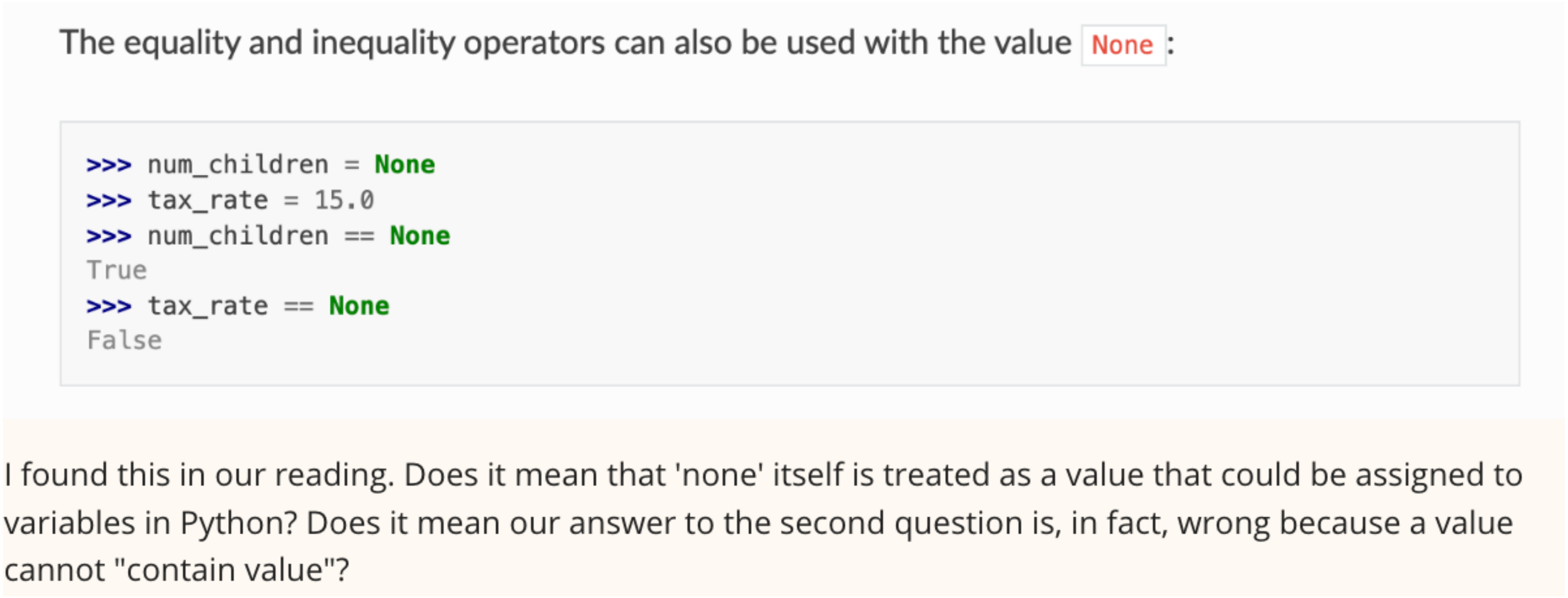
MACS 30111

Control Flow

Agenda

- **Misc**
  - Who tested their code for str?
    - str(867-5309) vs str(”867-5309”) vs str = "867-5309"
  - Is there any example of when "not" to use None as the default value?
  - Ed: discussion / Qs
- HW00 **grading**
- SE1 **due date**: TUESDAY (try to submit by Friday 9/29)
- NAME COACH!
- Note: recommended reading from online version of book (not PDF – content is the same but numbering is a bit different)

What do we think?


The equality and inequality operators can also be used with the value `None`:

```
>>> num_children = None
>>> tax_rate = 15.0
>>> num_children == None
True
>>> tax_rate == None
False
```

I found this in our reading. Does it mean that 'none' itself is treated as a value that could be assigned to variables in Python? Does it mean our answer to the second question is, in fact, wrong because a value cannot "contain value"?

AI AND YOU/ME/WE/US

- What does it mean for something to be your own work?
- What does it mean to use AI?
- What is / should our policy be?

Topics:

- ❑ Introduction
- ❑ *if else* conditional Statements
- ❑ *for* loops (sequence-based loops)
- ❑ *while* loops (condition-based loops)

Statements

Simple statements: assignments and the print function

```
n = 7
print("n is", n)
n = n + 10
print("n is now", n)
```

These are four statements, which Python will execute sequentially.

A program is a sequence of *statements* that are run in the order in which they appear.

Control Flow

Sometimes, instead of running statements sequentially, we may want to alter the ***control flow*** of the program. For example:

- *I may only want to run some statements if a given condition is met: "Add a tax to the price, unless the customer is tax-exempt"*
- *I may want to run the some statements multiple times: "For every item in our inventory, increase the price by 5%"*

Imperative programming languages (e.g., Python) provide ***conditional statements*** and ***looping statements*** precisely to implement behaviors like these.

Topics:

- ❑ Introduction
- ❑ ***if else* conditional Statements**
- ❑ *for* loops (sequence-based loops)
- ❑ *while* loops (condition-based loops)

Conditional statements

For example:

```
if (n % 2) == 1:
    print(n, "is odd")
else:
    print(n, "is even")
```

The basic structure:

```
if <boolean expression>:
    <statements to run if True>
else:
    <statements to run if False>
```

When describing Python syntax, we will use <...> to denote placeholders.

A conditional statement allows the program to perform different actions based on the value of a boolean expression.

Focus on formatting

- Notice we don’t NEED to use parentheses for the entire statement
    - But can, to make it easier for us to see / parse

For example:

```
if (n % 2) == 1:
    print(n, "is odd")
else:
    print(n, "is even")
```

The basic structure:

```
if <boolean expression>:
    <statements to run if True>
else:
    <statements to run if False>
```

Conditional statements

For example:

```
if n < 0:
    print(n, "is negative")
elif n % 2 == 1:
    print(n, "is positive and odd")
else:
    print(n, "is positive and even")
```

Conditionals can also have multiple branches:

```
if <boolean expression>:
    <block>
elif <boolean expression>:
    <block>
else:
    <block>
```

Quiz

Conditional statements involve using the following keywords …

- ○ if, otherwise
- ○ if, else, default
- ○ if, elif, else

A conditional statement in Python decides what branch to run by evaluating …

- ○ An arithmetic expression
- ○ A boolean expression
- ○ An expression that returns either one or zero

Topics:

- ❑ Introduction
- ❑ *if else* conditional Statements
- ❑ ***for* loops (sequence-based loops)**
- ❑ *while* loops (condition-based loops)

Loops

Loops provide a mechanism for **repeating** work in a program.

For example:

- Given a set of values, we may want to perform the same action on each of them.
- We may want to keep performing a certain action until a condition is true.

There are two types of loops: *"for"* loops and *"while"* loops.

“for” loops

Structure:

```
for <variable> in <sequence>:
    <statements to run>
```

For example:

```
for n in [1, 4, 8, 9, 11]:
    print(n)
```

Perform the same action on each of them in sequence

“*for*” loops

Structure:

for <*variable*> **in** <*sequence*>**:**
    <*statements to run*>

“body” of the loop:
- Can contain multiple statements
- Conditional, loops

```
for n in [1, 4, 8, 9, 11]:
    if (n % 2) == 1:
        print(n, "is odd")
    else:
        print(n, "is even")
```

“for” loops

Using for loops to do something with all the integers in a given range.

```
for n in [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]:
    if (n % 2) == 1:
        print(n, "is odd")
    else:
        print(n, "is even")
```

The built-in range function:

```
for n in range(1, 21):
    if (n % 2) == 1:
        print(n, "is odd")
    else:
        print(n, "is even")
```

Primality Testing

Given an integer, determine whether it is prime or not:

- greater than 1
- can only be divided by itself and 1

Hint: combine loops and conditionals

Code

Work through: sketch

- Given an integer, determine whether it is prime or not:
    - Is the integer larger than 1?
    - Is the number divisible by anything smaller than itself?
- Code attempt:

```
var = 5

if var > 1:
        for num in range (2, var):
                if var % num == 0:
                        print(“var is not prime”)
                else:
                        print(“var is prime”)
else:
        print(“integer is not prime”)
```

Work through: sketch

- Given an integer, determine whether it is prime or not:
  - Is the integer larger than 1?
  - Is the number divisible by anything smaller than itself?
- Code attempt:

```
encountered_divisor = False
var = 83
for i in range(2, var):
	if var % i == 0:
		encountered_divisor = True

if encountered_divisor:
	print(var, "is NOT prime")
else:
	print(var, "is prime")
```

Quiz

What statement do we use to stop the execution of a loop?

- stop
- exit
- break
- endloop

Further example:

- What will this code do?

```
encountered_divisor = False
 var = 80

for i in range(2, var):
    if var % i == 0:
        encountered_divisor = True
                print(i)
                break
if encountered_divisor:
        print(var, "is NOT prime")
else:
        print(var, "is prime")
```

Topics:

- Introduction
- *if else* conditional Statements
- *for* loops (sequence-based loops)
- ***while* loops (condition-based loops)**

Source: https://www.google.com/imgres?imgurl=https%3A%2F%2Fthumbs.dreamstime.com%2Fb%2Fwarning-precaution-attention-alert-icon-exclamation-mark-triangle-shape-stock-vector-161619022.jpg&tbnid=cs39D65ivQqdqM&vet=12ahUKEwjqyf78u8uBAxWiP94AHeaYAAAQMygFegQIARBk..i&imgrefurl=https%3A%2F%2Fwww.dreamstime.com%2Fillustration%2Falert-icon.html&docid=5Jir8W1uV2V0YM&w=800&h=800&q=red%20alert&hl=en&ved=2ahUKEwjqyf78u8uBAxWiP94AHeaYAAAQMygFegQIARBk

“*while*” loops

Structure:

while <*Boolean expression*>:
    <*statements to run*>

Adds up all the integers between 1 and N:

```
N = 10
i = 1
sum = 0

while i <= N:
    sum = sum + i
    i = i + 1

print(sum)
```

Repeat an action while a condition is true

Explicitly increment i

while	for

`while` *`<boolean expression>`*`:`
`<statements to run>`
	`for` *`<variable>`* **`in`** *`<sequence>`*`:`
	`<statements to run>`

repeat action with a boolean expression as stop condition	repeat action in sequence
unknown number of iterations	fixed number of iterations
more general, everything with for loop can be expressed as a while loop	less error-prone when working with sequences of values

`n = 1`
`while n < 11:`
`    if (n % 2) == 1:`
`        print(n, "is odd")`
`    else:`
`        print(n, "is even")`
`    n += 1`
	`for n in [1,2,3,4,5,6,7,8,9,10]:`
	`    if (n % 2) == 1:`
	`        print(n, "is odd")`
	`    else:`
	`        print(n, "is even")`

Quiz

A while loop repeats a block of code while a condition is true. How is this condition specified?

- ○ A boolean expression
- ○ An if-else statement
- ○ With a sequence of values

“for” loops are preferable when…

- ○ The body of the loop doesn’t include any if-else statements
- ○ Iterating over a sequence of values
- ○ I need to explicitly specify the stopping condition of the loop

Single quotes, double quotes, and backslash

```
He said: "she argues:'hello, world'"
```

- Put double quotes inside a single quotes;
- Put single quotes inside a double quotes;
- Use backslash to escape: if double quotes inside a double quotes, or single quotes inside a single quotes:

```
print("He said: \"she argues: 'hello, world'\"")
```

Summary:

- Introduction
- *if else* conditional statements
- *for* loops (sequence-based loops)
- *while* loops (condition-based loops)

Coding practice:

Chapter:

- 1.3