Building Robot Brains

Week #3
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Robot Brains

- When you write a program, you are actually building a brain for your Robot
- In the computing world, this brain is replaceable
  - Firefox as a Browser
  - iTunes as a Media Player
  - VLC as a Movie Player
- By learning to write Robot programs you are also learning to write computer programs
Structure of a Robot Brain

- The basic structure of a Program (Brain) is:
  ```python
  def main():
    <do something>
    <do something>
    ...
  
  Every Robot program will begin with
  ```
  ```python
  from myro import *
  init()
  ```

- Then you import other files/modules or you ask the robot to do something using the modules
Robot Dance

- Make the Robot do some random movements using function moves()

```python
# The main dance program

def main():
    print "Running the dance routine..."
    yoyo(0.5, 0.5)
    wiggle(0.5, 0.5)
    yoyo(1, 1)
    wiggle(1, 1)
    print "...Done"

main()
```

The function ‘print’ will print out what you have entered in the double quotes “   ”

When the main() function is called, the functions in main() are called in order so you get the output:

Running the dance routine...
...Done
Try this:

```python
speak("Dude! Pardon me, would you have any Grey Poupon?")
```

- Python comes with several other useful libraries or modules
- Libraries are made up of sets of functions
- You can import the commands provided in a library
- Every programming language has a set of predefined functions and a mechanism for defining additional functions
A name in Python must begin with either an alphabetic letter (a-z or A-Z) or the underscore (i.e. _) and can be followed by any sequence of letters, digits, or underscore letters.

- jitterBug2
- my_2_cents

By giving functions a name you have a way of defining new functions.
Functions can take parameters that help customize what they do. In the above example, you can issue the following two commands:

```python
>>> yoyo(0.8, 2.5)
>>> yoyo(0.3, 1.5)
```

It is better you choose names which makes sense

For example:

A function `turnRight()` should turn the robot right and NOT make it go in circles or dance

PS: This is not mandatory though! 😊
Values

- Designating values by names is an important feature of Programming
- We can create names for speed, temperature etc.
- Designating Values
  
  \[
  \text{aveHighTemp} = 37 \\
  \text{DowIndex} = 12548.30 \\
  \text{myFavoriteRobot} = "C3PO"
  \]

- Syntax: \(<\text{variable name}> = <\text{expression}>\)
  
  - Strings are given within double quotes
What you type at the Python prompt >>>> is an Expression

```python
>>> 5
5
>>> 5 + 3
8
>>> 3 * 4
12
>>> 3.2 + 4.7
7.9
>>> 10 / 2
5
```

- Addition (+), subtraction (-), multiplication (*), and division (/) can be used on numbers to form expressions that involve numbers
- Whole numbers are called integers and those with decimal points in them are called floating point numbers
- Python handles both (try 10.0/3.0)
Strings

Python requires that strings be written enclosed in quotes: which could be single ('I am a string'), double ("Me too!"), or even triple quotes (""I'm string as well!"")

Python also provides some operations on strings using which you can write some useful string expressions

```python
>>> mySchool = "Bryn Mawr College"
>>> yourSchool = "Georgia Institute of Technology"
>>> yourSchool+mySchool
'Georgia Institute of TechnologyBryn Mawr College'
```
Estimate the world population growth in a year and also per day. Given that on January 1, 2008 the world's population was estimated at 6,650,000,000 and the estimated growth is at the rate of +1.14%
In a large program if you want to change some value, you can search for the value line by line and modify your program to reflect the new value.

Instead you can use the *input* facility of Python.

Python has a simple input command:

- Syntax: `<variable name> = input(<some prompt string>)`
- `Population = input("Enter current world population: ")`
Pythonese – Computation

This is how your GUI will look when you use the `input` function

```python
>>> This program computes population growth figures.
Enter current world population: 6650000000
Enter the growth rate: 1.14
World population today is 6650000000
In one year, it will grow by 75810000.0
An average daily increase of 207698.630137
>>> main()
This program computes population growth figures.
Enter current world population: 6725810000
Enter the growth rate: 2.2
World population today is 6725810000
In one year, it will grow by 147967820.0
An average daily increase of 405391.287671
>>> ```
Pythonesse – Repetitions

- If you want the dance behavior 10 times

```python
for i in range(10):
    dance()
```

- Syntax for repetition:

```python
for <variable> in <sequence>:
    <do something>
    <do something>
    ...
```

- `range()` function is used to specify a sequence

```python
range(10)
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```
Pythonese – Repetition

- What if you want to make the robot dance forever??
- How do you stop it?
- In addition to repeating by counting, you can also specify repetition using time

```python
while timeRemaining(10):
    <do something>
    <do something>
    ... 
```
Values in Python can be numbers (integers or floating point numbers) or strings.

Operations can be performed on Values.

<variable name> = <expression>

This is how Python assigns values to variables.

range(10)

Generates a sequence of numbers from 0..9.

range(n1, n2)

Generates a list of numbers starting from n1…(n2-1).

range(5, 10) will generate the list of numbers [5, 6, 7, 8, 9]

range(n1, n2, step)

Generates a list of numbers from n1…(n2-1) in steps of step.

range(5, 10, 2) will generate the list of numbers [5, 7, 9]
Repetition

for <variable> in <sequence>:
    <do something>
    <do something>
    ...

while timeRemaining(<seconds>):
    <do something>
    <do something>
    ...
    ...

while True:
    <do something>
    <do something>