

[301] Variables and Expressions

Tyler Caraza-Harter

Learning Objectives

Variables:

- Purpose
- Naming

Assignment:

- Syntax
- Reassignment

Types of errors:

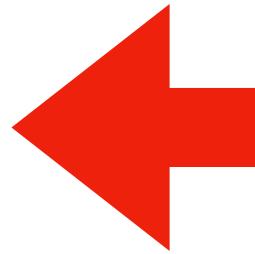
- syntax, runtime, semantic

**Reading:
Ch 2 of Think Python**

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

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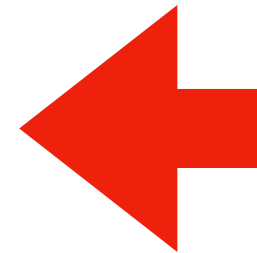
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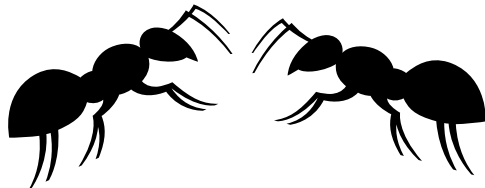
Review

Expressions, Variables, and Assignments



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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 $3 \% 2 == 1$

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what if we don't want it to be fixed?

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$x + y$

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

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

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

Expressions

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

$x + y$

(diameter)

value1

num %

1. 0

2. zero

3. num1

4. True

5. hello

6. "goodbye"

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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:

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

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

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

= **num** % 2 == 0 or **num** % 2 == 1

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
```

```
is_even_or_odd = num % 2 == 0 or num % 2 == 1
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Expression

Assignment

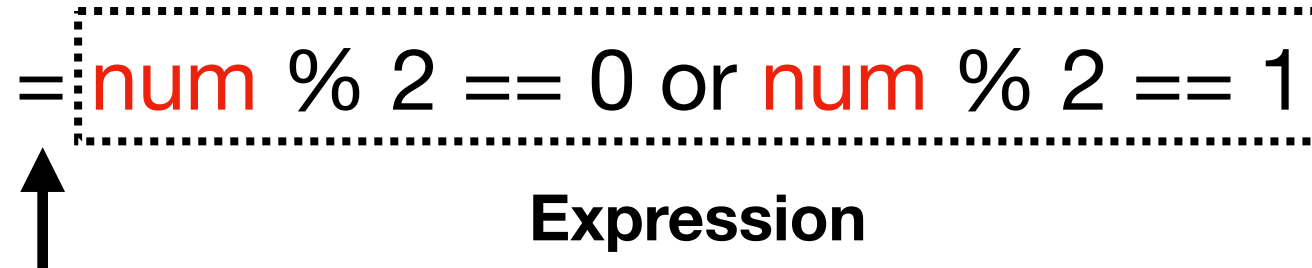
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The diagram illustrates the components of an assignment statement. An upward-pointing arrow from the label 'Assignment Operator' points to the '=' symbol in the line 'is_even_or_odd = num % 2 == 0 or num % 2 == 1'. A dashed rectangular box encloses the entire right-hand side of the assignment, 'num % 2 == 0 or num % 2 == 1', with the label 'Expression' centered below it.

Assignment Operator

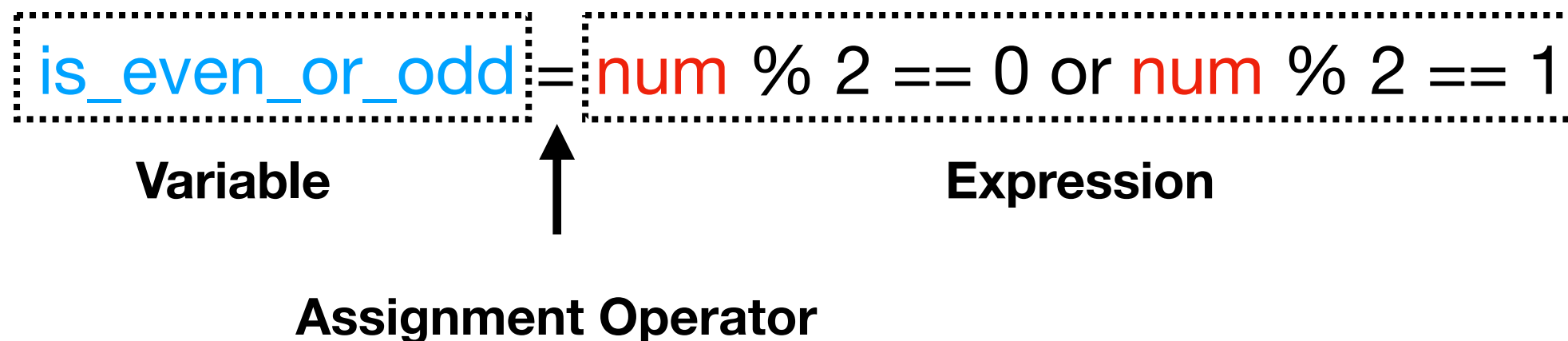
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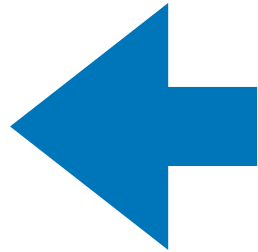


Today's Outline

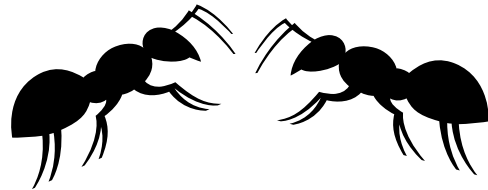
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Demos



Bugs



Demos

Naming variables

Demos

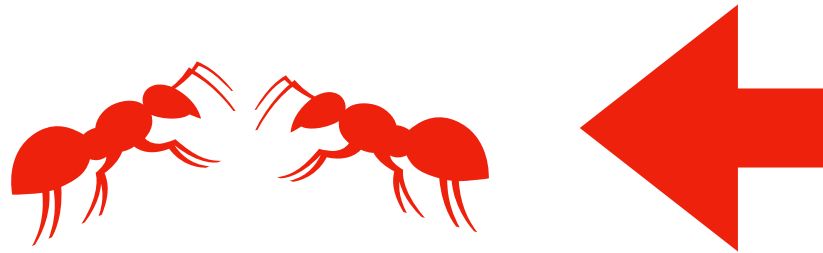
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Categories of Errors

1

dog cat the of chase any

[word soup, not grammatically sensible]

2

3

Categories of Errors

1

Syntax Error

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

- 5 = x

2

3

Categories of Errors

1

Syntax Error

- It never makes sense in any context; Python doesn't even run
- `5 = x`

2

this sentence is false

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

3

Categories of Errors

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Syntax Error

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- `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`

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one week is 10 days long
[grammatical, coherent, but incorrect]

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Semantic Error

- It runs with no error, but you get the wrong answer
- `square_area = square_side * 2`

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Runtime Error

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what kind of error is the worst? (Error, etc)

3

Semantic Error

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- `square_area = square_side * 2`

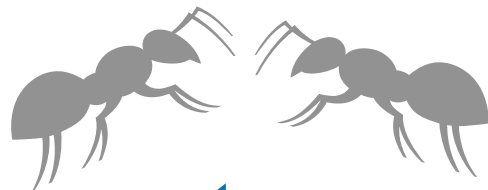
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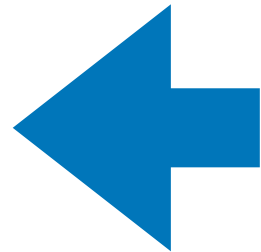
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Demos

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

output is

`you may continue: True`

NO

output is


`you may continue: False`

Today's Outline

Review

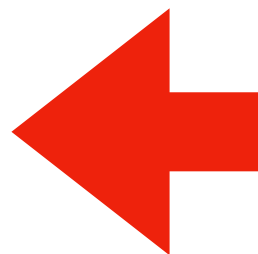
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Demos

What Variable Names are Allowed?

`1st_score = 100` [bad variable]

`score_1 = 100` [good variable]

Variable naming rules have become quite complex:

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

Python 3 has become friendlier to non-English programmers

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)

for 301, 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

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GOOD:

```
cs301  
CS301  
cs_301  
_cs301
```

BAD:

```
301class  
and  
pi3.14  
x!
```

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pi3.14 1  
x! 1
```

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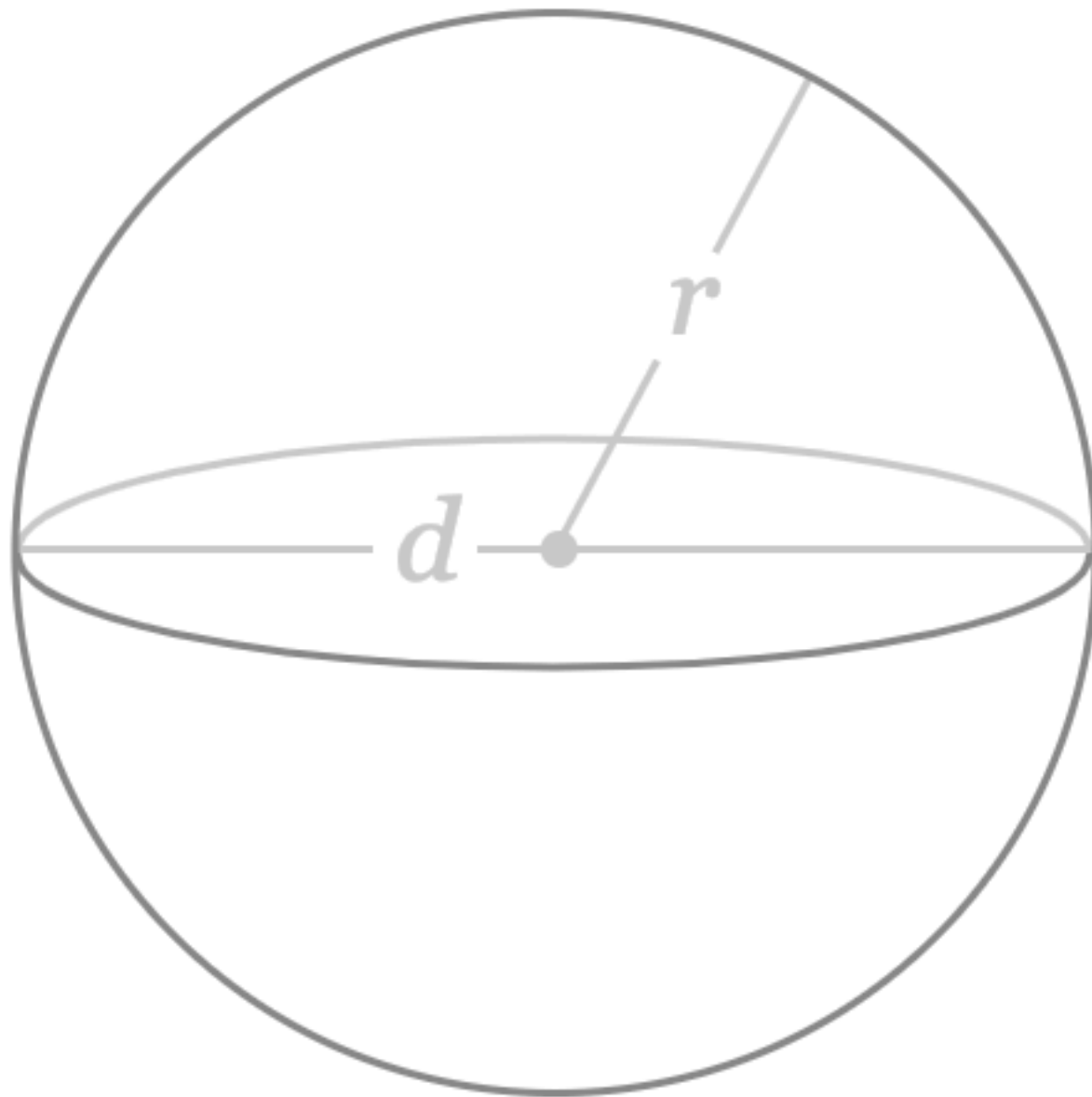
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Sphere Volume Demo



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

bonus: find radius given a volume

Quadratic Formula Demo

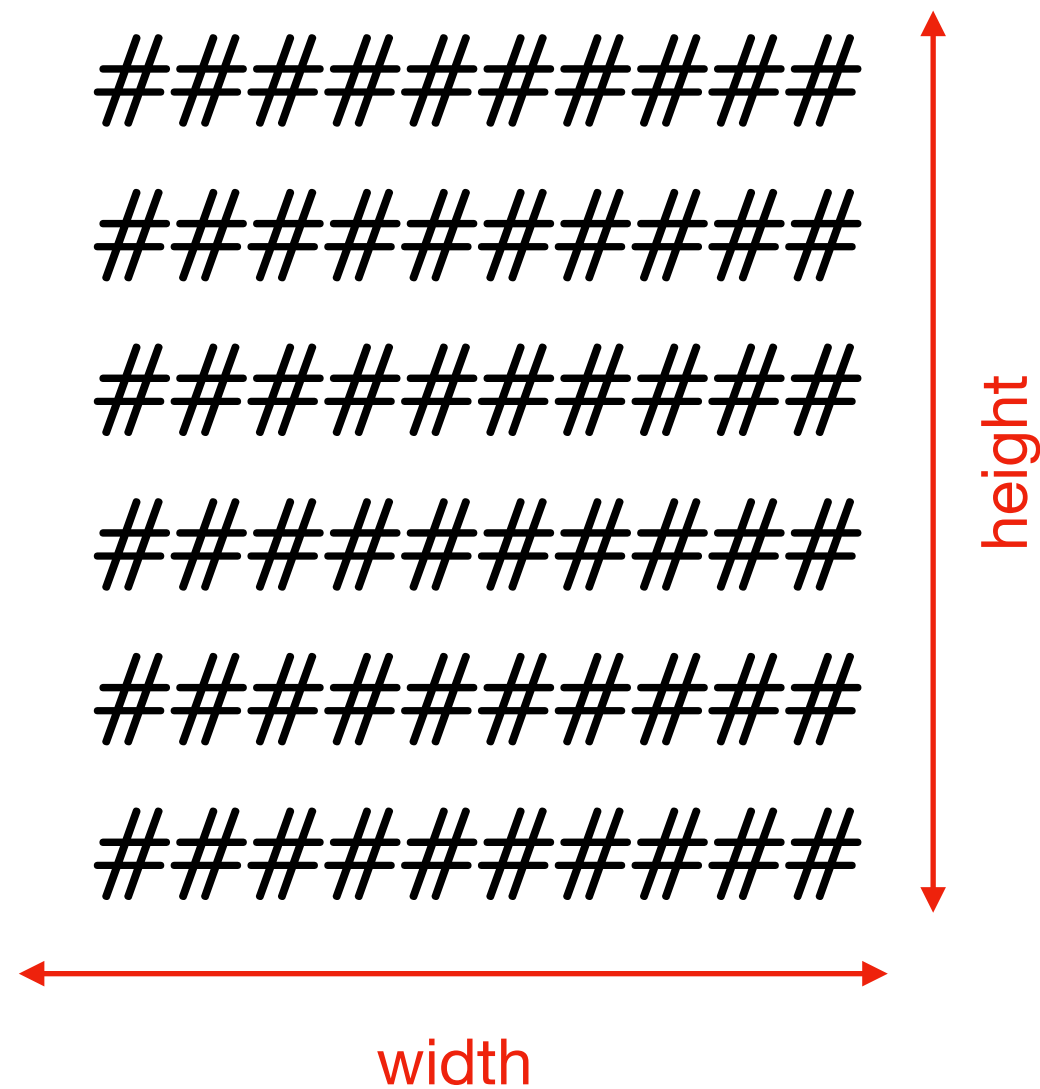
$$ax^2 + bx + c = 0$$

what values of x satisfy the above?

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

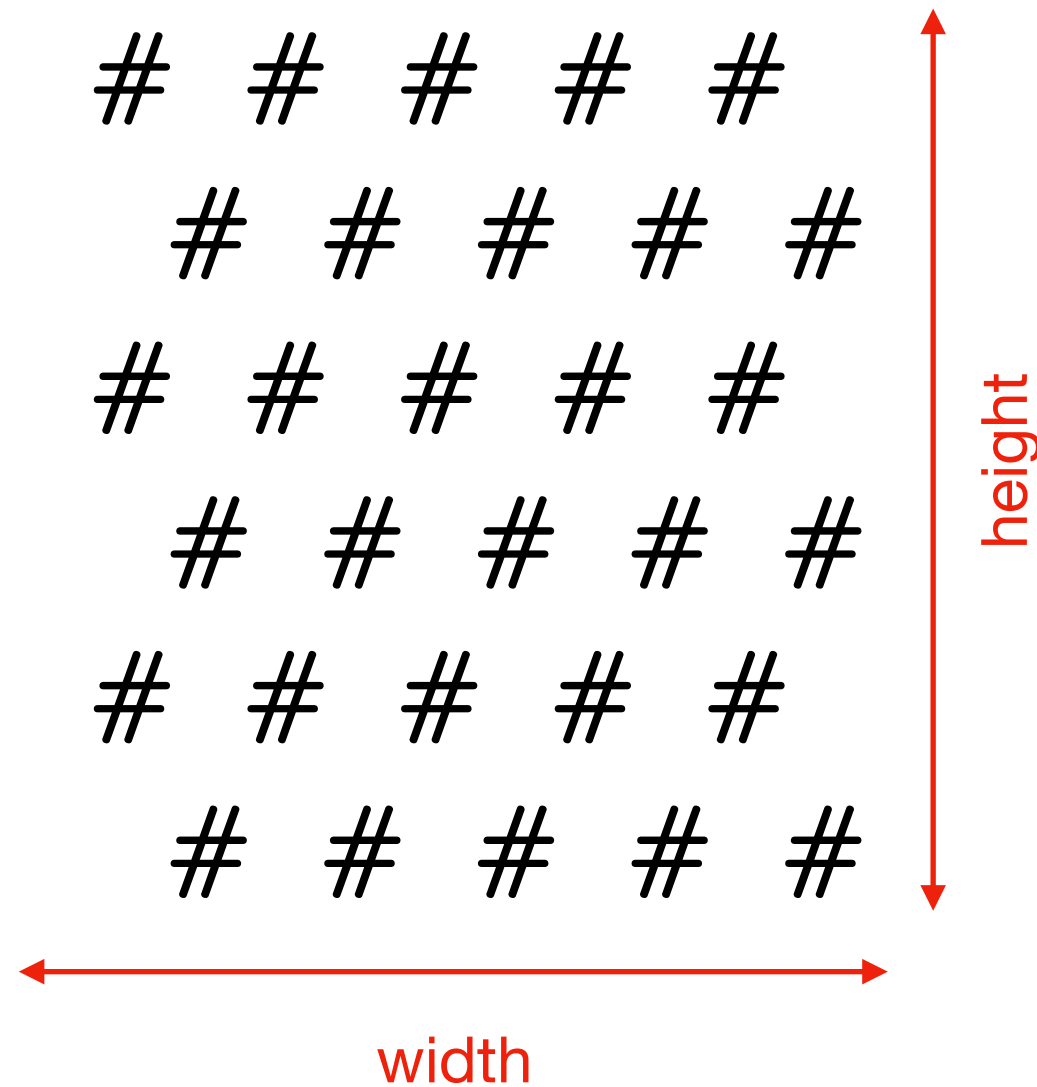
Character Art: Block

write some code to draw the following:



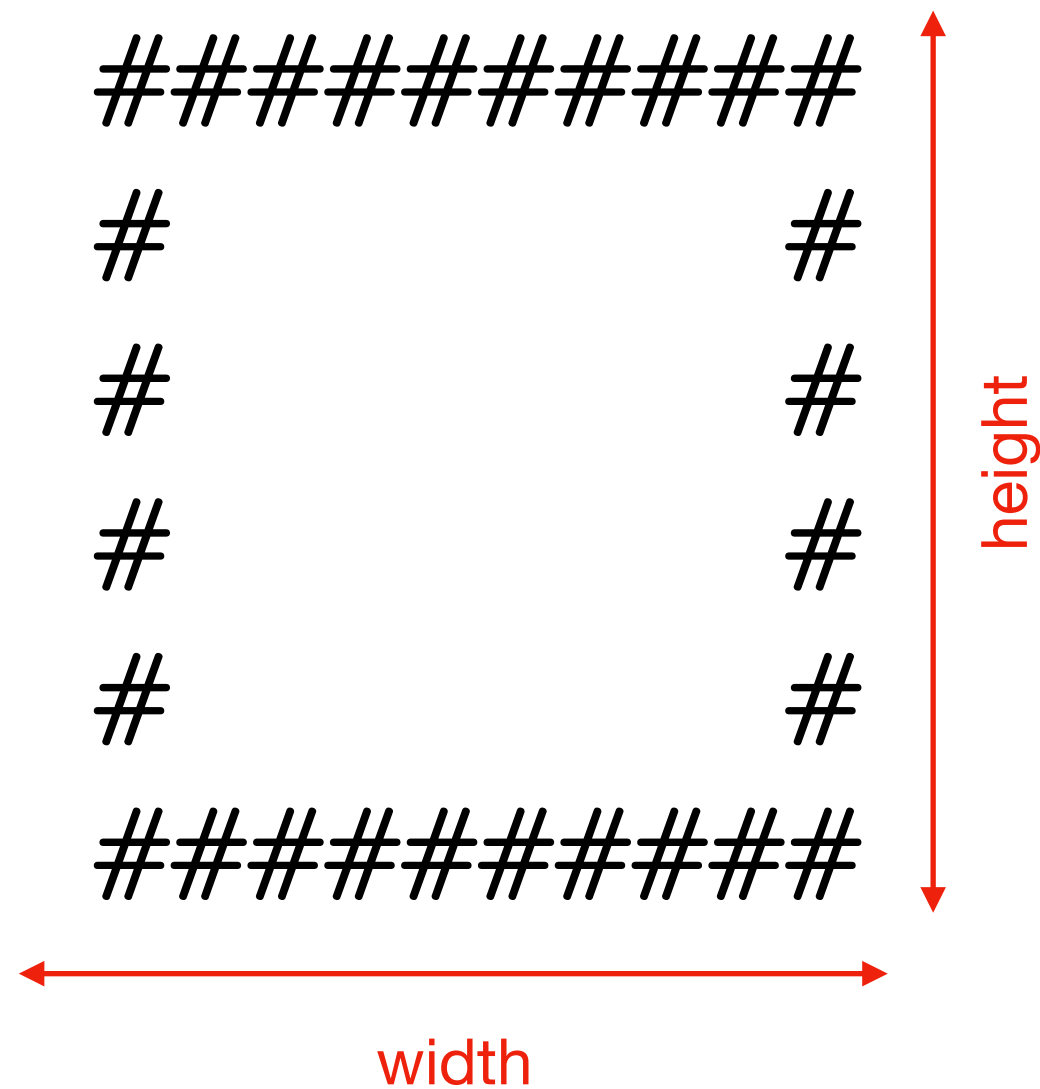
Character Art: Checkers

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:

