Arrays

https://www.w3schools.com/python/python_arrays.asp

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Arrays

- An important “**data** structure” in programming concepts
  - **Store and organize data values in a structure**
- An array is a special variable, **which can hold more than one value at a time**
- An array can hold many values under a single name, and you can **access the values by referring to an index number**

Other important data structures include matrices, tables, datasets, lists, queues, stacks, linked lists, etc.

Why Arrays?

- If you have a list of items (a list of car names, for example), storing the cars in single variables could look like this:
  - car1 = "Ford"
    car2 = "Volvo"
    car3 = "BMW"
- However, what if you want to loop through the cars and find a specific one? And what if you have not just 3 cars, but 300?
- The solution is an array!

Array Syntax

Example

Get the value of the first array item:

```
x = cars[0]
```

Array Syntax 2

Example

Modify the value of the first array item:

```
cars[0] = "Toyota"
```

Array Syntax 3

Example

Return the number of elements in the `cars` array:

```
x = len(cars)
```

Array Syntax 4

Example

Print each item in the `cars` array:

```
for x in cars:
  print(x)
```

Array Syntax 5

Example

Add one more element to the `cars` array:

```
cars.append("Honda")
```

Array Syntax 7

Example

Delete the second element of the `cars` array:

```
cars.pop(1)
```

Array Syntax 8

Example

Delete the element that has the value "Volvo":

```
cars.remove("Volvo")
```

Array Methods Summary

Array Methods

Python has a set of built-in methods that you can use on lists/arrays.

Method	Description
append()	Adds an element at the end of the list
clear()	Removes all the elements from the list
copy()	Returns a copy of the list
count()	Returns the number of elements with the specified value
extend()	Add the elements of a list (or any iterable), to the end of the current list
index()	Returns the index of the first element with the specified value
insert()	Adds an element at the specified position
pop()	Removes the element at the specified position
remove()	Removes the first item with the specified value
reverse()	Reverses the order of the list
sort()	Sorts the list

RECALL: Nested Loops MORE

- Often times, the body of a loop is yet another loop!
- Think about how to process data that is 2D, or 3D, or N-dimensional
- **Can you think of an example data that has 2 dimensions?**

- **We will come back to this topic after we discuss arrays/lists**

Array + Loops → POWER

Array + Loops → DATA PROCESSING POWER

Example 1: Statistical Analysis

? What does this code do?

? What does each of the four parts do?

? What does "histogram[myList[i]] += 1" do?

```
1  import random

   myList = []

   max = 10

   for i in range(0,100):
      x = random.randint(0,max)
      myList.append(x)

   histogram = []

2  for i in range(0,max+1):
      histogram.append(0)   # initialize
      print(histogram[i])

3  for i in range(0,100):
      histogram[myList[i]] += 1

4  for i in range(0,max+1):
      print(histogram[i])
```

Example 2: Image Processing

```
for x in range(1, len(image[i])-1):
   for y in range(1, len(image[i][j])-1):
      image[x][y] = int((image[x-1][y-1] + image[x][y-1] + image[x+1][y-1] +
                         image[x-1][y] + image[x][y] + image[x+1][y] +
                         image[x-1][y+1] + image[x][y+1] + image[x+1][y+1])/9)
```

? What does this code do?

? What does image[x][y] mean?

Example 2: Image Processing Brief

From https://thecustomizewindows.com/2014/01/image-averaging-in-image-processing/