

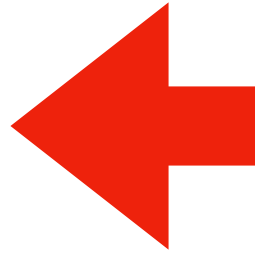
[220 / 319] Variables and Expressions

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Andy Kuemmel

Today's Outline

Review

- Operator Precedence



Expressions, Variables, and Assignments

Demos

Bugs



Demos

Naming variables

Demos

Unordered

What is it?	Python Operator
comparison	==, !=, <, <=, >, >=
signs	+x, -x
AND	and
add/subtract	+, -
exponents	**
NOT	not
OR	or
multiply/divide	*, /, //, %

Ordered by Precedence

What is it?	Python Operator

simplify first

simplify last

Unordered

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10 - -2 // 3

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Ordered by Precedence

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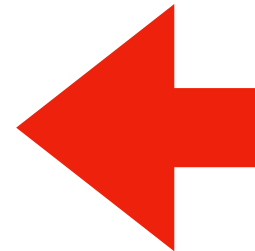
1+1==2 or 3 ** 10000000 > 2 ** 20000000

logical operators
can "short circuit"

Today's Outline

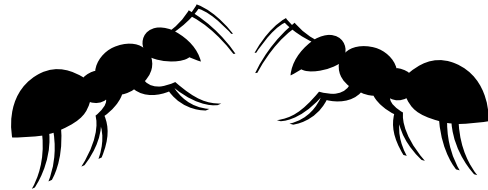
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Expressions

Expressions are a mix of **operators** and **operands**. For example:

$5 + 5$

$(8/2) ** 2 * 3.14$

$3 * 3 > 4 + 4$

$3 \% 2 == 0$ or $3 \% 2 == 1$

Each of these operands is an example of a *literal*: a fixed value

Expressions

Expressions are a mix of operators and operands. For example:

$x + y$

$(\text{diameter}/2) ** 2 * \text{pi}$

$\text{value1} * \text{value1} > \text{value2} + \text{value2}$

$\text{num} \% 2 == 0$ or $\text{num} \% 2 == 1$

An operand may also be a *variable*: not fixed

Expressions

Expressions are a mix of operators and operands. For example:

$x + y$

(diameter

value \times

num $\% 2$

Quick Test! Circle the **literals** (others are **variables**)

1. 0

2. zero

3. num1

4. True

5. hello

6. "goodbye"

An operand may also be a *variable*: not fixed

How do we put a value in a variable?

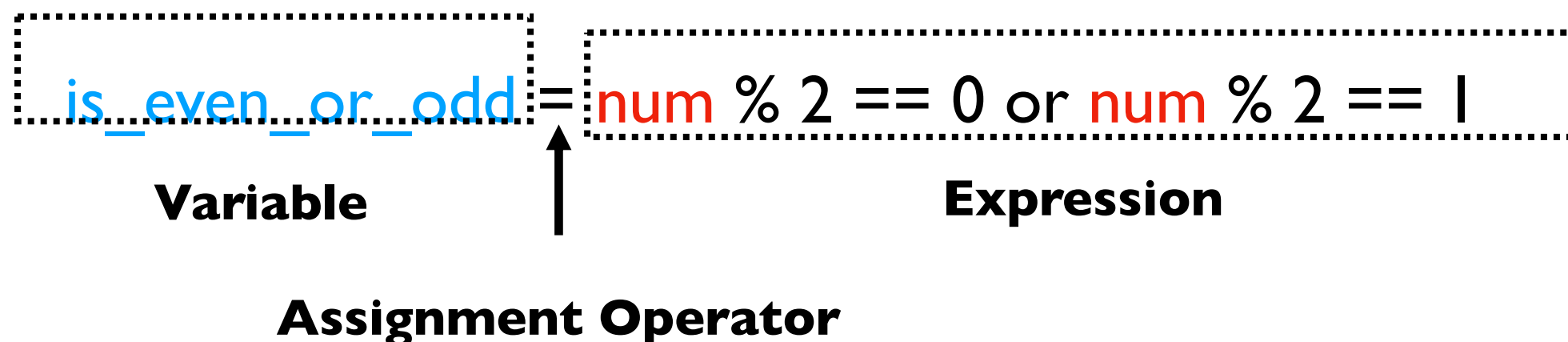
Assignment

An **assignment** computes an expression (maybe a simple one) and puts the result in a variable:

total = **x** + **y**

area = (**diameter**/2) ** 2 * **pi**

is_bigger = **value1** * **value1** > **value2** + **value2**



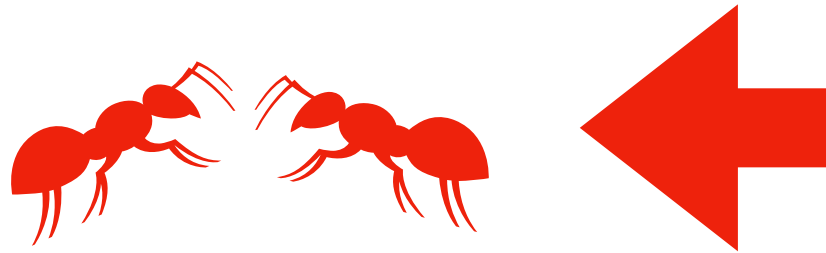
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Categories of Errors

1

dog cat the of chase any

[word soup, not grammatically sensible]

2

this sentence is false

[grammatical, but my head explodes if I think about it]

3

one week is 10 days long

[grammatical, coherent, but incorrect]

Categories of Errors

1

Syntax Error

- It never makes sense in any context; Python doesn't even run

- `5 = x`

2

Runtime Error

- Need to run to find out whether it will crash
- Appears with different names (TypeError, ZeroDivisionError, etc)

- `x = 5 / 0`

3

Semantic Error

- It runs with no error, but you get the wrong answer

- `square_area = square_side * 2`

Categories of Errors

1

Syntax Error

- It never makes sense in any context; Python doesn't even run

- `5 = x`

2

Runtime Error

- **what kind of error is the worst?**

- `x = 5 / 0`

3

Semantic Error

- It runs with no error, but you get the wrong answer

- `square_area = square_side * 2`

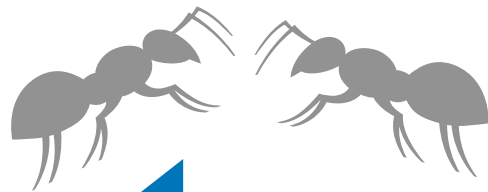
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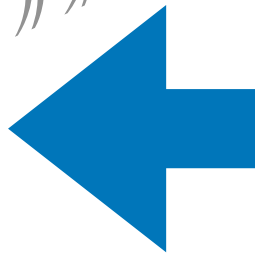
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int Demo

```
a = 3  
b = 4  
c = 5  
d = 6
```

**What is the sum of all the odd values?
(in this case, 3 + 5)**



float Demo

Compound growth:

- you start with **\$1000**
- every year it grows by **7%**
- you wait **30 years**
- how much do you have at the end?

year 0: \$1000

year 1: \$1070

year 2: ...



str Demo

Visually compare two scores:

- Alice has 10 points
- Bob has 8 points

Desired output:

```
alice: | | | | | | | | | |
bob:   | | | | | | | |
```

even better

```
alice: | | | | | | | | | |
bob:   | | | | | | | |
```

bool Demo

Bounds check: is the value between 0 and 100?

YES

NO

output is

you may continue: True

output is

you may continue: False

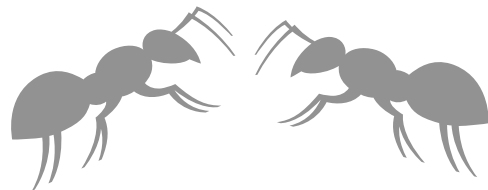
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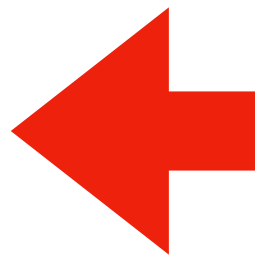
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What Variable Names are Allowed?

`1st_score = 100` [bad variable]

`score_1 = 100` [good variable]

`firstScore = 100` [not a recommended variable]

`first_score = 100` [recommended variable]

current rules are quite complex:

<https://www.python.org/dev/peps/pep-3131>

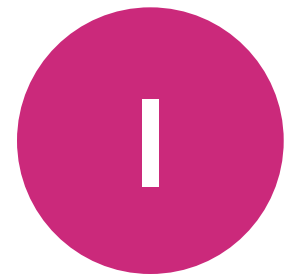
please don't use camel case:

<https://www.python.org/dev/peps/pep-0008/>

Python 3 has become friendlier to non-English programmers

`quero_café = True` ← this is allowed, and
different than "e"

Conservative Rules for English Code



Only use letters a-z (upper and lower), numbers, and underscores



Don't start with a number



Don't use Python keywords (e.g., and, False, etc)

for 220, you may use characters from any script and variables in any language you prefer, but we won't cover variable naming rules for any other language

Conservative Rules for English Code

1

Only use letters a-z (upper and lower), numbers, and underscores

2

Don't start with a number

3

Don't use Python keywords (e.g., and, False, etc)

GOOD:

cs220
CS220
cs_220
_cs220

BAD:

220class
and
pi3.14
x!

PLEASE never name a variable after a type (e.g., int, str, etc)

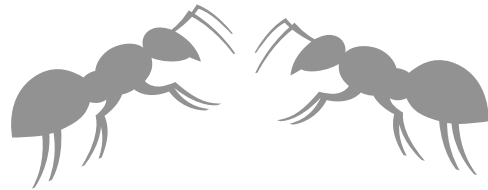
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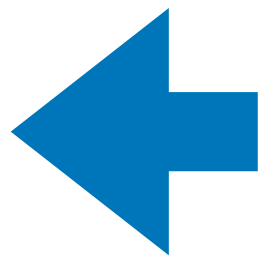
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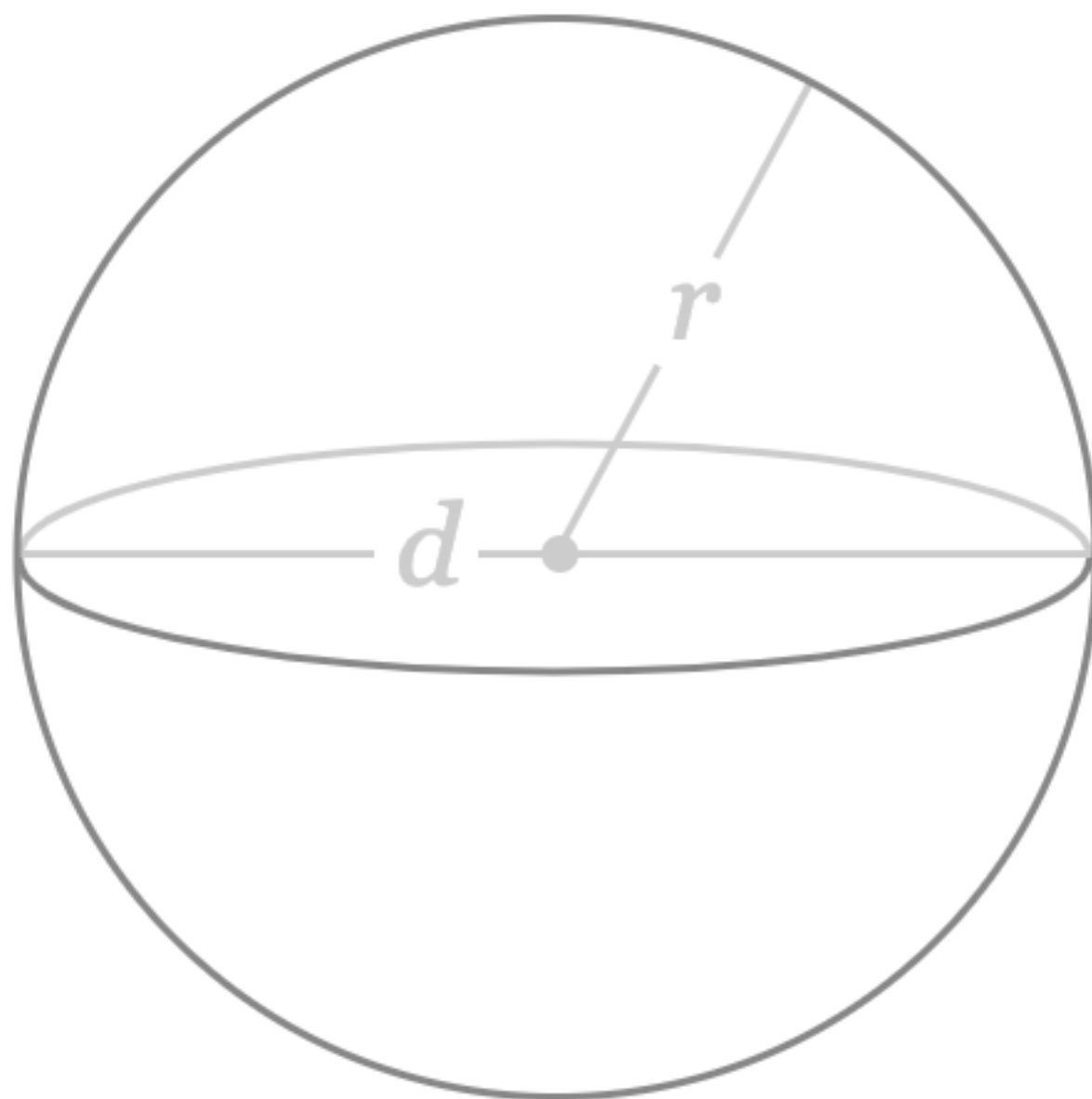
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Sphere Volume Demo



$$V = \frac{4}{3} \pi r^3$$

bonus: find radius given a volume

Quadratic Formula Demo

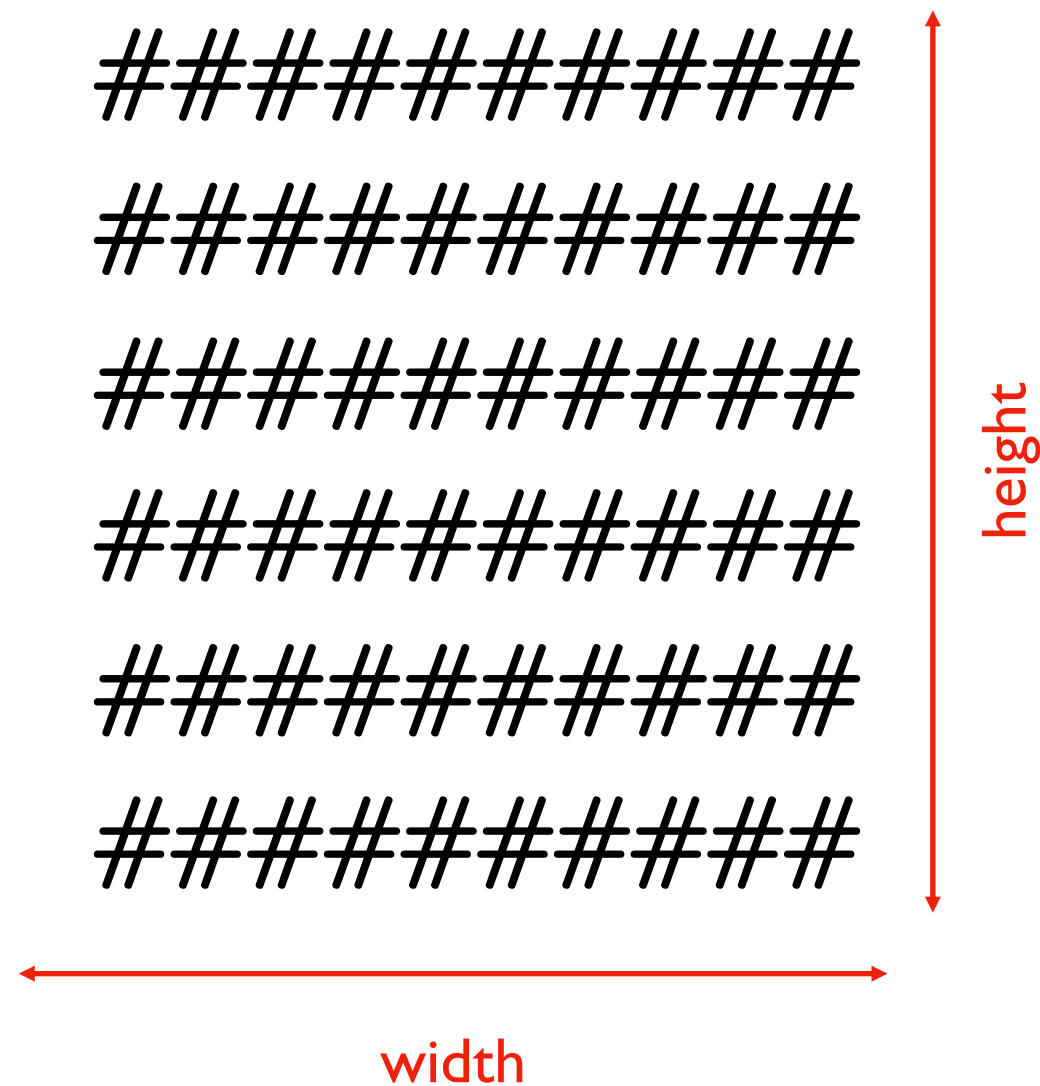
$$ax^2 + bx + c = 0$$

what values of x satisfy the above?

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

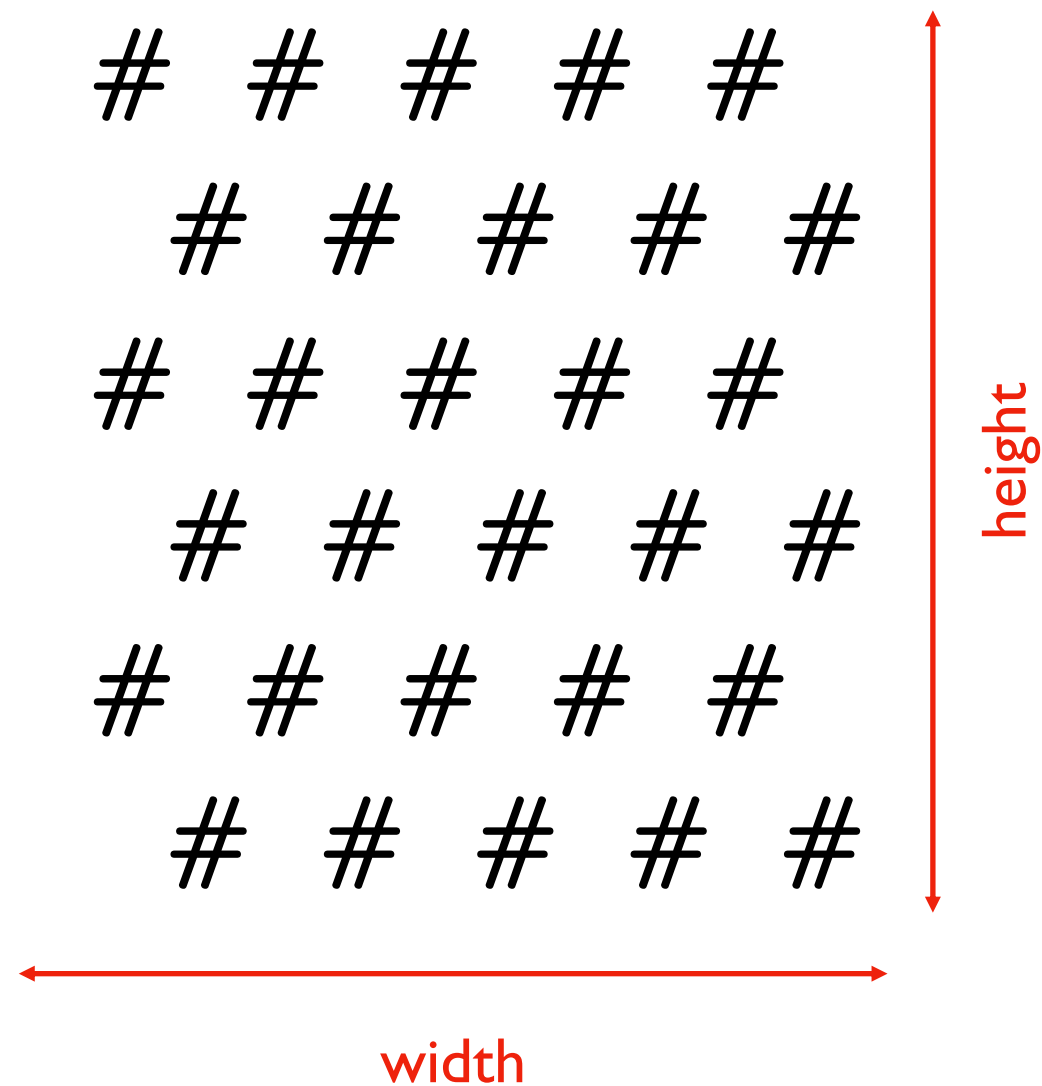
Character Art: Block

write some code to draw the following:



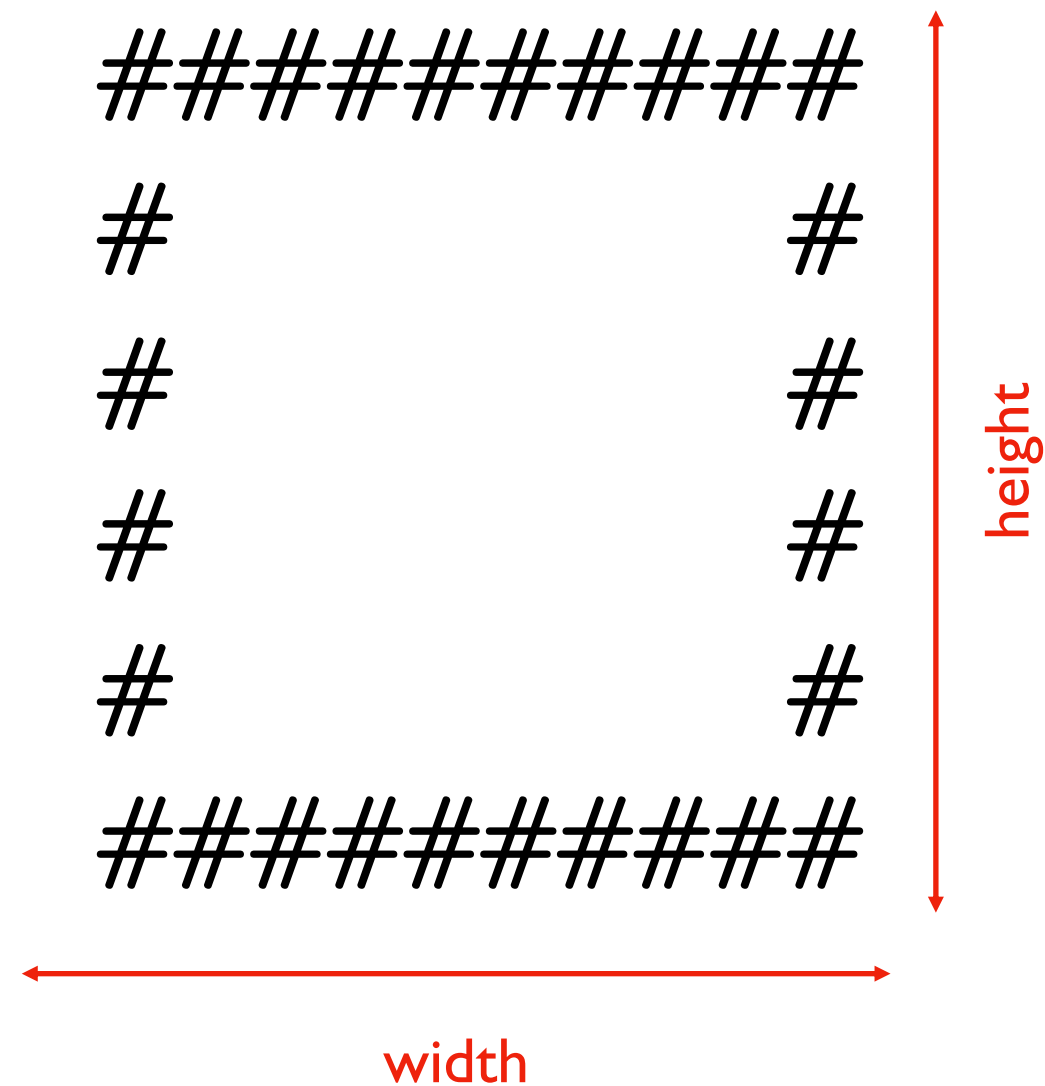
Character Art: Checkers

write some code to draw the following:



Character Art: Border

write some code to draw the following:



Character Art: Snake

write some code to draw the following:

