

Intro to programming II

Week 5

Lists

A variable pairs a name with a piece of data:

```
my_gpa = 3.9
```

A list pairs a name with many pieces of data:

```
grades = [3.8, 4.0, 3.9, 3.9]
```

or

```
classes = ['Engl', 'Math', 'Art', 'Music']
```

A list with no elements is called an empty list:

```
a = []
```

To access a value in the list, we index it, starting at 0, same as we did to access chars in strings:

```
print(grades[0])  
>>> 3.8  
print(classes[3])  
>>> Music
```

Likewise, we can 'slice' a list, i.e., get pieces of a list, in the same way we got pieces of a string, selecting a range from the first element that we want to the first element that we do not want:

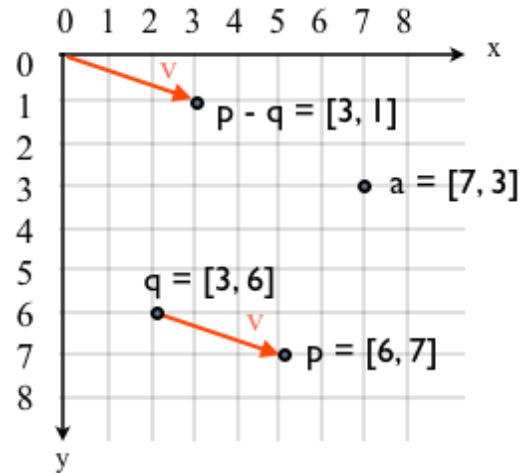
```
print(classes[1:3])  
>>> ['Math', 'Art']  
print(classes[:3])  
>>> ['Engl', 'Math', 'Art']  
print(classes[1:])  
>>> ['Math', 'Art', 'Music']
```

To change an element of a list, we simply assign it, like any other variable:

```
classes[1] = 'P.E.'  
print(classes)  
>>> ['Engl', 'P.E.', 'Art', 'Music']
```

Points and vectors

A cartesian coordinate frame specifies points of a plane using orthogonal directions called x and y.



A point is a location in the frame. For example, the point a is at location [7, 3]; the special point [0, 0] is called the origin; in computer images it is at the top-left of the image.

A vector, represented with an arrow, is composed of a magnitude (i.e., a length) and a direction. Since it does not depend on a location, we can move it around and it is still the same vector. In the image, we have the vector v shown both when anchored at point q and when anchored at the origin. In both cases it points in the same direction and it is the same length so it is the same vector.

If we anchor the vector v at q = [3,6] then it ends at p = [6, 7]. The length of the vector along the x axis is $v_x = 3$ and along the y axis is $v_y = 1$.

We use vectors to represent velocities, with their magnitude and direction representing the speed and direction of the motion. Hence an object that is at position P_0 and have a velocity v at time 0 will be at position $P_1 = P_0 + v$ at time 1.

If the vector $v = [v_x, v_y]$ is the velocity of our object, then the velocity will be $[-v_x, v_y]$ after bouncing off a vertical wall, and $[v_x, -v_y]$ after bouncing off a horizontal wall.