Exam on Thursday, October 3
Basic Data Types

Integers
Floating Point Numbers
Strings
**Integer**

```
int
```

A whole number

Can be of unlimited size

Be careful not to use commas in your numbers, for example: 1,000
Floating point number

float

A number that contains a decimal point
Has minimum and maximum values
Limited precision
4 is not the same as 4.0
Arithmetic Operators

Lowest precedence to highest precedence

+    -
*    /
//
%
**
String

str

A sequence of one or more characters
A *string* of letters and numbers
Enclosed in quotation marks
Double quoted strings can contain single quotes and vice versa
Triple quotes can span multiple lines
String Operators

+  
*  
#
Variable

= 

A name that refers to a value

An “assignment statement” gives a value to a variable

Variables remember things

Variables can change, too

= is Python’s assignment token
Variable Names

Can be of any length

Characters must be letters, numbers, or the underscore (_)

First character cannot be a number

Case sensitive

Python keywords cannot be used as variable names
Multiple Assignment

Assigning more than one variable at a time is possible

```
a, b, c = 'foo', 'bar', 'baz'
```

Swapping variable values

```
x, y = y, x
```
print()
Built-In Functions

A function is a reusable chunk of code

We’ve already been using functions
- print()  
- int()  
- type()

Function name and arguments

Parentheses mean “execute this function”

Some functions take no input
Modules

A collection of related functions

To use a module, it must be imported:
import module

Then you can use any of the functions in that module:
module.function( )

You can also import all a module’s functions at once:
from module import *

This allows you to call the function without appending the module
Math Module
Contains many useful mathematical functions

Square root
Pi
Exponentiation
Degree conversion
Tangents
Getting Help

Python has lots of documentation built in.

Functions and modules usually come with brief explanations.

To list functions in a module:
```python
dir(module)
```

To see all of Python’s built-in functions:
```python
dir(__builtins__)
```

To get help with a specific function:
```python
help(function)
```

Python’s general help utility:
```python
help()
```
input()
Writing Programs

A program is just a text file containing Python statements.

A program can have two lines of code or thousands.

Any plain text editor can be used—although we will stick with IDLE.

Give your files the extension "py".

Python executes the file by running all the statements from top to bottom.
Basic Input

`input()`

Reading strings from the keyboard

Input function

`variable = input('Prompt ')`

Input can be in the form of a string or numeric data type

However, the value is always assigned to a variable as a string
Line Breaks for Long Statements

Programming statements are normally written on one line.

If necessary, statements can be broken up into multiple lines with the line continuation character (backslash).

```python
print('This line and \this line are connected.')</n```

\ must be placed at the end of the first line, before it is broken.
More on the Print Function

One of the most common functions we’ve been using

Important in our standalone Python programs for providing output

Additional arguments to the print function include separator, end character

Separator default
sep = ' ' 

End character default
end = '\n'
Escape Characters

\n
New line character

\t

Tab character

\'

Single quote character

\"

Double quote character

\\

Backslash character
The format function allows you to format numbers, like floats.

Takes two arguments: the value to be formatted, and the format specification.

```
format(value, 'format_spec')
```

The last number will also be rounded as appropriate.
### Boolean Logic and If-Statements

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>a == b</th>
<th>a != b</th>
<th>a and b</th>
<th>a or b</th>
<th>not a</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>True</td>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>True</td>
<td>True</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>True</td>
<td>False</td>
</tr>
</tbody>
</table>
Boolean Logic

Programming languages make decisions in binary terms

Two boolean values: True and False

True and False can be assigned to variables, just like strings and numbers

Logical operators for boolean values: 
==, !=, and, or, and not
Equivalence

\[ a == b \]

Evaluates to True when \( a \) and \( b \) are the same:

- Both \( a \) and \( b \) are True
- Both \( a \) and \( b \) are False
Negation

\[ a \neq b \]

Evaluates to True when \( a \) and \( b \) are not the same:

- \( a \) is True and \( b \) is False
- \( a \) is False and \( b \) is True
And

\( a \) and \( b \)

Evaluates to True when both \( a \) and \( b \) are True:

- \( a \) is True and \( b \) is True
Or

\( a \) or \( b \)

Evaluates to True when \( a \) is True \textit{or} \( b \) is True:

- \( a \) is True and \( b \) is True
- \( a \) is True and \( b \) is False
- \( a \) is False and \( b \) is True
Not

Not a

Evaluates to True when \( a \) is False and False when \( a \) is True:

- \( a \) is False
- \( b \) is False
# Truth Table

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>a == b</th>
<th>a != b</th>
<th>a and b</th>
<th>a or b</th>
<th>not a</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>True</td>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>True</td>
<td>True</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>True</td>
<td>False</td>
</tr>
</tbody>
</table>
Order of Execution
Highest to Lowest

a == b
a != b
not a
a and b
a or b
Conditional Statements

Allow you to change the flow of a Python program

Consist of if-statements

Introduce code blocks
If/Else-Statements

if
else

Begins with the keyword if
Followed by a Boolean expression
May be followed by an else block for alternate conditions
If/Else If-Statements

if
elif

If-statement with more than one condition

Multiple elif blocks are permitted

else block is optional
Semantic Indentation

Code blocks are meaningful in Python

Indentation marks blocks of code and is not an optional format

Code blocks must be indented consistently by the same amount

As a result, Python code is clearer and more legible
Exam on Thursday, October 3