COMPSCI 111 / 111G

Mastering Cyberspace:
An introduction to practical computing

Programming with Python

- Input, Output

- Variables, Assignment

- Simple operations

Programming Languages

A programming language is a formal language that specifies how to perform a computational task

Many programming languages exist

- Fortran
- Visual Basic
- C, C++, C#
- Java
- Python

http://www.python.org/
http://en.wikipedia.org/wiki/Programming

Translating Code

High-level languages

- Easy for humans to understand
- Too complex for a CPU
- Need to translate to a lower level language

Compiler

- Translates entire file at once
- Entire file can be understood by the CPU

Interpreter

- Runs the code while it is being translated
- Translates a line, runs the code, translates a line, etc.

http://en.wikipedia.org/wiki/Interpreter_(computing)

Statements

A program consists of a series of instructions

- Instructions in a program are called statements
- Computer executes them in the order they appear

Must be precise

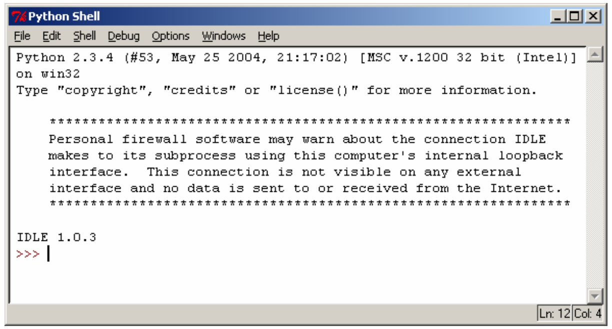
- Computer does what you say, not what you mean

Using IDLE

Integrated Development Environment

- Text Editor
- Interpreter to run the code
- May include other tools to help a programmer

IDLE is an IDE for Python



```
Python 2.3.4 (#53, May 25 2004, 21:17:02) [MSC v.1200 32 bit (Intel)]
on win32
Type "copyright", "credits" or "license()" for more information.

    ****************************************************************
    Personal firewall software may warn about the connection IDLE
    makes to its subprocess using this computer's internal loopback
    interface.  This connection is not visible on any external
    interface and no data is sent to or received from the Internet.
    ****************************************************************

IDLE 1.0.3
>>> |
```

Running Python instructions

Interactive Interpreter

- Allows you to type statements directly at the prompt
- Statement is executed when you hit <Enter>
- Very useful for experimentation
- Good for learning

Running a Script

- Type a sequence of statements into a file
- Save the file with the file extension .py
- Running the program executes each statement in turn

Example: Hello World

The first program you normally write

- Traditional
- Prints out the message "Hello World"

Python

```
print "Hello World"
```

Java

```
public class MyProgram{
   public static void main(String[] args){
      System.out.println("Hello World");
   }
}
```

Comments

Comments

- Used to make comments to human readers
- Ignored by the computer
- Start with hash sign (#), ignores everything until end of line
- Always start a program with comments describing the Author and Date.

```
#Author: Andrew Luxton-Reilly
#Date: 7/05/06
#Purpose: Show the use of comments

print "Hello"       #Hello, Hello
print "Is there anybody in there"
print "Just nod if you can hear me"
print "Is there anyone at home"
```

Types of information

Strings

- Sequence of characters
- Plain text (ASCII or Unicode)
- Enclosed in quote marks
- E.g. "Hello", "Goodbye"

Integers

- Numbers without a decimal point
- E.g. -100, 0, 45

Floating-point numbers

- Numbers with a decimal point
- E.g. -1.00002, 0.0, 4.5, 45.0,

Printing output

Use the `print` statement

```
print "Hello"
print 34.9
print 2
```

Printing more than one thing on a single line

- Separate each thing with a comma
- Single space used between different things in the output

```
print "Hello", "World"
print "The year is 2006"
print "The year is", 2006
```

Exercise

What is the output produced by the following program:
(Use the ^ symbol to represent a space)

```
print "This", "is"
print "a program that has"
print 3, "lines"

print 1,2,3,4
print "1,2,3,4"
print "1234", 1,2
print "1",2,3,"4"
```

Arithmetic operators

Used to perform calculations between numeric values

Operation	Symbol
Exponent	`**`
Multiply	`*`
Divide	`/`
Remainder	`%`
Add	`+`
Subtract	`-`

Operators

```
print 2 + 3
print 3 – 4
print 4 * 3
print 3 / 2
print 7 % 3
```

```
print 7 / 2
print 7.0 / 2
```

```
print 7 % 2
print 7 % 3
print 4 % 7
```

String operations

Concatenation

- Join two strings together
- `+`
- `"Hello" + " " + "World"`

Repetition

- Repeat a string multiple times
- `*`
- `"Hello World" * 3`

Exercise

What is the output produced the following program?

```
print 1 + 2 + 3
print "1" + "2" + "3"
print 1 * 2
print "1" * 2

print 2 / 3
print 1.0 + 3 / 2
print 1 + 3 / 2.0

print 2 % 3
print 20 % 7
print 20 / 7
```

Variables

Variable in mathematics

- Symbol that acts as a placeholder
- Same value used everywhere the symbol is used
- Impossible to have

```
x = 9
x = 5
```

impossible in mathematics

Variable in computer science

- Name of a box
- Used to store different values at different times

```
x = 9
x = 5
```

valid in computer science

Assignment statement

Storing a value in a variable

- Assigning a value to the variable
- Equals sign

```
age = 23
sizeOfFruitbat = 56
numberOfWeasels = 17
```

Valid name of a variable

- Start with a lower case letter
- Each subsequent word starts with upper case
- May contain numbers (or the underscore)
- May not be a keyword that means something special in Python

Using variables

```
height = 10
width = 20
area = height * width

print "Area =", area
```

```
age = 21
print "Age =", age
age = age + 1
print "Next year my age =", age
```

Exercise

What is the output produced by the following program?

```
a = 17
b = 5

print a
print b

temp = a
a = b
b = temp

print a
print b
```

Reading input from the user

Reading a number

- `input( prompt )`
- Store the input in a variable

```
age = input("Enter your age: ")
```

Reading a string

- `raw_input( prompt )`
- Store the input in a variable

```
name = raw_input("Enter your name: ")
```

Examples

Write a program that converts NZD to USD

- Currently 1 NZD = 0.6409 USD

```
#Author: Andrew Luxton-Reilly
#Date: 7/05/06

#Ratio of NZD to USD
currencyRatio = 0.6409 # 1 NZD = 0.6409 USD

#Ask the user to enter the NZD value
nzd = input("Please enter the dollar value (NZD): ")

#Calculate the amount of USD
usd = nzd * currencyRatio

#Print the output to the user
print nzd, "NZ dollars is worth", usd, "US dollars"
```

Exercise

Write a program that converts a temperature from Fahrenheit to Celsius.

The formula to convert from Fahrenheit to Celsius is:

$$\text{Celsius} = (5 / 9) * (\text{Fahrenheit} - 32)$$