[220 / 319] Variables and Expressions

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Readings:
Chapter 2 of Think Python,
Chapter 3 of Python for Everybody

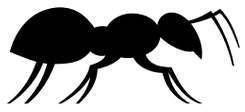
Due: P1

Today's Outline

Review
- Operator Precedence

Expressions, Variables, and Assignments

Demos

Bugs 

Demos

Naming variables

Demos

Unordered

What is it?	Python Operator

Ordered by Precedence

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

simplify first

10 - -2 // 3

simplify last

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simplify first

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

logical operators
can "short circuit"

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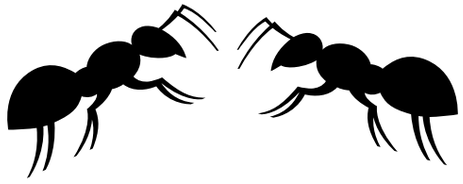

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Expressions

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

(diameter/2) ** 2 * pi

value1 * value1 > value2 + value2

num % 2 == 0 or 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

(diamete

value1 *

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?

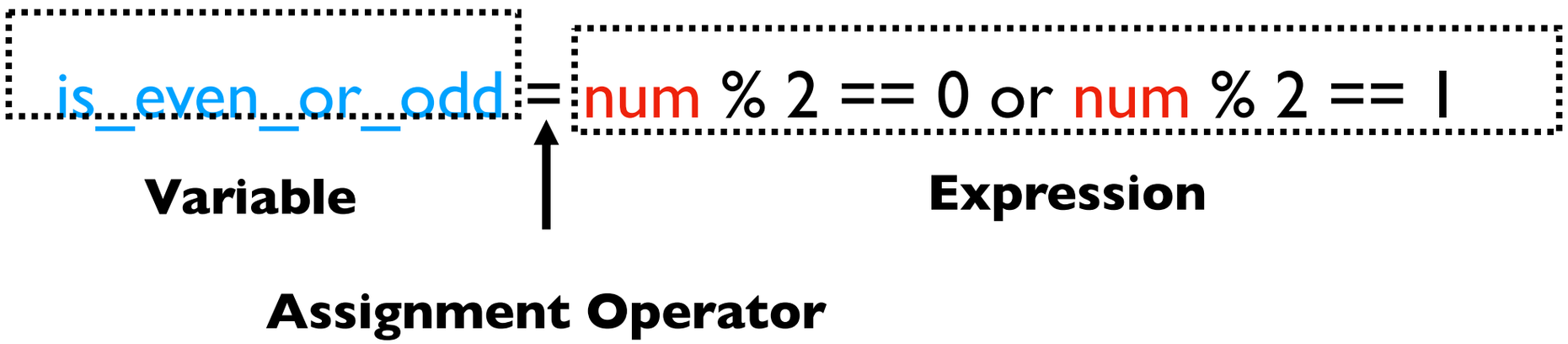
Assignment

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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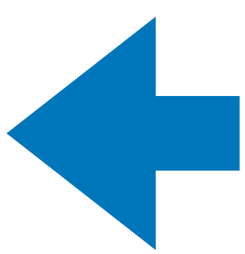

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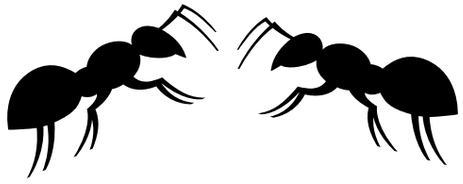

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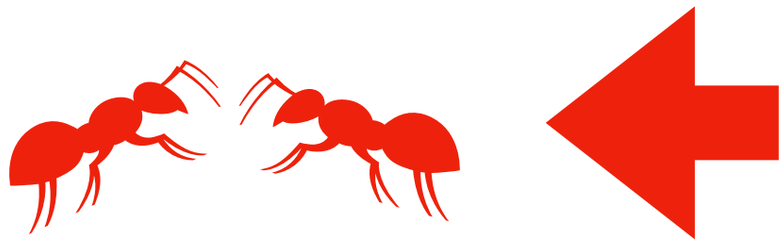

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Categories of Errors

1

dog cat the of chase any

[word soup, not grammatically sensible]

2

3

Categories of Errors

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Syntax Error

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

2

3

Categories of Errors

1

Syntax Error

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2

this sentence is false

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

3

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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`

Categories of Errors

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Syntax Error

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

- `x = 5 / 0`

what kind of error is the worst?

3

Semantic Error

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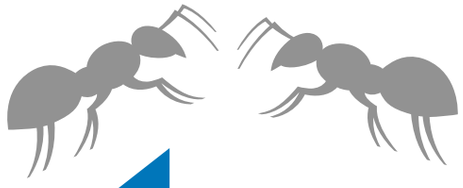

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Example: int expressions

```
seconds = 12345
```


Print out hours, minutes, and seconds

Example: float expressions

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: ...

Example: string expressions

Visually compare two scores:

- Alice has 10 points
- Bob has 8 points

Desired output:

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

even better

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

Example: bool expressions

Bounds check: is the value between 0 and 100?

YES

output is

`you may continue: True`

NO

output is

`you may continue: False`

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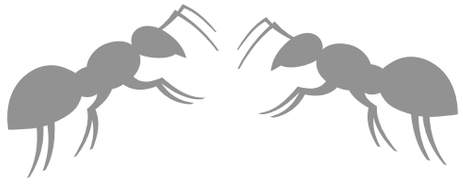

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What Variable Names are Allowed?

```
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

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 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!
```

what rules are violated?

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

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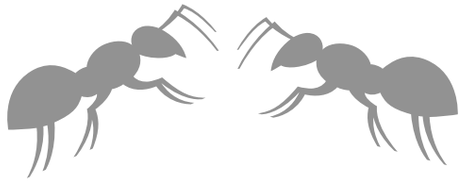

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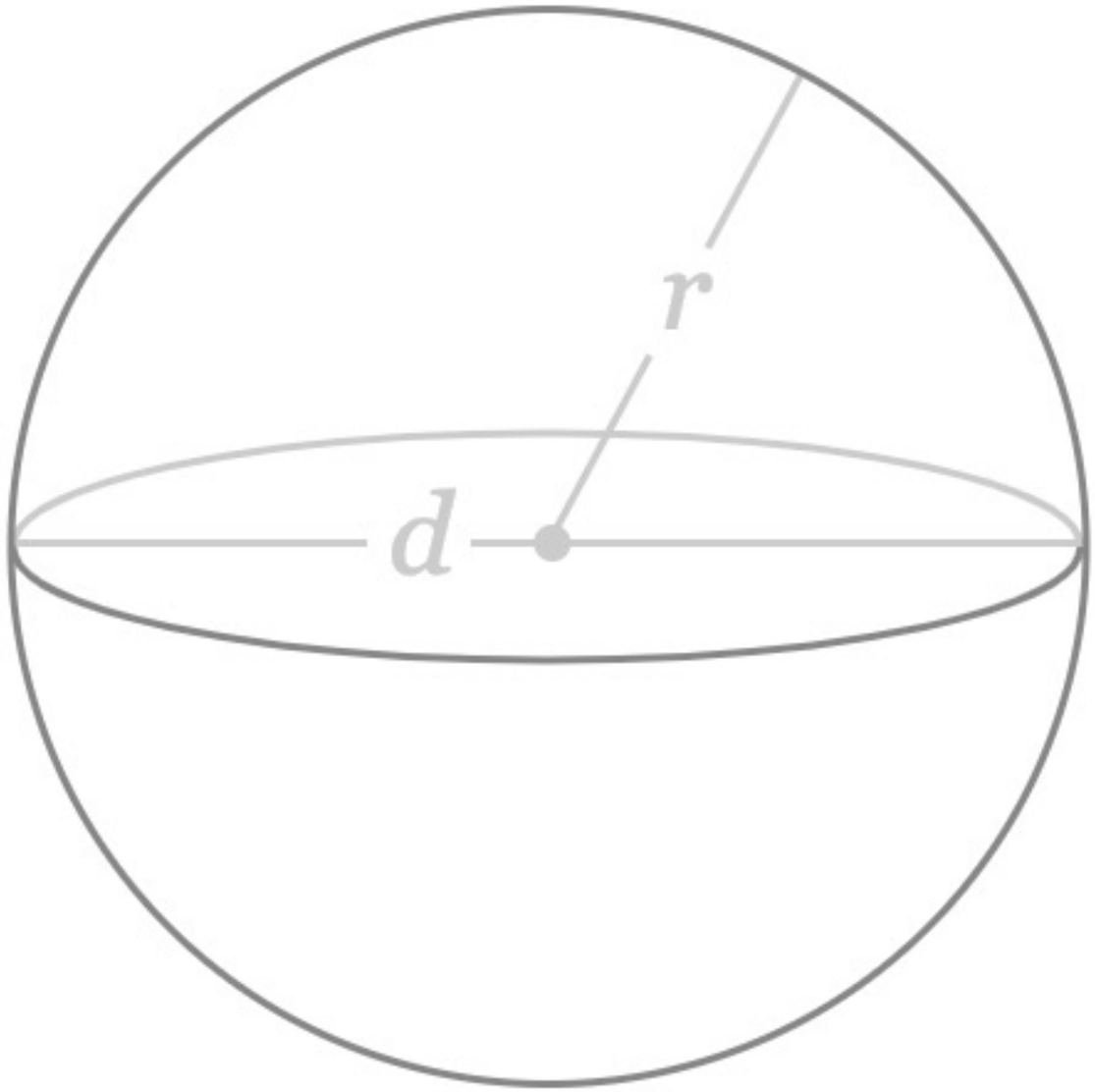
Practice: Sphere Volume



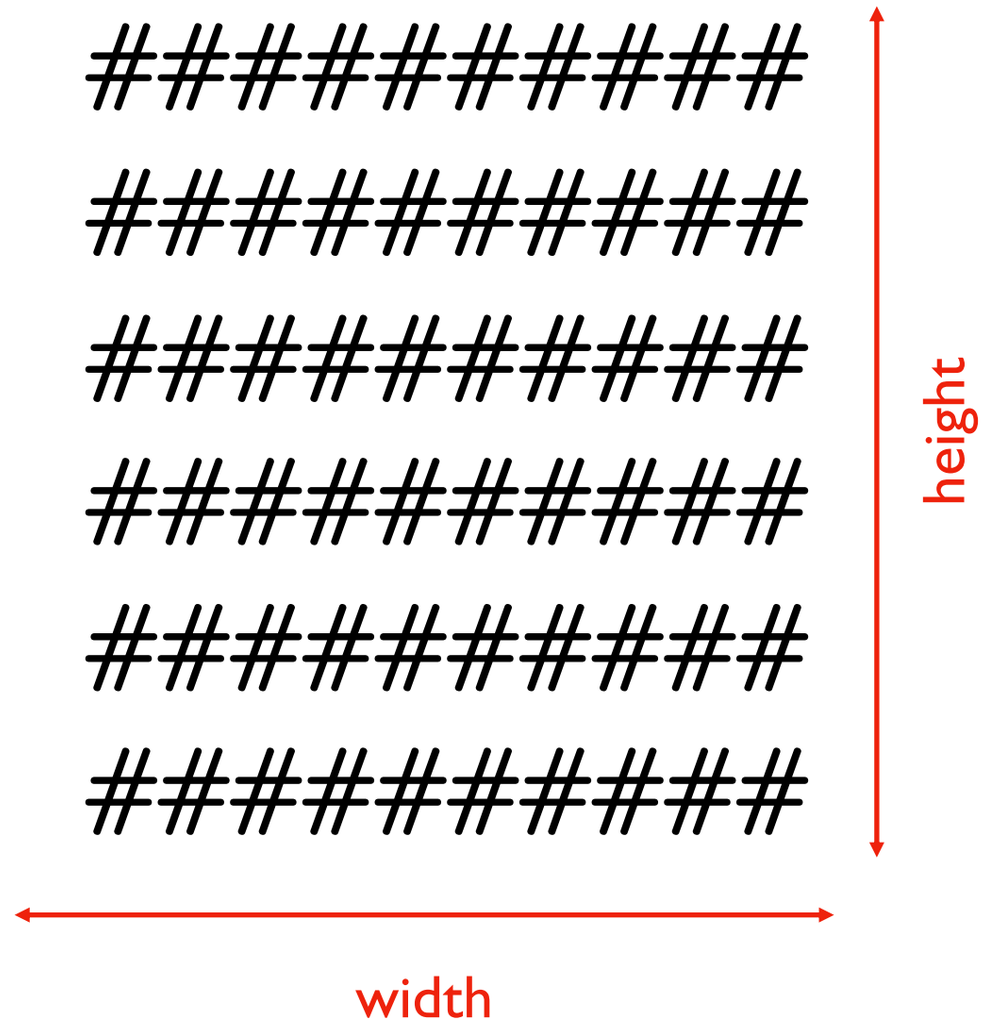
$$V = \frac{4}{3}\pi r^3$$

extension: find radius given a volume

https://www.google.com/search?q=sphere%20calc%3A%20find%20V&oq=area+of+a+sphere&aqs=chrome.0.0l6.2671j0j7&sourceid=chrome&ie=UTF-8&skip=s

Practice: Character Art - Block

write some code to draw the following:



Practice: Quadratic Formula

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

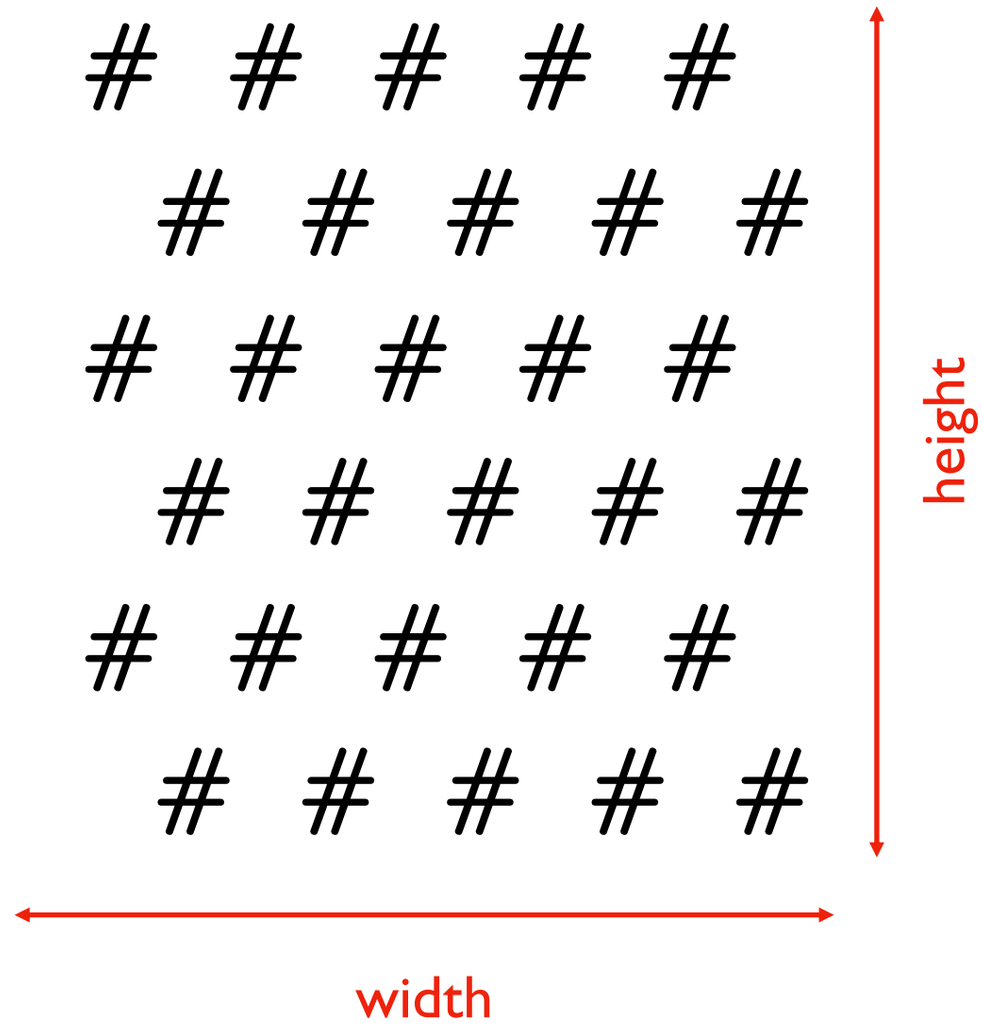
what values of x satisfy the above?

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

https://en.wikipedia.org/wiki/Quadratic_formula

Challenge*: Checkers

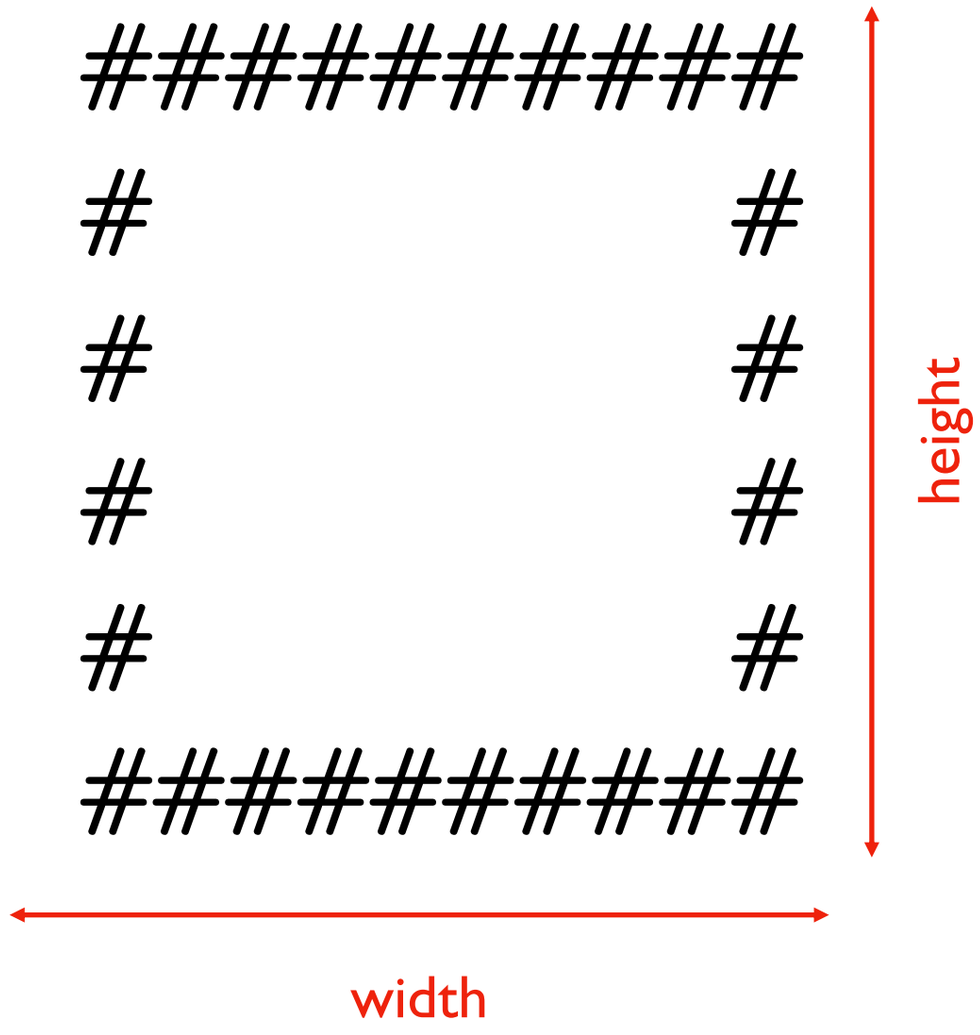
write some code to draw the following:



*** Challenge = beyond what you would be asked to do on an exam**

Challenge: Border

write some code to draw the following:



Challenge: Snake

write some code to draw the following: