Beginner's Python Cheat Sheet

Variables and Strings

Variables are used to assign labels to values. A string is a series of characters, surrounded by single or double quotes. Python's f-strings allow you to use variables inside strings to build dynamic messages.

Hello world

```
print("Hello world!")
```

Hello world with a variable

```
msg = "Hello world!"
print(msg)
```

f-strings (using variables in strings)

```
first_name = 'albert'
last_name = 'einstein'
full_name = f"{first_name} {last_name}"
print(full_name)
```

Lists

A list stores a series of items in a particular order. You access items using an index, or within a loop.

Make a list

```
bikes = ['trek', 'redline', 'giant']
```

Get the first item in a list

```
first_bike = bikes[0]
```

Get the last item in a list

```
last_bike = bikes[-1]
```

Looping through a list

```
for bike in bikes:
    print(bike)
```

Adding items to a list

```
bikes = []
bikes.append('trek')
bikes.append('redline')
bikes.append('giant')
```

Making numerical lists

```
squares = []
for x in range(1, 11):
    squares.append(x**2)
```

Lists (cont.)

List comprehensions

```
squares = [x**2 for x in range(1, 11)]
```

Slicing a list

```
finishers = ['sam', 'bob', 'ada', 'bea']
first_two = finishers[:2]
```

Copying a list

```
copy_of_bikes = bikes[:]
```

Tuples

Tuples are similar to lists, but the items in a tuple can't be modified.

Making a tuple

```
dimensions = (1920, 1080)
resolutions = ('720p', '1080p', '4K')
```

If statements

If statements are used to test for particular conditions and respond appropriately.

Conditional tests

```
equal                x == 42
not equal            x != 42
greater than         x > 42
  or equal to        x >= 42
less than            x < 42
  or equal to        x <= 42
```

Conditional tests with lists

```
'trek' in bikes
'surly' not in bikes
```

Assigning boolean values

```
game_active = True
can_edit = False
```

A simple if test

```
if age >= 18:
    print("You can vote!")
```

If-elif-else statements

```
if age < 4:
    ticket_price = 0
elif age < 18:
    ticket_price = 10
elif age < 65:
    ticket_price = 40
else:
    ticket_price = 15
```

Dictionaries

Dictionaries store connections between pieces of information. Each item in a dictionary is a key-value pair.

A simple dictionary

```
alien = {'color': 'green', 'points': 5}
```

Accessing a value

```
print(f"The alien's color is {alien['color']}.")
```

Adding a new key-value pair

```
alien['x_position'] = 0
```

Looping through all key-value pairs

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for name, number in fav_numbers.items():
    print(f"{name} loves {number}.")
```

Looping through all keys

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for name in fav_numbers.keys():
    print(f"{name} loves a number.")
```

Looping through all the values

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for number in fav_numbers.values():
    print(f"{number} is a favorite.")
```

User input

Your programs can prompt the user for input. All input is stored as a string.

Prompting for a value

```
name = input("What's your name? ")
print(f"Hello, {name}!")
```

Prompting for numerical input

```
age = input("How old are you? ")
age = int(age)

pi = input("What's the value of pi? ")
pi = float(pi)
```

While loops

A while loop repeats a block of code as long as a certain condition is true. While loops are especially useful when you can't know ahead of time how many times a loop should run.

A simple while loop

```
current_value = 1
while current_value <= 5:
    print(current_value)
    current_value += 1
```

Letting the user choose when to quit

```
msg = ''
while msg != 'quit':
    msg = input("What's your message? ")
    print(msg)
```

Functions

Functions are named blocks of code, designed to do one specific job. Information passed to a function is called an argument, and information received by a function is called a parameter.

A simple function

```
def greet_user():
    """Display a simple greeting."""
    print("Hello!")

greet_user()
```

Passing an argument

```
def greet_user(username):
    """Display a personalized greeting."""
    print(f"Hello, {username}!")

greet_user('jesse')
```

Default values for parameters

```
def make_pizza(topping='pineapple'):
    """Make a single-topping pizza."""
    print(f"Have a {topping} pizza!")

make_pizza()
make_pizza('mushroom')
```

Returning a value

```
def add_numbers(x, y):
    """Add two numbers and return the sum."""
    return x + y

sum = add_numbers(3, 5)
print(sum)
```

Classes

A class defines the behavior of an object and the kind of information an object can store. The information in a class is stored in attributes, and functions that belong to a class are called methods. A child class inherits the attributes and methods from its parent class.

Creating a dog class

```
class Dog:
    """Represent a dog."""

    def __init__(self, name):
        """Initialize dog object."""
        self.name = name

    def sit(self):
        """Simulate sitting."""
        print(f"{self.name} is sitting.")

my_dog = Dog('Peso')

print(f"{my_dog.name} is a great dog!")
my_dog.sit()
```

Inheritance

```
class SARDog(Dog):
    """Represent a search dog."""

    def __init__(self, name):
        """Initialize the sardog."""
        super().__init__(name)

    def search(self):
        """Simulate searching."""
        print(f"{self.name} is searching.")

my_dog = SARDog('Willie')

print(f"{my_dog.name} is a search dog.")
my_dog.sit()
my_dog.search()
```

Infinite Skills

If you had infinite programming skills, what would you build?

As you're learning to program, it's helpful to think about the real-world projects you'd like to create. It's a good habit to keep an "ideas" notebook that you can refer to whenever you want to start a new project.

If you haven't done so already, take a few minutes and describe three projects you'd like to create. As you're learning you can write mall sprograms that relate to these ideas, so you can get practice writing code relevant to topics you're interested in.

Working with files

Your programs can read from files and write to files. Files are opened in read mode by default, but can also be opened in write mode and append mode.

Reading a file and storing its lines

```
filename = 'siddhartha.txt'
with open(filename) as file_object:
    lines = file_object.readlines()

for line in lines:
    print(line)
```

Writing to a file

The variable referring to the file object is often shortened to `f`.

```
filename = 'journal.txt'
with open(filename, 'w') as f:
    f.write("I love programming.")
```

Appending to a file

```
filename = 'journal.txt'
with open(filename, 'a') as f:
    f.write("\nI love making games.")
```

Exceptions

Exceptions help you respond appropriately to errors that are likely to occur. You place code that might cause an error in the try block. Code that should run in response to an error goes in the except block. Code that should run only if the try block was successful goes in the else block.

Catching an exception

```
prompt = "How many tickets do you need? "
num_tickets = input(prompt)

try:
    num_tickets = int(num_tickets)
except ValueError:
    print("Please try again.")
else:
    print("Your tickets are printing.")
```

Zen of Python

Simple is better than complex

If you have a choice between a simple and a complex solution, and both work, use the simple solution. Your code will be easier to maintain, and it will be easier for you and others to build on that code later on.

Beginner's Python Cheat Sheet - Lists

What are lists?

A list stores a series of items in a particular order. Lists allow you to store sets of information in one place, whether you have just a few items or millions of items. Lists are one of Python's most powerful features readily accessible to new programmers, and they tie together many important concepts in programming.

Defining a list

Use square brackets to define a list, and use commas to separate individual items in the list. Use plural names for lists, to make it clear that the variable represents more than one item.

Making a list

```
users = ['val', 'bob', 'mia', 'ron', 'ned']
```

Accessing elements

Individual elements in a list are accessed according to their position, called the index. The index of the first element is 0, the index of the second element is 1, and so forth. Negative indices refer to items at the end of the list. To get a particular element, write the name of the list and then the index of the element in square brackets.

Getting the first element

```
first_user = users[0]
```

Getting the second element

```
second_user = users[1]
```

Getting the last elements

```
newest_user = users[-1]
```

Modifying individual items

Once you've defined a list, you can change the value of individual elements in the list. You do this by referring to the index of the item you want to modify.

Changing an element

```
users[0] = 'valerie'
users[1] = 'robert'
users[-2] = 'ronald'
```

Adding elements

You can add elements to the end of a list, or you can insert them wherever you like in a list. This allows you to modify existing lists, or start with an empty list and then add items to it as the program develops.

Adding an element to the end of the list

```
users.append('amy')
```

Starting with an empty list

```
users = []
users.append('amy')
users.append('val')
users.append('bob')
users.append('mia')
```

Inserting elements at a particular position

```
users.insert(0, 'joe')
users.insert(3, 'bea')
```

Removing elements

You can remove elements by their position in a list, or by the value of the item. If you remove an item by its value, Python removes only the first item that has that value.

Deleting an element by its position

```
del users[-1]
```

Removing an item by its value

```
users.remove('mia')
```

Popping elements

If you want to work with an element that you're removing from the list, you can "pop" the item. If you think of the list as a stack of items, `pop()` takes an item off the top of the stack.

By default `pop()` returns the last element in the list, but you can also pop elements from any position in the list.

Pop the last item from a list

```
most_recent_user = users.pop()
print(most_recent_user)
```

Pop the first item in a list

```
first_user = users.pop(0)
print(first_user)
```

List length

The `len()` function returns the number of items in a list.

Find the length of a list

```
num_users = len(users)
print(f"We have {num_users} users.")
```

Sorting a list

The `sort()` method changes the order of a list permanently. The `sorted()` function returns a copy of the list, leaving the original list unchanged.

You can sort the items in a list in alphabetical order, or reverse alphabetical order. You can also reverse the original order of the list. Keep in mind that lowercase and uppercase letters may affect the sort order.

Sorting a list permanently

```
users.sort()
```

Sorting a list permanently in reverse alphabetical order

```
users.sort(reverse=True)
```

Sorting a list temporarily

```
print(sorted(users))
print(sorted(users, reverse=True))
```

Reversing the order of a list

```
users.reverse()
```

Looping through a list

Lists can contain millions of items, so Python provides an efficient way to loop through all the items in a list. When you set up a loop, Python pulls each item from the list one at a time and assigns it to a temporary variable, which you provide a name for. This name should be the singular version of the list name.

The indented block of code makes up the body of the loop, where you can work with each individual item. Any lines that are not indented run after the loop is completed.

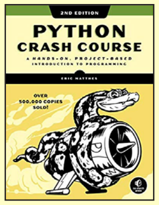
Printing all items in a list

```
for user in users:
    print(user)
```

Printing a message for each item, and a separate message afterwards

```
for user in users:
    print(f"\nWelcome, {user}!")
    print("We're so glad you joined!")

print("\nWelcome, we're glad to see you all!")
```



The range() function

You can use the `range()` function to work with a set of numbers efficiently. The `range()` function starts at 0 by default, and stops one number below the number passed to it. You can use the `list()` function to efficiently generate a large list of numbers.

Printing the numbers 0 to 1000

```
for number in range(1001):
    print(number)
```

Printing the numbers 1 to 1000

```
for number in range(1, 1001):
    print(number)
```

Making a list of numbers from 1 to a million

```
numbers = list(range(1, 1000001))
```

Simple statistics

There are a number of simple statistical operations you can run on a list containing numerical data.

Finding the minimum value in a list

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
youngest = min(ages)
```

Finding the maximum value

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
oldest = max(ages)
```

Finding the sum of all values

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
total_years = sum(ages)
```

Slicing a list

You can work with any subset of elements from a list. A portion of a list is called a slice. To slice a list start with the index of the first item you want, then add a colon and the index after the last item you want. Leave off the first index to start at the beginning of the list, and leave off the second index to slice through the end of the list.

Getting the first three items

```
finishers = ['kai', 'abe', 'ada', 'gus', 'zoe']
first_three = finishers[:3]
```

Getting the middle three items

```
middle_three = finishers[1:4]
```

Getting the last three items

```
last_three = finishers[-3:]
```

Copying a list

To copy a list make a slice that starts at the first item and ends at the last item. If you try to copy a list without using this approach, whatever you do to the copied list will affect the original list as well.

Making a copy of a list

```
finishers = ['kai', 'abe', 'ada', 'gus', 'zoe']
copy_of_finishers = finishers[:]
```

List comprehensions

You can use a loop to generate a list based on a range of numbers or on another list. This is a common operation, so Python offers a more efficient way to do it. List comprehensions may look complicated at first; if so, use the for loop approach until you're ready to start using comprehensions.

To write a comprehension, define an expression for the values you want to store in the list. Then write a for loop to generate input values needed to make the list.

Using a loop to generate a list of square numbers

```
squares = []
for x in range(1, 11):
    square = x**2
    squares.append(square)
```

Using a comprehension to generate a list of square numbers

```
squares = [x**2 for x in range(1, 11)]
```

Using a loop to convert a list of names to upper case

```
names = ['kai', 'abe', 'ada', 'gus', 'zoe']

upper_names = []
for name in names:
    upper_names.append(name.upper())
```

Using a comprehension to convert a list of names to upper case

```
names = ['kai', 'abe', 'ada', 'gus', 'zoe']

upper_names = [name.upper() for name in names]
```

Styling your code

Readability counts

Follow common Python formatting conventions:
- Use four spaces per indentation level.
- Keep your lines to 79 characters or fewer.
- Use single blank lines to group parts of your program visually.

Tuples

A tuple is like a list, except you can't change the values in a tuple once it's defined. Tuples are good for storing information that shouldn't be changed throughout the life of a program. Tuples are usually designated by parentheses.

You can overwrite an entire tuple, but you can't change the values of individual elements.

Defining a tuple

```
dimensions = (800, 600)
```

Looping through a tuple

```
for dimension in dimensions:
    print(dimension)
```

Overwriting a tuple

```
dimensions = (800, 600)
print(dimensions)

dimensions = (1200, 900)
print(dimensions)
```

Visualizing your code

When you're first learning about data structures such as lists, it helps to visualize how Python is working with the information in your program. Python Tutor is a great tool for seeing how Python keeps track of the information in a list. Try running the following code on pythontutor.com, and then run your own code.

Build a list and print the items in the list

```
dogs = []
dogs.append('willie')
dogs.append('hootz')
dogs.append('peso')
dogs.append('goblin')

for dog in dogs:
    print(f"Hello {dog}!")
print("I love these dogs!")

print("\nThese were my first two dogs:")
old_dogs = dogs[:2]
for old_dog in old_dogs:
    print(old_dog)

del dogs[0]
dogs.remove('peso')
print(dogs)
```

Beginner's Python Cheat Sheet

Variables and Strings

Variables are used to assign labels to values. A string is a series of characters, surrounded by single or double quotes. Python's f-strings allow you to use variables inside strings to build dynamic messages.

Hello world

```
print("Hello world!")
```

Hello world with a variable

```
msg = "Hello world!"
print(msg)
```

f-strings (using variables in strings)

```
first_name = 'albert'
last_name = 'einstein'
full_name = f"{first_name} {last_name}"
print(full_name)
```

Lists

A list stores a series of items in a particular order. You access items using an index, or within a loop.

Make a list

```
bikes = ['trek', 'redline', 'giant']
```

Get the first item in a list

```
first_bike = bikes[0]
```

Get the last item in a list

```
last_bike = bikes[-1]
```

Looping through a list

```
for bike in bikes:
    print(bike)
```

Adding items to a list

```
bikes = []
bikes.append('trek')
bikes.append('redline')
bikes.append('giant')
```

Making numerical lists

```
squares = []
for x in range(1, 11):
    squares.append(x**2)
```

Lists (cont.)

List comprehensions

```
squares = [x**2 for x in range(1, 11)]
```

Slicing a list

```
finishers = ['sam', 'bob', 'ada', 'bea']
first_two = finishers[:2]
```

Copying a list

```
copy_of_bikes = bikes[:]
```

Tuples

Tuples are similar to lists, but the items in a tuple can't be modified.

Making a tuple

```
dimensions = (1920, 1080)
resolutions = ('720p', '1080p', '4K')
```

If statements

If statements are used to test for particular conditions and respond appropriately.

Conditional tests

```
equal               x == 42
not equal           x != 42
greater than        x > 42
  or equal to       x >= 42
less than           x < 42
  or equal to       x <= 42
```

Conditional tests with lists

```
'trek' in bikes
'surly' not in bikes
```

Assigning boolean values

```
game_active = True
can_edit = False
```

A simple if test

```
if age >= 18:
    print("You can vote!")
```

If-elif-else statements

```
if age < 4:
    ticket_price = 0
elif age < 18:
    ticket_price = 10
elif age < 65:
    ticket_price = 40
else:
    ticket_price = 15
```

Dictionaries

Dictionaries store connections between pieces of information. Each item in a dictionary is a key-value pair.

A simple dictionary

```
alien = {'color': 'green', 'points': 5}
```

Accessing a value

```
print(f"The alien's color is {alien['color']}.")
```

Adding a new key-value pair

```
alien['x_position'] = 0
```

Looping through all key-value pairs

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for name, number in fav_numbers.items():
    print(f"{name} loves {number}.")
```

Looping through all keys

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for name in fav_numbers.keys():
    print(f"{name} loves a number.")
```

Looping through all the values

```
fav_numbers = {'eric': 7, 'ever': 4, 'erin': 47}

for number in fav_numbers.values():
    print(f"{number} is a favorite.")
```

User input

Your programs can prompt the user for input. All input is stored as a string.

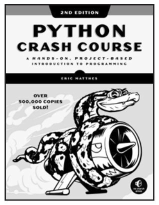
Prompting for a value

```
name = input("What's your name? ")
print(f"Hello, {name}!")
```

Prompting for numerical input

```
age = input("How old are you? ")
age = int(age)

pi = input("What's the value of pi? ")
pi = float(pi)
```



While loops

A while loop repeats a block of code as long as a certain condition is true. While loops are especially useful when you can't know ahead of time how many times a loop should run.

A simple while loop

```
current_value = 1
while current_value <= 5:
    print(current_value)
    current_value += 1
```

Letting the user choose when to quit

```
msg = ''
while msg != 'quit':
    msg = input("What's your message? ")
    print(msg)
```

Functions

Functions are named blocks of code, designed to do one specific job. Information passed to a function is called an argument, and information received by a function is called a parameter.

A simple function

```
def greet_user():
    """Display a simple greeting."""
    print("Hello!")

greet_user()
```

Passing an argument

```
def greet_user(username):
    """Display a personalized greeting."""
    print(f"Hello, {username}!")

greet_user('jesse')
```

Default values for parameters

```
def make_pizza(topping='pineapple'):
    """Make a single-topping pizza."""
    print(f"Have a {topping} pizza!")

make_pizza()
make_pizza('mushroom')
```

Returning a value

```
def add_numbers(x, y):
    """Add two numbers and return the sum."""
    return x + y

sum = add_numbers(3, 5)
print(sum)
```

Classes

A class defines the behavior of an object and the kind of information an object can store. The information in a class is stored in attributes, and functions that belong to a class are called methods. A child class inherits the attributes and methods from its parent class.

Creating a dog class

```
class Dog:
    """Represent a dog."""

    def __init__(self, name):
        """Initialize dog object."""
        self.name = name

    def sit(self):
        """Simulate sitting."""
        print(f"{self.name} is sitting.")

my_dog = Dog('Peso')

print(f"{my_dog.name} is a great dog!")
my_dog.sit()
```

Inheritance

```
class SARDog(Dog):
    """Represent a search dog."""

    def __init__(self, name):
        """Initialize the sardog."""
        super().__init__(name)

    def search(self):
        """Simulate searching."""
        print(f"{self.name} is searching.")

my_dog = SARDog('Willie')

print(f"{my_dog.name} is a search dog.")
my_dog.sit()
my_dog.search()
```

Infinite Skills

If you had infinite programming skills, what would you build?

As you're learning to program, it's helpful to think about the real-world projects you'd like to create. It's a good habit to keep an "ideas" notebook that you can refer to whenever you want to start a new project.

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Working with files

Your programs can read from files and write to files. Files are opened in read mode by default, but can also be opened in write mode and append mode.

Reading a file and storing its lines

```
filename = 'siddhartha.txt'
with open(filename) as file_object:
    lines = file_object.readlines()

for line in lines:
    print(line)
```

Writing to a file

The variable referring to the file object is often shortened to `f`.

```
filename = 'journal.txt'
with open(filename, 'w') as f:
    f.write("I love programming.")
```

Appending to a file

```
filename = 'journal.txt'
with open(filename, 'a') as f:
    f.write("\nI love making games.")
```

Exceptions

Exceptions help you respond appropriately to errors that are likely to occur. You place code that might cause an error in the try block. Code that should run in response to an error goes in the except block. Code that should run only if the try block was successful goes in the else block.

Catching an exception

```
prompt = "How many tickets do you need? "
num_tickets = input(prompt)

try:
    num_tickets = int(num_tickets)
except ValueError:
    print("Please try again.")
else:
    print("Your tickets are printing.")
```

Zen of Python

Simple is better than complex

If you have a choice between a simple and a complex solution, and both work, use the simple solution. Your code will be easier to maintain, and it will be easier for you and others to build on that code later on.

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Getting the first element

```
first_user = users[0]
```

Getting the second element

```
second_user = users[1]
```

Getting the last elements

```
newest_user = users[-1]
```

Modifying individual items

Once you've defined a list, you can change the value of individual elements in the list. You do this by referring to the index of the item you want to modify.

Changing an element

```
users[0] = 'valerie'
users[1] = 'robert'
users[-2] = 'ronald'
```

Adding elements

You can add elements to the end of a list, or you can insert them wherever you like in a list. This allows you to modify existing lists, or start with an empty list and then add items to it as the program develops.

Adding an element to the end of the list

```
users.append('amy')
```

Starting with an empty list

```
users = []
users.append('amy')
users.append('val')
users.append('bob')
users.append('mia')
```

Inserting elements at a particular position

```
users.insert(0, 'joe')
users.insert(3, 'bea')
```

Removing elements

You can remove elements by their position in a list, or by the value of the item. If you remove an item by its value, Python removes only the first item that has that value.

Deleting an element by its position

```
del users[-1]
```

Removing an item by its value

```
users.remove('mia')
```

Popping elements

If you want to work with an element that you're removing from the list, you can "pop" the item. If you think of the list as a stack of items, `pop()` takes an item off the top of the stack.

By default `pop()` returns the last element in the list, but you can also pop elements from any position in the list.

Pop the last item from a list

```
most_recent_user = users.pop()
print(most_recent_user)
```

Pop the first item in a list

```
first_user = users.pop(0)
print(first_user)
```

List length

The `len()` function returns the number of items in a list.

Find the length of a list

```
num_users = len(users)
print(f"We have {num_users} users.")
```

Sorting a list

The `sort()` method changes the order of a list permanently. The `sorted()` function returns a copy of the list, leaving the original list unchanged.

You can sort the items in a list in alphabetical order, or reverse alphabetical order. You can also reverse the original order of the list. Keep in mind that lowercase and uppercase letters may affect the sort order.

Sorting a list permanently

```
users.sort()
```

Sorting a list permanently in reverse alphabetical order

```
users.sort(reverse=True)
```

Sorting a list temporarily

```
print(sorted(users))
print(sorted(users, reverse=True))
```

Reversing the order of a list

```
users.reverse()
```

Looping through a list

Lists can contain millions of items, so Python provides an efficient way to loop through all the items in a list. When you set up a loop, Python pulls each item from the list one at a time and assigns it to a temporary variable, which you provide a name for. This name should be the singular version of the list name.

The indented block of code makes up the body of the loop, where you can work with each individual item. Any lines that are not indented run after the loop is completed.

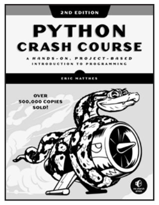
Printing all items in a list

```
for user in users:
    print(user)
```

Printing a message for each item, and a separate message afterwards

```
for user in users:
    print(f"\nWelcome, {user}!")
    print("We're so glad you joined!")

print("\nWelcome, we're glad to see you all!")
```



The range() function

You can use the `range()` function to work with a set of numbers efficiently. The `range()` function starts at 0 by default, and stops one number below the number passed to it. You can use the `list()` function to efficiently generate a large list of numbers.

Printing the numbers 0 to 1000

```
for number in range(1001):
    print(number)
```

Printing the numbers 1 to 1000

```
for number in range(1, 1001):
    print(number)
```

Making a list of numbers from 1 to a million

```
numbers = list(range(1, 1000001))
```

Simple statistics

There are a number of simple statistical operations you can run on a list containing numerical data.

Finding the minimum value in a list

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
youngest = min(ages)
```

Finding the maximum value

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
oldest = max(ages)
```

Finding the sum of all values

```
ages = [93, 99, 66, 17, 85, 1, 35, 82, 2, 77]
total_years = sum(ages)
```

Slicing a list

You can work with any subset of elements from a list. A portion of a list is called a slice. To slice a list start with the index of the first item you want, then add a colon and the index after the last item you want. Leave off the first index to start at the beginning of the list, and leave off the second index to slice through the end of the list.

Getting the first three items

```
finishers = ['kai', 'abe', 'ada', 'gus', 'zoe']
first_three = finishers[:3]
```

Getting the middle three items

```
middle_three = finishers[1:4]
```

Getting the last three items

```
last_three = finishers[-3:]
```

Copying a list

To copy a list make a slice that starts at the first item and ends at the last item. If you try to copy a list without using this approach, whatever you do to the copied list will affect the original list as well.

Making a copy of a list

```
finishers = ['kai', 'abe', 'ada', 'gus', 'zoe']
copy_of_finishers = finishers[:]
```

List comprehensions

You can use a loop to generate a list based on a range of numbers or on another list. This is a common operation, so Python offers a more efficient way to do it. List comprehensions may look complicated at first; if so, use the for loop approach until you're ready to start using comprehensions.

To write a comprehension, define an expression for the values you want to store in the list. Then write a for loop to generate input values needed to make the list.

Using a loop to generate a list of square numbers

```
squares = []
for x in range(1, 11):
    square = x**2
    squares.append(square)
```

Using a comprehension to generate a list of square numbers

```
squares = [x**2 for x in range(1, 11)]
```

Using a loop to convert a list of names to upper case

```
names = ['kai', 'abe', 'ada', 'gus', 'zoe']

upper_names = []
for name in names:
    upper_names.append(name.upper())
```

Using a comprehension to convert a list of names to upper case

```
names = ['kai', 'abe', 'ada', 'gus', 'zoe']

upper_names = [name.upper() for name in names]
```

Styling your code

Readability counts

Follow common Python formatting conventions:
- Use four spaces per indentation level.
- Keep your lines to 79 characters or fewer.
- Use single blank lines to group parts of your program visually.

Tuples

A tuple is like a list, except you can't change the values in a tuple once it's defined. Tuples are good for storing information that shouldn't be changed throughout the life of a program. Tuples are usually designated by parentheses.

You can overwrite an entire tuple, but you can't change the values of individual elements.

Defining a tuple

```
dimensions = (800, 600)
```

Looping through a tuple

```
for dimension in dimensions:
    print(dimension)
```

Overwriting a tuple

```
dimensions = (800, 600)
print(dimensions)

dimensions = (1200, 900)
print(dimensions)
```

Visualizing your code

When you're first learning about data structures such as lists, it helps to visualize how Python is working with the information in your program. Python Tutor is a great tool for seeing how Python keeps track of the information in a list. Try running the following code on pythontutor.com, and then run your own code.

Build a list and print the items in the list

```
dogs = []
dogs.append('willie')
dogs.append('hootz')
dogs.append('peso')
dogs.append('goblin')

for dog in dogs:
    print(f"Hello {dog}!")
print("I love these dogs!")

print("\nThese were my first two dogs:")
old_dogs = dogs[:2]
for old_dog in old_dogs:
    print(old_dog)

del dogs[0]
dogs.remove('peso')
print(dogs)
```