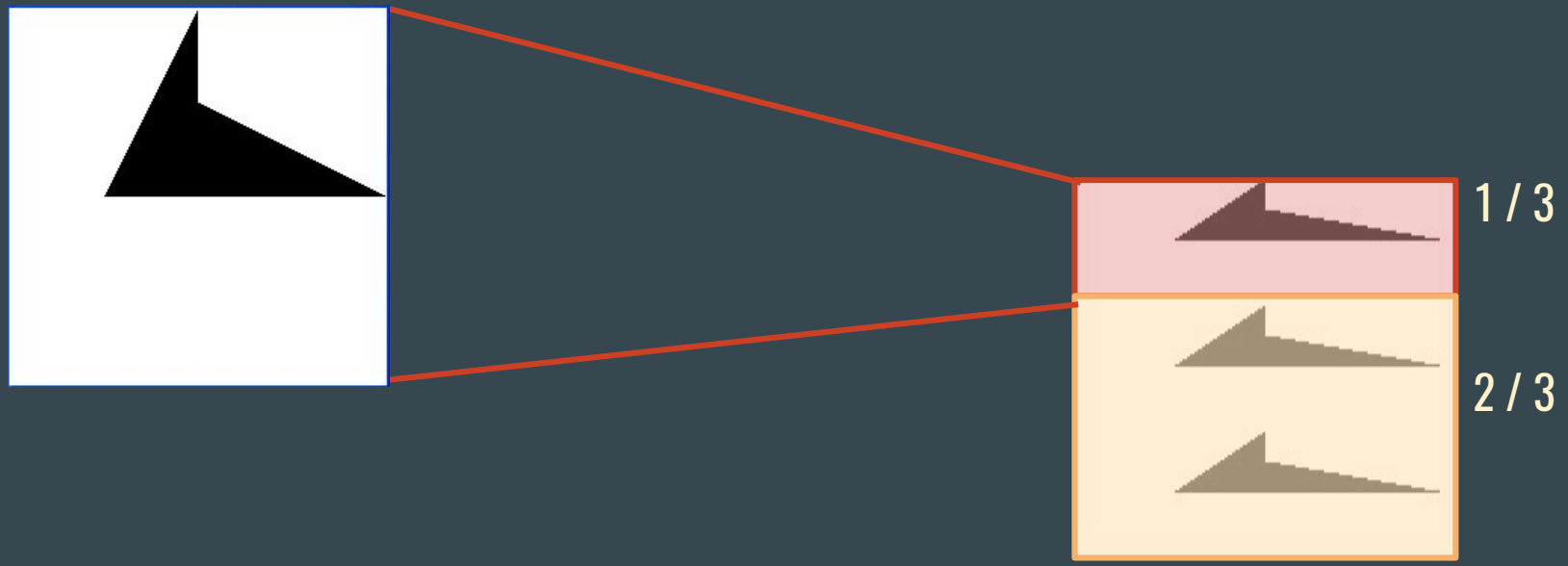
How do we make this into 3 rows then?

```
stack_frac(1/3, nova_bb, ??)
```



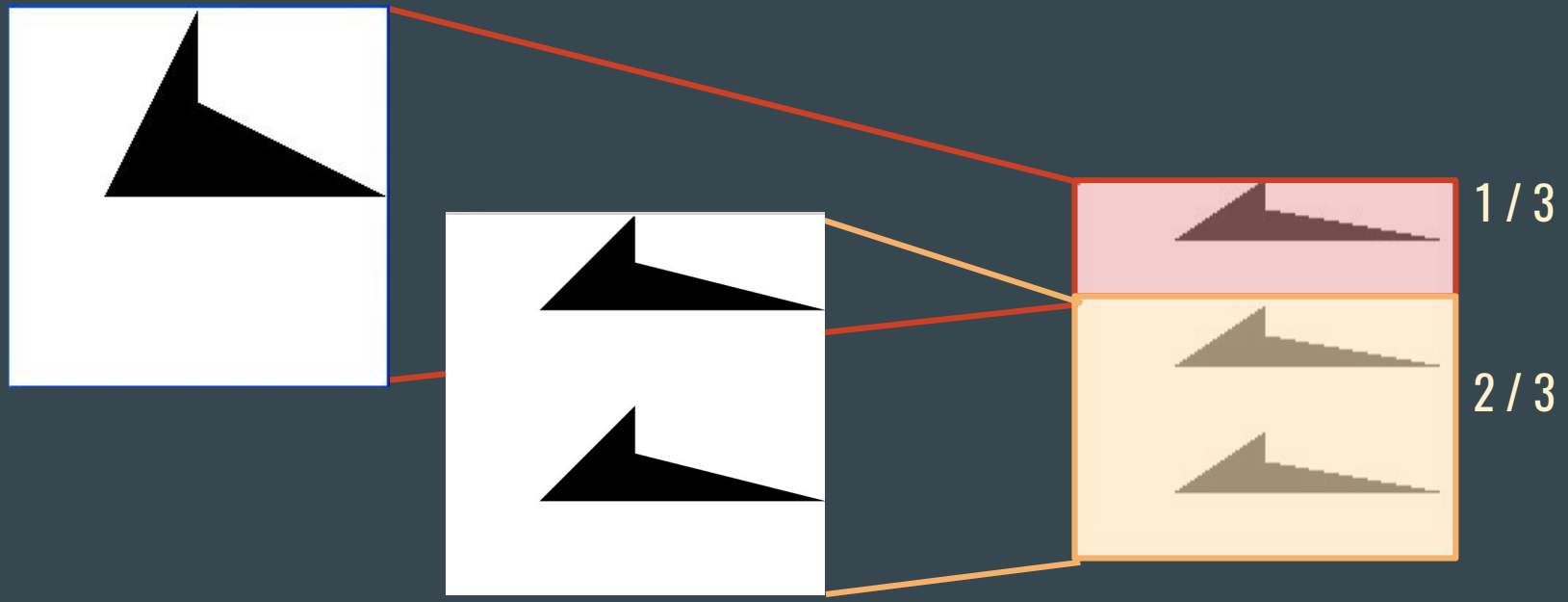
How do we make this into 3 rows then?

```
stack_frac(1/3, nova_bb, ??)
```



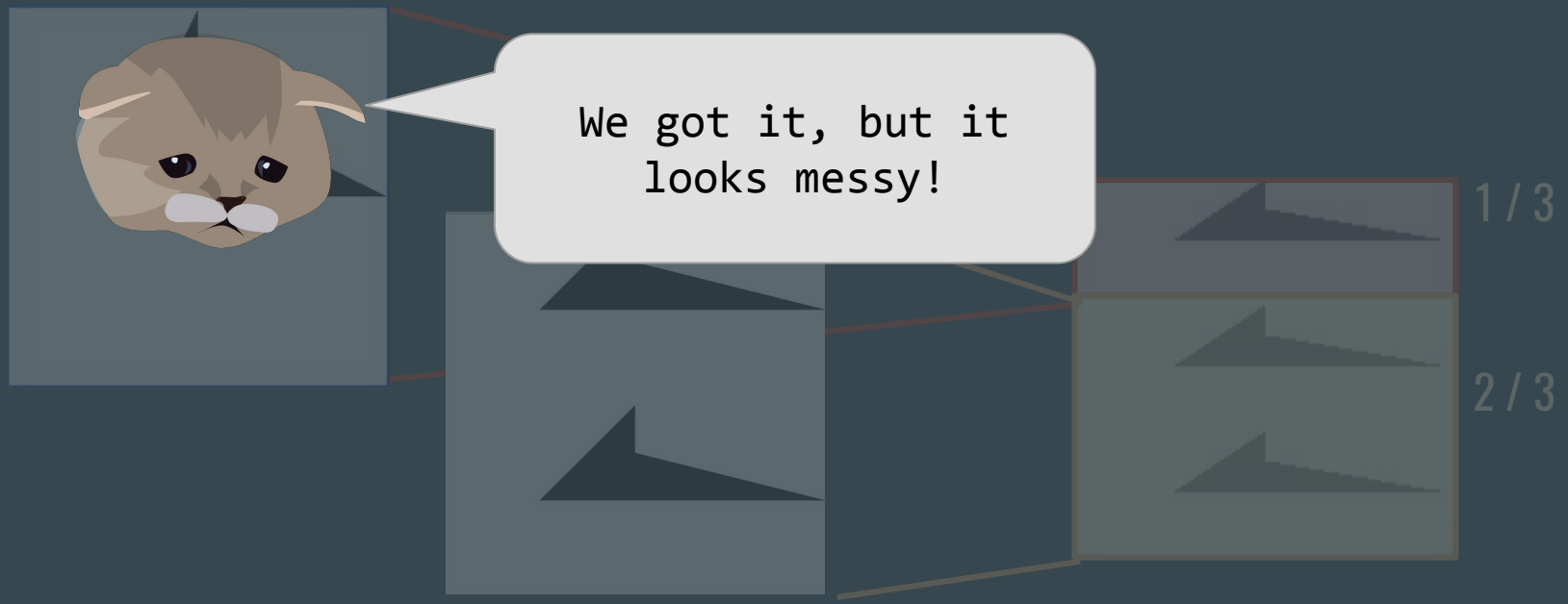
How do we make this into 3 rows then?

```
stack_frac(1/3, nova_bb, (stack_frac(1/2, nova_bb, nova_bb)))
```



How do we make this into 3 rows then?

```
stack_frac(1/3, nova_bb, (stack_frac(1/2, nova_bb, nova_bb)))
```



Remember Variables?

Remember order ‘5 cans of tuna’

order = ‘5 cans of tuna’

Interpreter

IDLE

Python 3.5.1 Shell

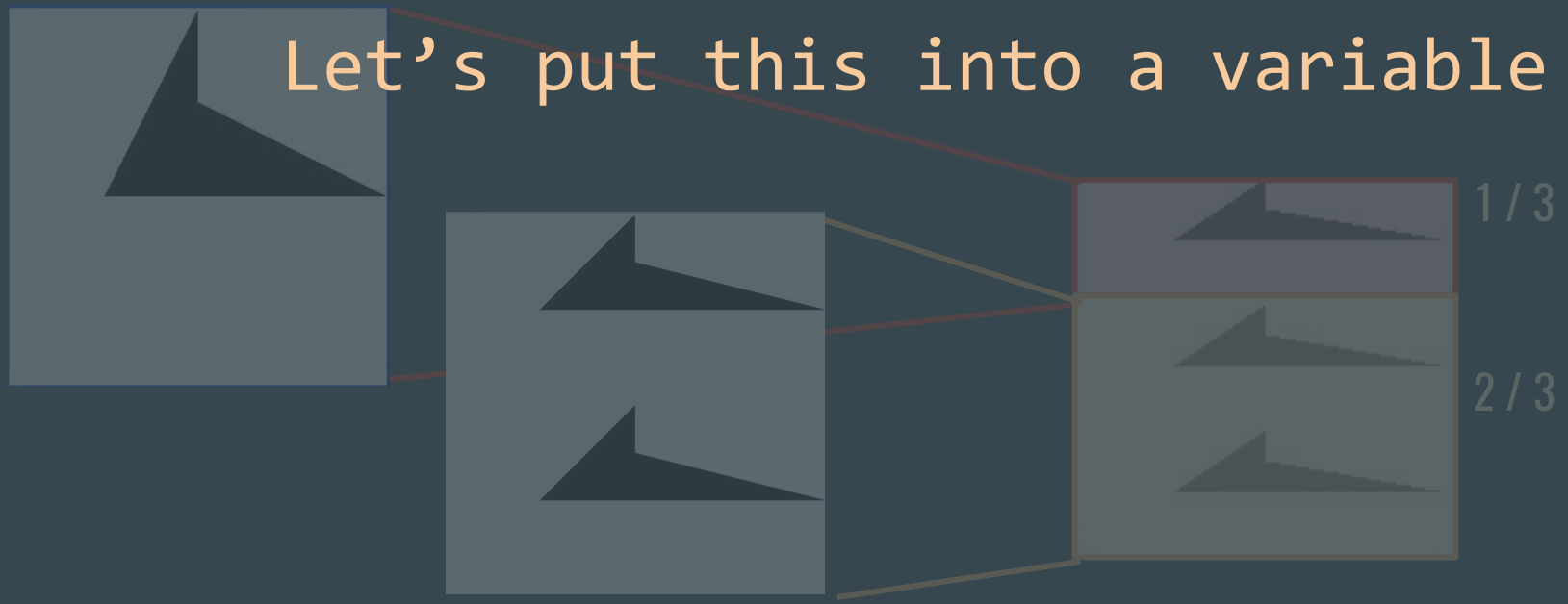
```
>>> order = '5 cans of tuna'
```

Ln: 21 Col: 0

Making it neater

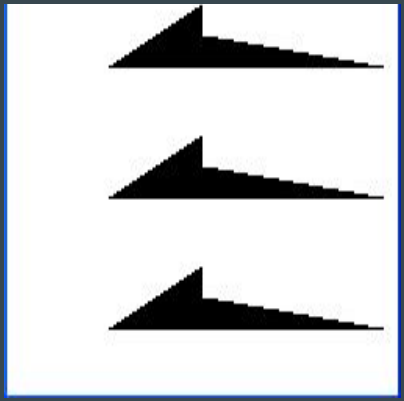
```
stack_frac(1/3, nova_bb, (stack_frac(1/2, nova_bb, nova_bb)))
```

Let’s put this into a variable



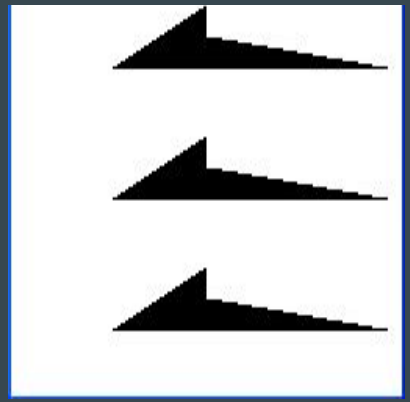
Making it neater

```
nova_2 = (stack_frac(1/2, nova_bb, nova_bb))
stack_frac(1/3, nova_bb, (stack_frac(1/2, nova_bb, nova_bb)))
```



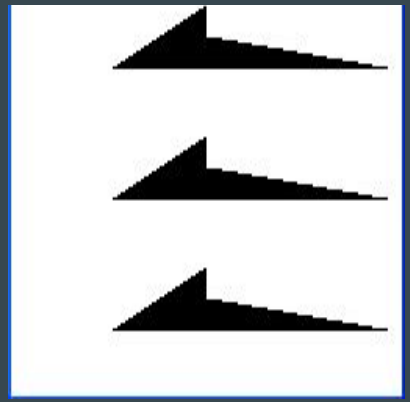
Making it neater

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
stack_frac(1/3, nova_bb, nova_2)
```



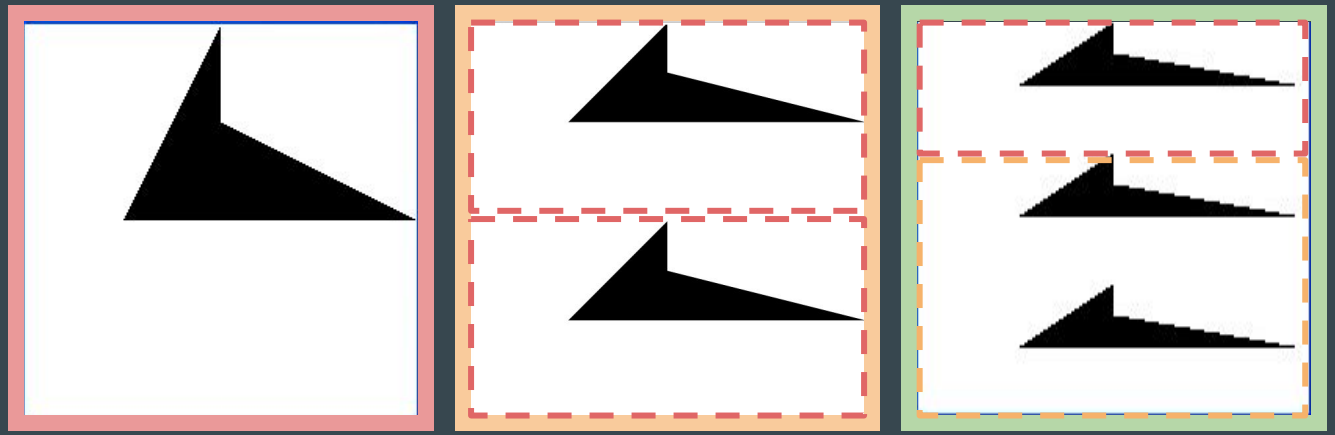
Making it neater

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
```



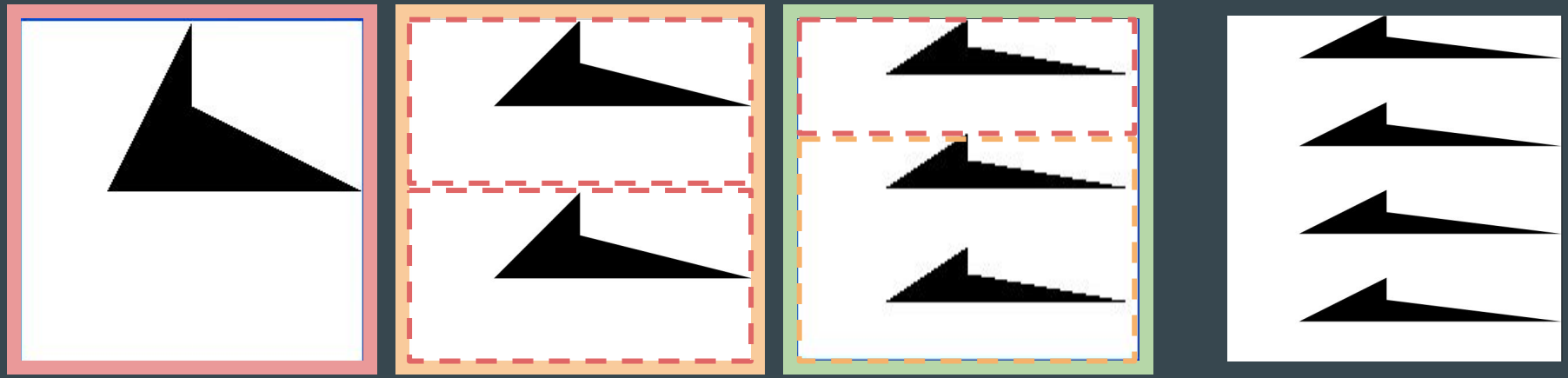
What we have so far

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
```



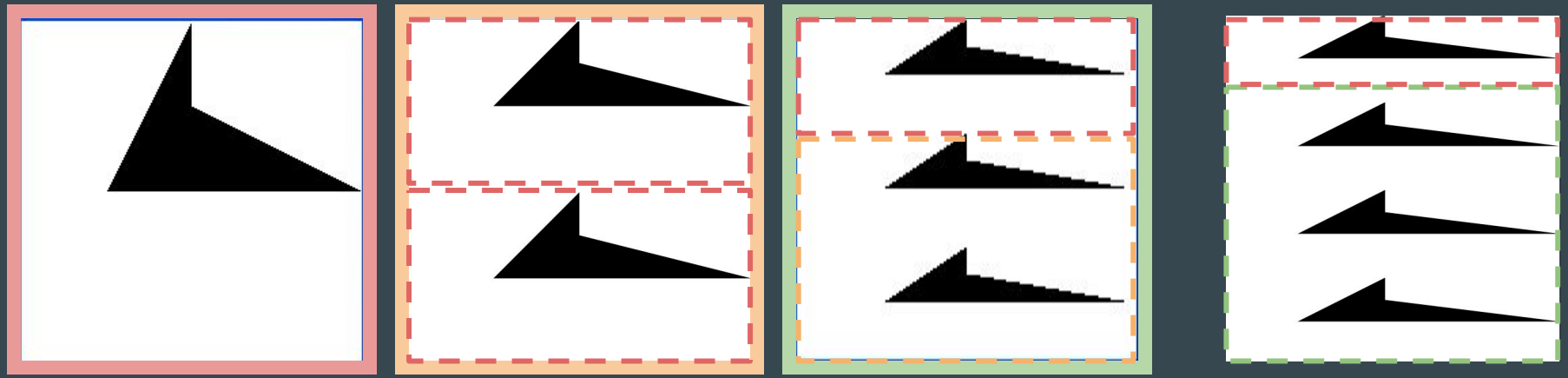
How about 4 rows?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
```



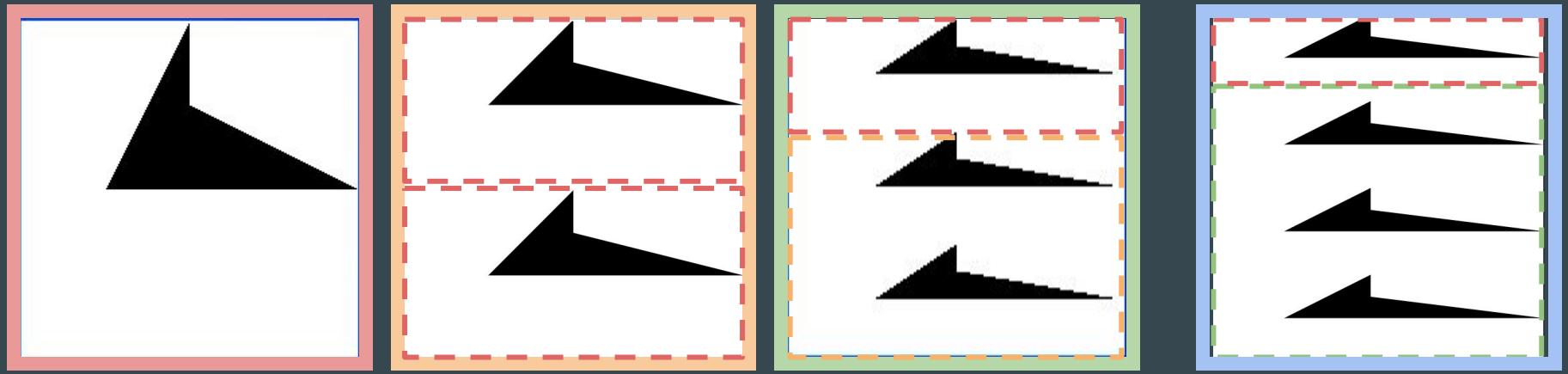
How about 4 rows?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
         stack_frac(1/4, nova_bb, nova_3)
```



How about 4 rows?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
```



And the 5th row....

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
```

And the 6th row....

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/ ,        ,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/ ,        ,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/ , nova_bb,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/ , nova_bb,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

Noticed any patterns so far?

```
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3                                  _2)
nova_4                                  _3)
nova_5                                  _4)
nova_6                                  _5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,          )
```

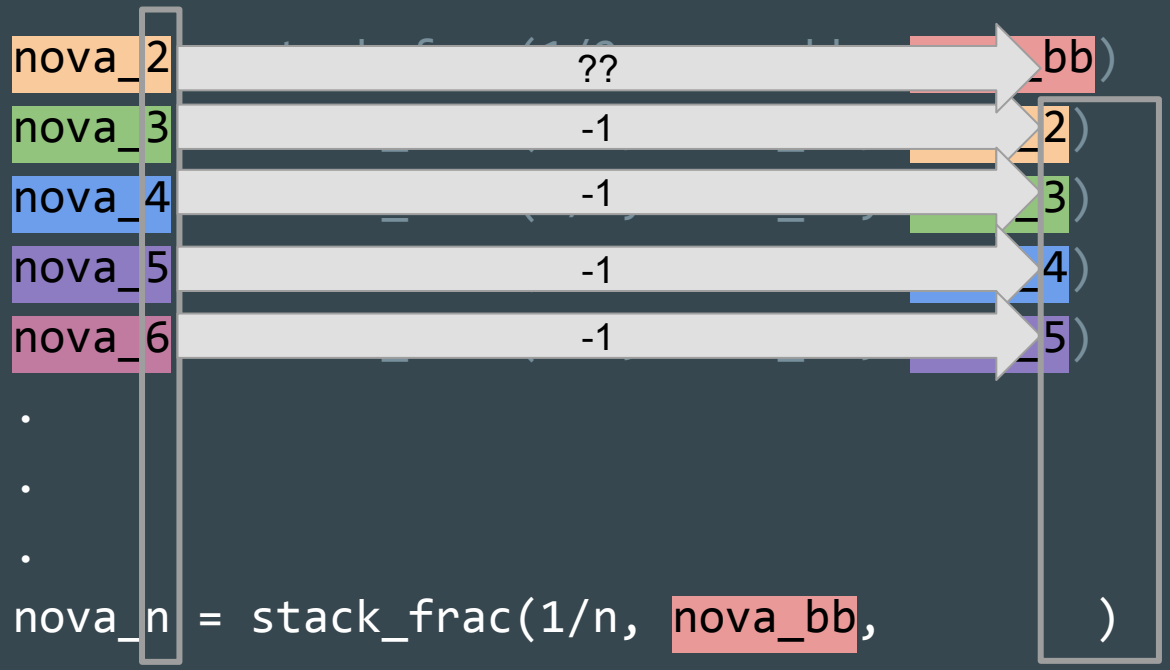
-1

-1

-1

-1

Noticed any patterns so far?



Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_bb)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

-1

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,        )
```

-1

-1

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2                                  1)
nova_3                                  2)
nova_4                                  3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,       )
```

-1

-1

-1

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2                    -1                    1)
nova_3                    -1                    2)
nova_4                    -1                    3)
nova_5                    -1                    4)
nova_6                    -1                    5)
.
.
.
nova_n = stack_frac(1/n, nova_bb,                )
```

Noticed any patterns so far?

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

-1

-1

-1

-1

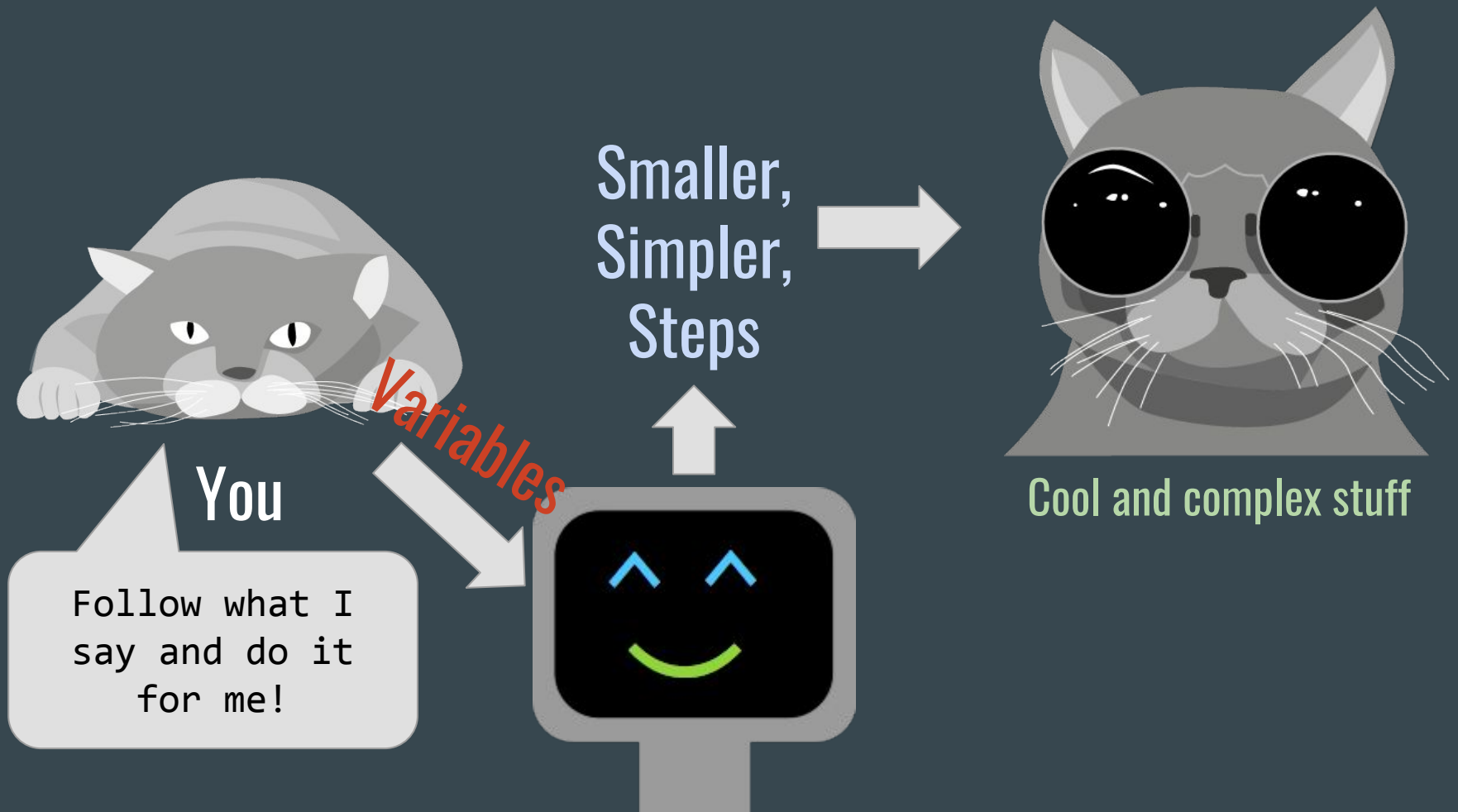
-1

This is how we stack n rows

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Smaller,
Simpler,
Steps

Cool and complex stuff


You
Follow what I say and do it for me!
Variables
Smaller, Simpler, Steps
Cool and complex stuff

Updating variables

```
age = 14
age = age + 1
```

Updating variables

```
age = 14
age = age + 1
```

```
= is not the same as ==
```

Updating Variables to simplify

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
nova_2 = stack_frac(1/2, nova_bb, result)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
nova_3 = stack_frac(1/3, nova_bb, result)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
nova_3 = stack_frac(1/3, nova_bb, result)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
nova_4 = stack_frac(1/4, nova_bb, result)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
nova_4 = stack_frac(1/4, nova_bb, result)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
nova_n = stack_frac(1/n, nova_bb, nova_n_minus1)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
result = stack_frac(1/n, nova_bb, result)
```

Updating Variables to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
result = stack_frac(1/n, nova_bb, result)
```

You

Follow what I say and do it for me!

Loops

Smaller, Simpler, Steps

Cool and complex stuff

Loops recap

```
print(0)
print(1)
print(2)
print(3)
print(4)
```

Loops recap

```
for number in range(5):
    print(number)
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0
```

Loops recap

```
for number in range(5):
    print(number)
```

number is 0 ➡ print(0) ➡ 0

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
➡ number is 1
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
➡number is 1 ➡ print(1) ➡ 1
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
➡number is 1 ➡ print(1) ➡ 1
➡number is 2
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
number is 1 ➡ print(1) ➡ 1
number is 2 ➡ print(2) ➡ 2
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
number is 1 ➡ print(1) ➡ 1
number is 2 ➡ print(2) ➡ 2
number is 3 ➡ print(3) ➡ 3
number is 4 ➡ print(4) ➡ 4
number is 5
```

Loops recap

```
for number in range(5):
    print(number)
```

```
for number in range(5):
    print(number+2)
```

```
number is 0 ➡ print(0) ➡ 0
number is 1 ➡ print(1) ➡ 1
number is 2 ➡ print(2) ➡ 2
number is 3 ➡ print(3) ➡ 3
number is 4 ➡ print(4) ➡ 4
number is 5
```

Loops recap

```
for number in range(5):
    print(number)
```

```
for number in range(5):
    print(number+2)
```

```
number is 0 ➡ print(0) ➡ 0
➡ number is 1 ➡ print(1) ➡ 1
➡ number is 2 ➡ print(2) ➡ 2
➡ number is 3 ➡ print(3) ➡ 3
➡ number is 4 ➡ print(4) ➡ 4
➡ number is 5
```

```
number is 0 ➡ print(0+2) ➡ 2
```

Loops recap

```
for number in range(5):
    print(number)
```

```
number is 0 ➡ print(0) ➡ 0
number is 1 ➡ print(1) ➡ 1
number is 2 ➡ print(2) ➡ 2
number is 3 ➡ print(3) ➡ 3
number is 4 ➡ print(4) ➡ 4
number is 5
```

```
for number in range(5):
    print(number+2)
```

```
number is 0 ➡ print(0+2) ➡ 2
number is 1 ➡ print(1+2) ➡ 3
number is 2 ➡ print(2+2) ➡ 4
number is 3 ➡ print(3+2) ➡ 5
number is 4 ➡ print(4+2) ➡ 6
number is 5
```

Using Loops to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
result = stack_frac(1/n, nova_bb, result)
```

Using Loops to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
result = stack_frac(1/n, nova_bb, result)
```

Using Loops to simplify

```
result = nova_bb
result = stack_frac(1/2, nova_bb, result)
result = stack_frac(1/3, nova_bb, result)
result = stack_frac(1/4, nova_bb, result)
result = stack_frac(1/5, nova_bb, result)
result = stack_frac(1/6, nova_bb, result)
.
.
.
result = stack_frac(1/n, nova_bb, result)
```

Using Loops to simplify

```
                result = nova_bb
number is 0 ➡ result = stack_frac(1/2, nova_bb, result)
number is 1 ➡ result = stack_frac(1/3, nova_bb, result)
number is 2 ➡ result = stack_frac(1/4, nova_bb, result)
number is 3 ➡ result = stack_frac(1/5, nova_bb, result)
number is 4 ➡ result = stack_frac(1/6, nova_bb, result)
                .
                .
                .
                result = stack_frac(1/n, nova_bb, result)
```

Using Loops to simplify

```
                    result = nova_bb
number is 0  ---+2---> 2, nova_bb, result)
number is 1  ---+2---> 3, nova_bb, result)
number is 2  ---+2---> 4, nova_bb, result)
number is 3  ---+2---> 5, nova_bb, result)
number is 4  ---+2---> 6, nova_bb, result)
                .
                .
                .
number is n-2  ---+2---> n, nova_bb, result)
```

Using Loops to simplify

```
                 result = nova_bb
number is 0 ➡ result = stack_frac(1/(number+2), nova_bb, result)
number is 1 ➡ result = stack_frac(1/(number+2), nova_bb, result)
number is 2 ➡ result = stack_frac(1/(number+2), nova_bb, result)
number is 3 ➡ result = stack_frac(1/(number+2), nova_bb, result)
number is 4 ➡ result = stack_frac(1/(number+2), nova_bb, result)
.               .
.               .
.               .
                result = stack_frac(1/(number+2), nova_bb, result)
```

Using Loops to simplify

```
result = nova_bb
```

```
result = stack_frac(1/(number+2), nova_bb, result)
```

Using Loops to simplify

```
result = nova_bb
for number in range(n):
    result = stack_frac(1/(number+2), nova_bb, result)
```

Using Loops to simplify

```
result = nova_bb
for number in range(n):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

Using Loops to simplify

```
result = nova_bb
for number in range(n):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

Example

```
result = nova_bb
for number in range(2):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

Example

```
result = nova_bb
for number in range(2):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

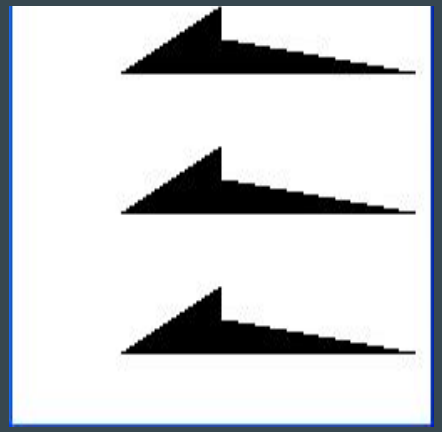
Example

```
result = nova_bb
for number in range(2):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
number is 0 ➡ result = stack_frac(1/2, nova_bb, result)
number is 1 ➡ result = stack_frac(1/3, nova_bb, result)
number is 2
```

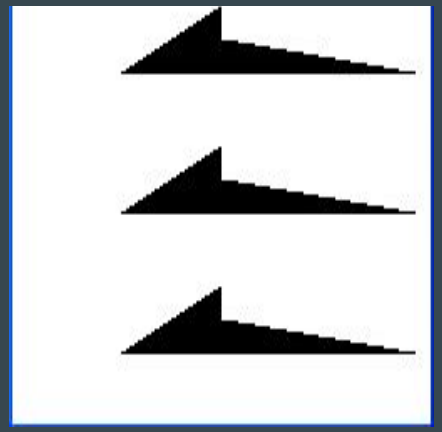
Example

```
result = nova_bb
for number in range(2):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```



Refining further

```
result = nova_bb
for number in range(2):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```



3 rows

Refining further

```
result = nova_bb
for number in range(n):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

n+1 rows

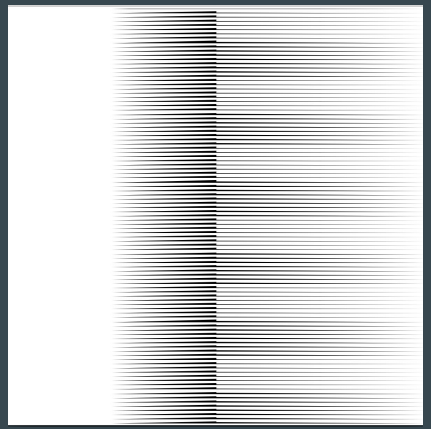
So that

```
result = nova_bb
for number in range(n-1):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

n rows

So that when n = 99,

```
result = nova_bb
for number in range(99-1):
    result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```



99 rows

See how much we have simplified our code

99 rows of nova_bb - Before

```
nova_1 = nova_bb
nova_2 = stack_frac(1/2, nova_bb, nova_1)
nova_3 = stack_frac(1/3, nova_bb, nova_2)
nova_4 = stack_frac(1/4, nova_bb, nova_3)
nova_5 = stack_frac(1/5, nova_bb, nova_4)
nova_6 = stack_frac(1/6, nova_bb, nova_5)
nova_7 = stack_frac(1/7, nova_bb, nova_6)
nova_8 = stack_frac(1/8, nova_bb, nova_7)
nova_9 = stack_frac(1/9, nova_bb, nova_8)
.
.
.
nova_99 = stack_frac(1/99, nova_bb, nova_98)
```

99 rows of nova_bb - After

```
result = nova_bb
for number in range(99-1):
     result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

Recap

You

Follow what I say and do it for me!

Smaller, Simpler, Steps

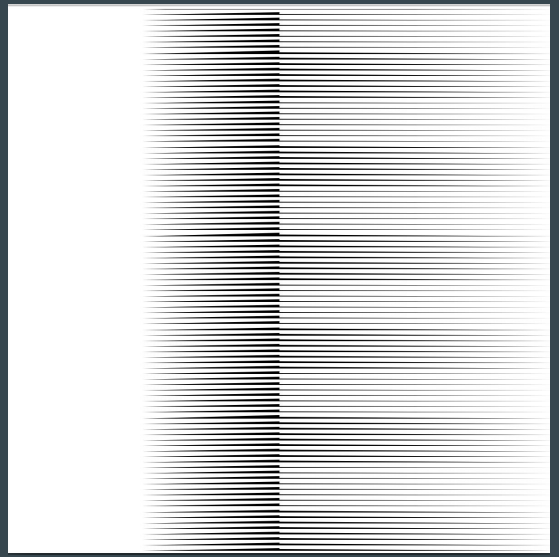
Cool and complex stuff

Recap

You

Follow what I say and do it for me!

Smaller, Simpler, Steps



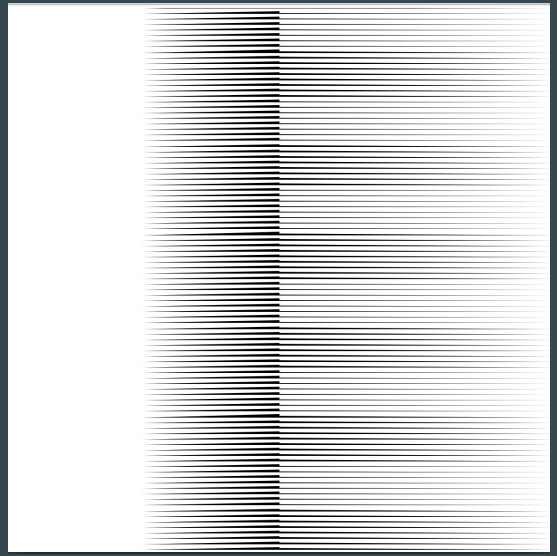
Cool and complex stuff

Instead of...

You

```
Step 1...
Step 2...
Step 3...
```

Repeat similar steps



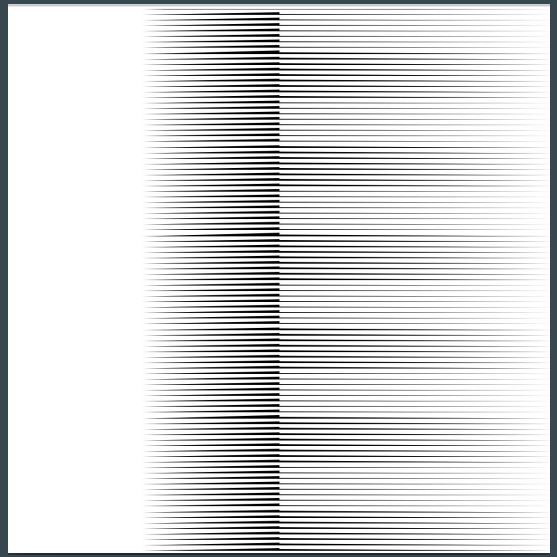
Cool and complex stuff

We did...

You

Update variable.

Repeat similar steps



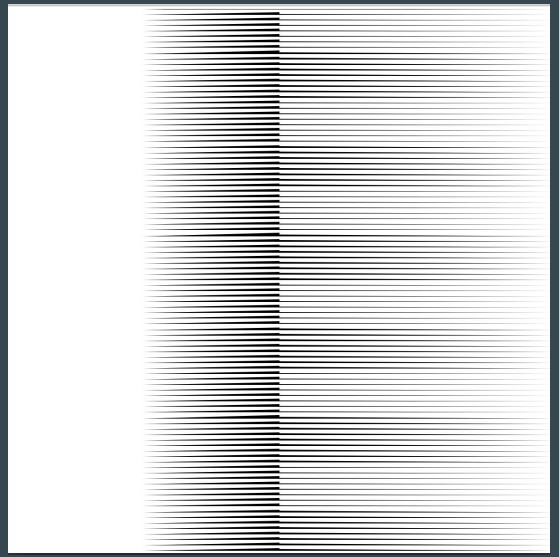
Cool and complex stuff

We did...

You

```
Loop this.
Update variable.
```

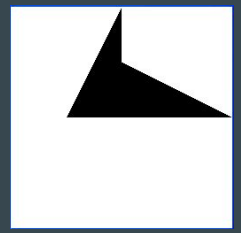
Repeat similar steps



Cool and complex stuff

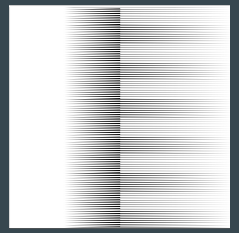
In the last video...

How do we use loops to repeat the same steps to create complex patterns?



nova_bb

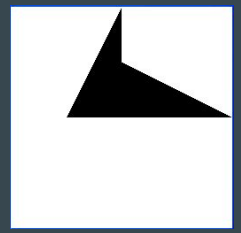
Repeat using loops



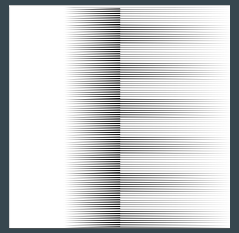
99 rows of nova_bb

In this video...

Can we reuse our code to produce do similar things to different runes?

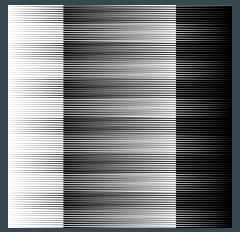


nova_bb



99 rows of nova_bb

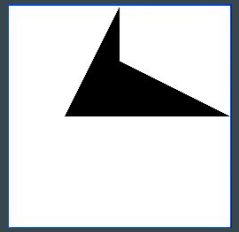
rcross_bb



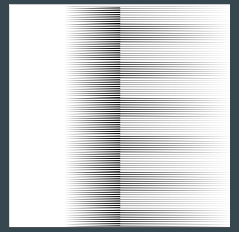
99 rows of rcross_bb

In this video...

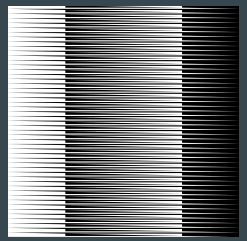
Can we reuse our code to produce do similar things to the same runes?



nova_bb

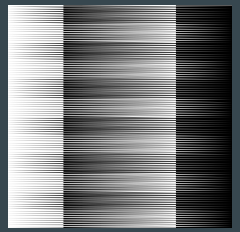


99 rows of nova_bb



50 rows of rcross_bb

rcross_bb



99 rows of rcross_bb

Can we simplify this further to use in more situations?

99 rows of nova_bb

```
result = nova_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

99 rows of circle_bb

```
result = circle_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

95 rows of nova_bb

```
result = nova_bb
for number in range(95-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

60 rows of circle_bb

```
result = circle_bb
for number in range(60-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

Recap - functions with parameters

```
def area_of_rectangle(length, breadth):

    return length * breadth
```

Recap - functions with parameters

```
def area_of_rectangle(length, breadth):
    return length * breadth
```

```
area_of_rectangle(length, breadth):
    return length * breadth
```

```
area_of_rectangle(3, 5)
```

Recap - functions with parameters

```
def area_of_rectangle(length, breadth):
    return length * breadth
```

```
area_of_rectangle(   3   , breadth):
    return   3   * breadth
```

```
area_of_rectangle(3, 5)
```

Recap - functions with parameters

```
def area_of_rectangle(length, breadth):
    return length * breadth
```

```
area_of_rectangle( 3 , 5 ):
    return 3 * 5
```

```
area_of_rectangle(3, 5)
```

What changes?

99 rows of nova_bb

```
result = nova_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

99 rows of circle_bb

```
result = circle_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

95 rows of nova_bb

```
result = nova_bb
for number in range(95-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

60 rows of circle_bb

```
result = circle_bb
for number in range(60-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

What changes? Number of rows

99 rows of nova_bb

```
result = nova_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

99 rows of circle_bb

```
result = circle_bb
for number in range(99-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

95 rows of nova_bb

```
result = nova_bb
for number in range(95-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

60 rows of circle_bb

```
result = circle_bb
for number in range(60-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

What changes?

Number of rows

Type of rune

99 rows of nova_bb

```
result = nova_bb
for number in range(99-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

99 rows of circle_bb

```
result = circle_bb
for number in range(99-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

95 rows of nova_bb

```
result = nova_bb
for number in range(95-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

60 rows of circle_bb

```
result = circle_bb
for number in range(60-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

parameters: Number of rows Type of rune

```
result = nova_bb
for number in range(99-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(99-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

```
result = nova_bb
for number in range(95-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(60-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

parameters: n Type of rune

```
result = nova_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

```
result = nova_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

parameters: n

Type of rune

```
result = nova_bb
for number in range(n-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

Similar code

```
result = nova_bb
for number in range(n-1):
        result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(n-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

Similar code

```
result = circle_bb
for number in range(n-1):
        result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

parameters: n Type of rune

```
result = nova_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), nova_bb, result)
show(result)
```

```
result = circle_bb
for number in range(n-1):
      result = stack_frac(1/(number+2), circle_bb, result)
show(result)
```

parameters: n rune

```
result = rune
for number in range(n-1):
      result = stack_frac(1/(number+2), rune, result)
show(result)
```


```
result = rune
for number in range(n-1):
      result = stack_frac(1/(number+2), rune, result)
show(result)
```

parameters: n rune

Similar code

```
result = rune
for number in range(n-1):
      result = stack_frac(1/(number+2), rune, result)
show(result)
```

```
result = rune
for number in range(n-1):
      result = stack_frac(1/(number+2), rune, result)
show(result)
```

parameters: n rune

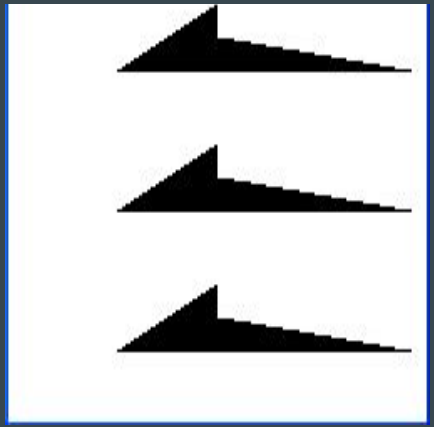
```
result = rune

for number in range(n-1):
    result = stack_frac(1/(number+2), rune, result)
show(result)
```

```
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```

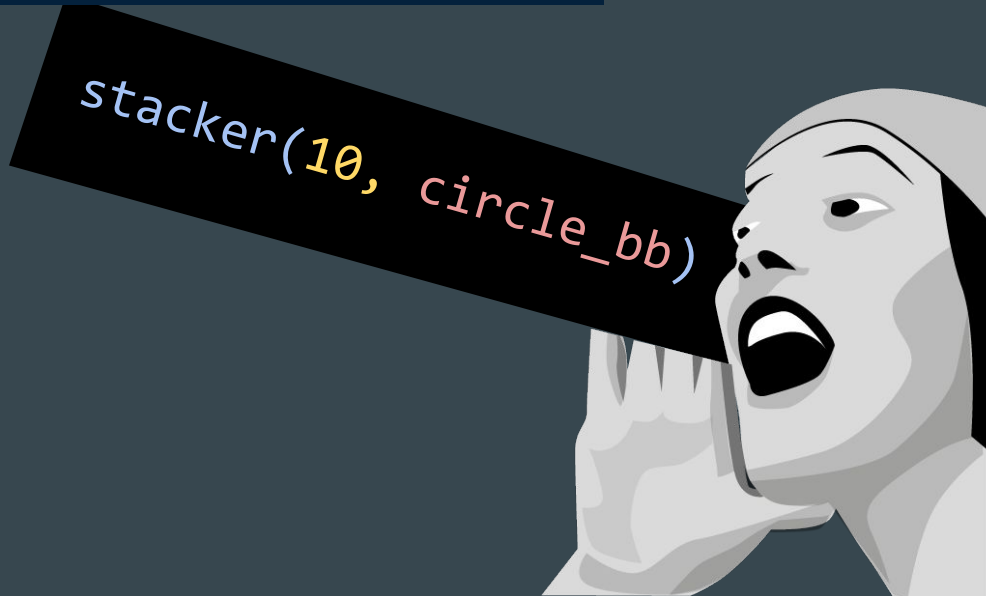
```python
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```

```python
stacker(3, nova_bb)
```

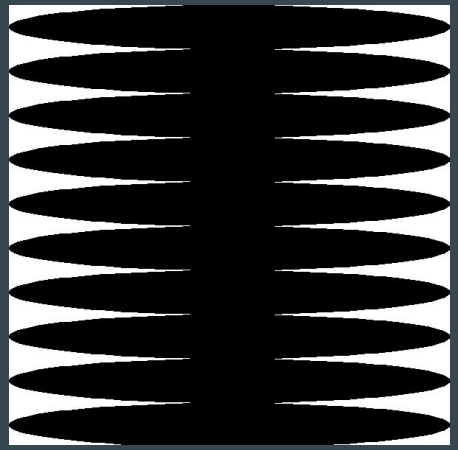
```python
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```

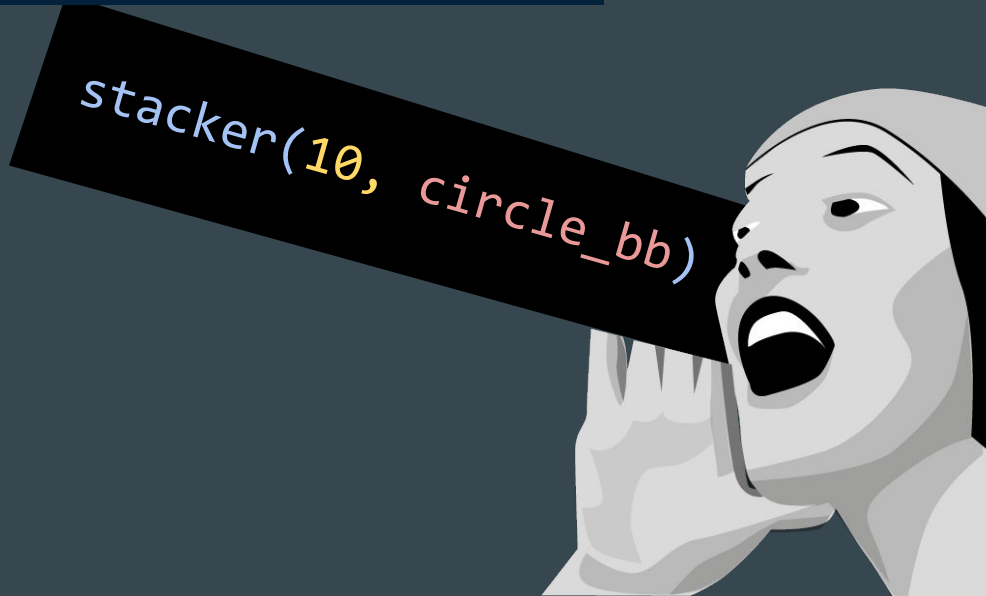


```
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```



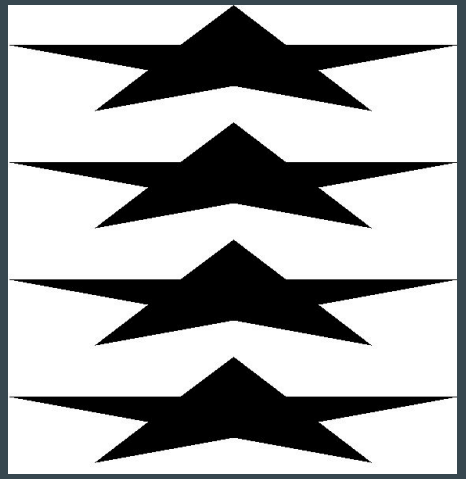
```
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```





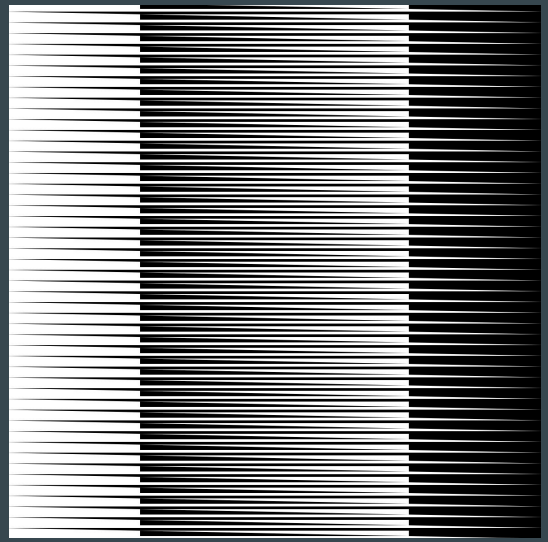
```
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```

```python
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```



```python
stacker(4, pentagram_bb)
```

```python
def stacker(n, rune):
    result = rune
    for number in range(n-1):
        result = stack_frac(1/(number+2), rune, result)
    show(result)
```



50 rows of rcross_bb

Summary

You

Follow what I say and do it for me!

Smaller, Simpler, Steps

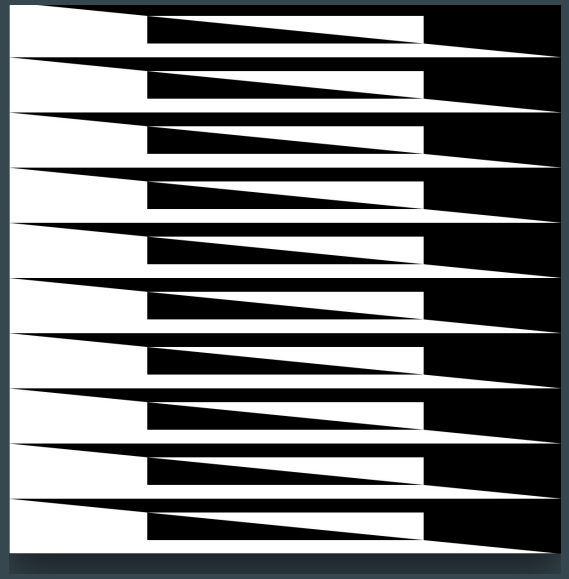
Cool and complex stuff

Last video

You

```
Loop this.
Update variable.
```

Repeat similar steps



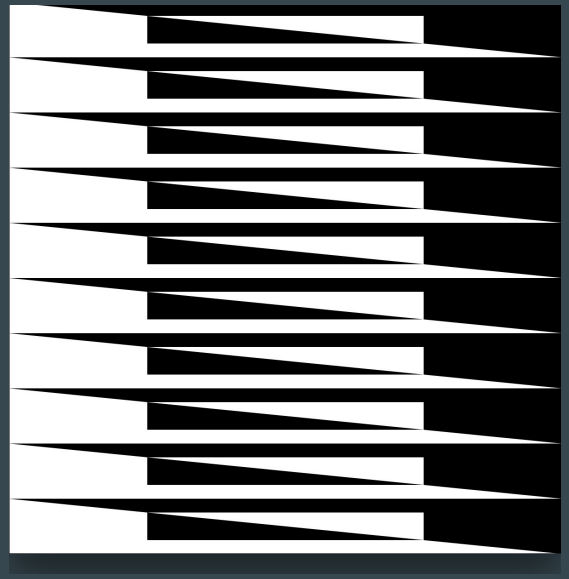
Cool and complex stuff

This video

You

```
Functions with
parameters
Loop this.
Update variable.
```

Repeat similar steps



Cool and complex stuff