Getting Started With Python Programming: Part I

- Tutorial: creating computer programs
- Variables
- Getting information from the user
- Common mathematical operators

Reminder!

- These course notes are mandatory
  - Get them before class and go over them before attending
- (If all else fails then look through them afterwards – at the very least to see what concepts/topics you are responsible for knowing).
  - It's the *first* step you should complete if you've missed lecture and need to catch up.
  - (The second step is to get the in class notes of a classmate).
  - After going through these notes the third step is to ask us for help in filling in any conceptual gaps.

James Tam

Tips For Success: Programming Sections

- (The previous 4 tips are still applicable but there's some tips specific to programming):
  - **Take extensive notes**: everything in class not just what the instructor "writes down" but also what he/she "says in class".
    - Some students may find when studying the lecture slides for the exam that they cannot understand concepts.
    - The extra "filling of the blanks" occurs during lecture so you need to annotate the slides with your own notes
  - After lectures have covered a particular concept/example
    - **If you have time try writing example programs on your own** (without looking at the online examples or notes) in order to create a program that fulfills the same task as the example program
    - (It's one thing to see the solution to a problem explained, your depth of understanding will be deeper if you have to re-create it from scratch yourself).
    - JT's note: you may find this unnecessary for the simple examples in this section but it will be beneficial to do this when more complex concepts are covered (e.g. nested loops onwards)

James Tam

Python

- This is the name of the programming language that will be used to illustrate different programming concepts this semester:
  - My examples will be written in Python
  - Your assignments will be written in Python
- Some advantages (from Python dot org)
  - Free
  - Powerful
  - Widely used (Google, NASA, Yahoo, Electronic Arts, some Linux operating system scripts etc.)
- Some starting python resources
  - Official website: http://www.python.org
  - An overview of the web site: https://www.python.org/about/gettingstarted/

James Tam

Python History

- Developed in the early 1990s by Guido van Rossum.
- Python was designed with a tradeoff in mind (from "*Python for everyone*" (Horstman and Necaise):
  - Pro: Python programmers could quickly *write programs* (and not be burdened with an overly difficult language)
  - Con: Python programs weren't optimized to *run* as efficiently as programs written in some other languages.

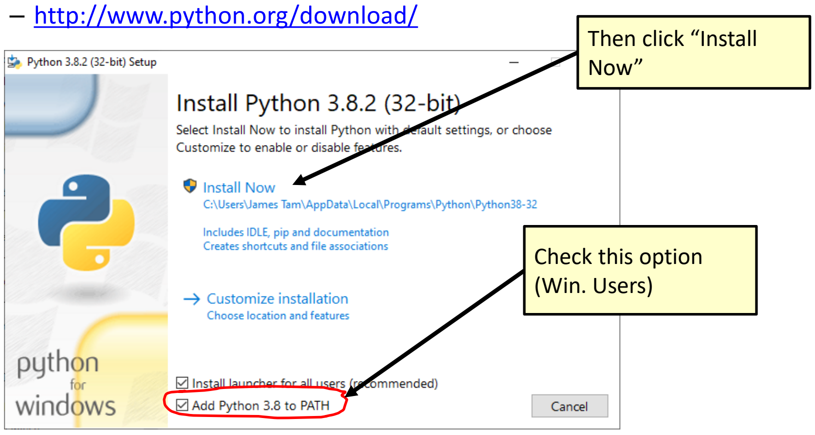
"Gawky and proud of it."

From: http://www.python.org/~guido/

James Tam

Working From Home (Installing Python): Windows

- Getting Python (*get version 3.X* and not version *2.X*)
  - http://www.python.org/download/


Python 3.8.2 (32-bit) Setup

Install Python 3.8.2 (32-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

Install Now
C:\Users\James Tam\AppData\Local\Programs\Python\Python38-32

Includes IDLE, pip and documentation
Creates shortcuts and file associations

Customize installation
Choose location and features

☑ Install launcher for all users (recommended)
☑ Add Python 3.8 to PATH

Cancel

Then click "Install Now"

Check this option (Win. Users)

  - Detailed information:
    - https://cspages.ucalgary.ca/~tam/resources/python/installing_accessing_python.pdf

James Tam

Online Help: Official Python Site

- *Basic explanation* of concepts (for beginners: along with examples to illustrate)
  - http://docs.python.org/py3k/tutorial/index.html
  - (Skip the notes on the interactive mode for now – it's where you don't save the program which leaves you nothing to submit for assignments).
  - For this course you need to create a python program in a file and then run the program defined in the file.

James Tam

Creating A Computer Program

1. A programmer writes the instructions of the program in high level (human can read and understand) language.
   - Examples: C, C++, java, python

```
# Details later this term
list = [1,2,'a']
for element in list
    print(element)
```

2. The program must be created and saved using a text editor (e.g. Notepad, WordPad or the editor that comes with python IDLE).
   - Don't use a word processor.
3. The program is then translated into binary/machine language (the only form that the computer can understand).

```
# Details in 2nd year
10000001
10010100 10000100
10000001 01010100
```

James Tam

Location Of My Online Examples

- For this semester you can find them in D2L under: `Content->Lectures`
- Then look under the appropriately named folder which is listed by date and topic.
- Alternatively you can find them by looking under the "main grid" of the course website (look for the 'examples' link):
  - https://pages.cpsc.ucalgary.ca/~tamj/2025/231P/#Main_grid:_course_schedule_for_the_lecture,_lecture_notes,_assignment_information

James Tam

The First Python Program

Name of the full example: `1small.py`

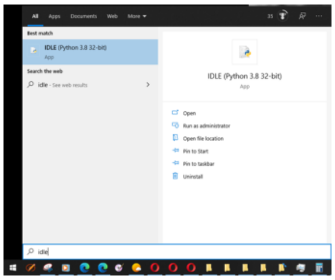
Filename: `1small.py`

```
print ("hello")
```

James Tam

Creating/Running Programs: Windows

- **Step 0: Before writing your program start IDLE (python editor)**
  - The editor automatically comes installed with your python download so it's the one that we will officially support.
  - You can use other editors but keep in mind **you may be on your own if you have problems with that editor**!
    - Starting IDLE (Windows)



–One Apple resource for using IDLE: https://www.python.org/download/mac/tcltk/

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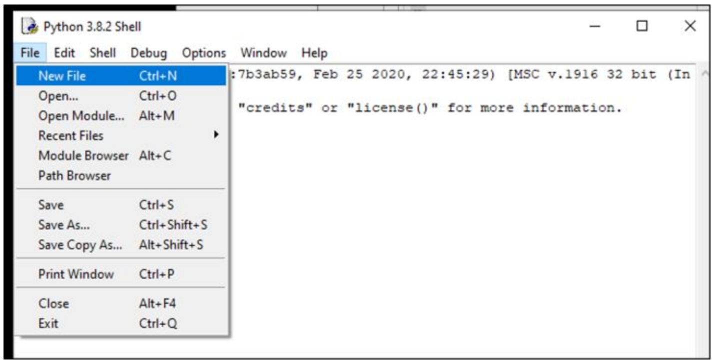
Creating/Running Programs: Windows (2)

- **Step 1**: Starting the python program editor from IDLE: `File->New File`



```
:7b3ab59, Feb 25 2020, 22:45:29) [MSC v.1916 32 bit (In

"credits" or "license()" for more information.
```

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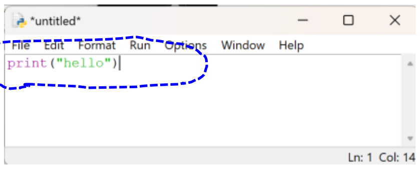
Creating/Running Programs: Windows (3)

- **Step 2**: Type your program into the editor window that appears (appears if you completed the previous step correctly):



```
print("hello")
```

- (The specifics of <u>what</u> to type into the editor will form the bulk of teaching material for this semester – details are coming soon).
  - For now you can just type in what you see in the above image.

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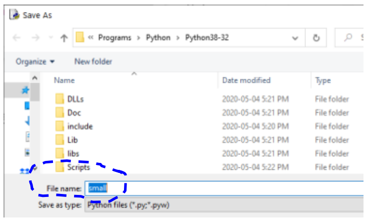
Creating/Running Programs: Windows (4)

- **Step 3**: Name your program: `File->Save`



Name	Date modified	Type
DLLs	2020-05-04 5:21 PM	File folder
Doc	2020-05-04 5:21 PM	File folder
include	2020-05-04 5:20 PM	File folder
Lib	2020-05-04 5:21 PM	File folder
libs	2020-05-04 5:21 PM	File folder
Scripts	2020-05-04 5:22 PM	File folder

File name: small

Save as type: Python files (*.py;*.pyw)

  - Using the IDLE editor you can simply save under the default file type.
    - (If you use another text editor such as WordPad then you will have to save it as a text file <u>and</u> make sure the filename ends with the right suffix ".py").
    - Save the program in a easy to remember location (don't use the default location – it's the install location of python and not easy to remember for most).
  - **Standards for naming programs**
    - Only use alphabetic or numeric characters in the save name
    - Don't include spaces or any other characters!

James Tam

Creating/**Running** Programs: Windows (5)

- **Step 4**: Running your program
  - Via the menu: `Run->Run Module`
  - Via key board shortcut: `F5`

James Tam

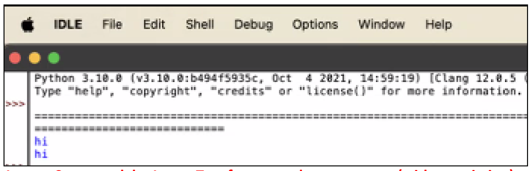
Opening Previously Created Programs

- Do this through the editor (IDLE):
- Menu options: `File->Open`
- Do not try to 'click' on the file (Windows users)
  - Windows: by default the operating system will try to run python programs (not allow you to edit it).

James Tam

MAC Version Of IDLE

- It should appear similar to the Windows version (or even the Linux version installed on the computers in the tutorial room).
- But you need to keep in mind that the menu bar on a MAC does not appear in the same location as the current application (i.e. in the image below the user has had to move IDLE window to just below the menu bar).



```
Python 3.10.0 (v3.10.0:b494f5935c, Oct  4 2021, 14:59:19) [Clang 12.0.5 (
Type "help", "copyright", "credits" or "license()" for more information.
>>>
=========================================================================
============================
hi
hi
```

Image: Screengrab by James Tam from a student computer (with permission).

- If you wish to customize the configuration of the menu:
  - https://discussions.apple.com/thread/252656653?sortBy=best

James Tam

Windows: Do Not Click On The Python File

- **Why you should not** run your program by clicking on it!
  - By default Windows will try to run the program in a new popup window and then close the window after the program finishes.
  - FYI: don't send python programs. The university MS-Exchange email server will block such file attachments.
    - Workaround for mailing a python program: rename the file name from `.py` to `.txt` before attaching it.
      - How to rename a file in Windows 10:
        - » https://www.howtogeek.com/665514/6-ways-to-rename-files-and-folders-in-windows-10/
      - (How to view filename extensions in Windows 10):
        - » https://www.howtogeek.com/205086/beginner-how-to-make-windows-show-file-extensions/
      - A MAC resource:
        - » https://support.apple.com/en-ca/guide/mac-help/mchlp2304/mac
    - Don't copy-paste the code into email because it may introduce new errors.

Video: showing how useless it is to just click on a file containing a python program (use the method that will be covered shortly):
https://pages.cpsc.ucalgary.ca/~tamj/resources/python/Clicking_on_a_python_program_annotated.mp4

James Tam

Embedded Video (In Case You Can't See It Via The Link On The Last Screen).

James Tam

Requirements For Naming The File Containing Your Program

- As mentioned: no spaces!
  - Okay: `A1.py`, `gradeProgram.py`
  - Not Okay: grade program.py
- Just stick to using alphabetic characters, numbers may be used but the first character should only be alphabetic.
  - Okay: `A1Tam.py`, `A1Sept12.py`
  - Not Okay: `A1(1).py`, `9-25-2015.py`

James Tam

Section Summary: Writing A Small "`Hello World`" Program

- You should know exactly what is required to create/run a simple, executable Python program.
  - While you may not be able to create a new program from scratch at this point, you should be able to enter/run `small.py` yourself.
- You should also become familiar with requirements for naming the file which contains your python program.

James Tam

Variables

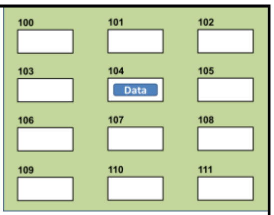


Image curtesy of James Tam

- Set aside a location in memory.
- Used to store information (temporary).
  - This location can store one 'piece' of information.
    - Putting another piece of information at an existing location *overwrites* previous information.
  - *At most* the information will be accessible as long as the program runs i.e., it's temporary
- Some types of information which can be stored in variables include:
  - integer (whole number storage only) e.g. `age = 37`
  - floating point (fractional) e.g. `height = 68.5`
  - strings (character information - essentially any characters you can type and more) e.g. `fightingName = "TamJet"` (enclosed in double quotes – do not use single quotes)

slide 22

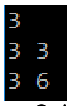
James Tam

The Assignment Operator: =

- The assignment operator '=' used in writing computer programs does not have the same meaning as mathematics.
  - Don't mix them up!
- Example:

```
y = 3 (what is stored in 'y' at this point)
x = y (what is stored in 'x','y' at this point)
y = 6 (what is stored in 'x','y' at this point)
```

- What is the end result? How was this derived (what are the intermediate
- **Name of the full example (shows output):** `2assignment.py`

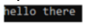


```
3
3 3
3 6
```

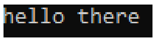
  - Quick tip after using the assignment operator: to show what a variable currently contains put the name of the variable without quotes inside the round brackets for the print function e.g.,
    - num = 888
    - `print(num)`

James Tam

Displaying Output Using The `Print()` Function:

- This function takes zero or more arguments (inputs)
  - Multiple arguments are separated with commas (extra blank appears in the output) `print("hello", "there")` 
    `hello there`
  - `print()` will display all the arguments followed by a blank line (the cursor is automatically moved to the next line).
  - Zero arguments just displays a blank line
- **Name of the full example**: `3outputExtras.py`

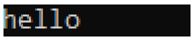
```
print("hello", "there")
```



```
hello there
```

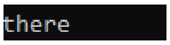
```
print()
```

```
print("hello")
```



```
hello
```

```
print("there")
```



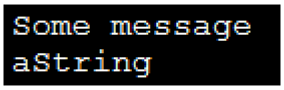
```
there
```

James Tam

`Print("… ")` Vs. `Print(<name>)`

- Enclosing the value in brackets **with quotes** means the value in between the quotes will be literally displayed onscreen.
- **Excluding the quotes** will display the contents of a memory location.
- **Name of the full example:** `4outputQuotes.py`

```
aString = "Some message"
print(aString)
print("aString")
```

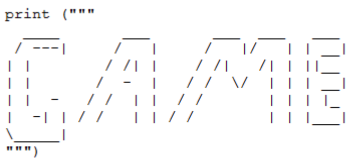


```
Some message
aString
```

James Tam

Triple Quoted Output

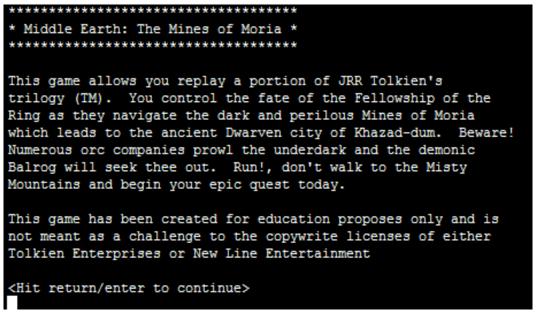
- Used to format text output (free form and to reduce the number of calls to the `print()` function)
- The way in which the text is typed into the program is exactly the way in which the text will appear onscreen.
- **Name of the full example**: 5tripleQuotes.py



```
print ("""

  ____       ___       ___  ___   ___
 / ---|     /   |     /   |/   | | __|
| |        / /| |    / /|   /| | ||__
| |       /  -  |   / /  \/  | | | __|
| |  -  / /  | |  / /       | | | |_
|  -| | / /   | | / /        | | |___|
\_____|
""")
```

From Python Programming (2nd Edition) by Michael Dawson



```
************************************
* Middle Earth: The Mines of Moria *
************************************

This game allows you replay a portion of JRR Tolkien's
trilogy (TM).  You control the fate of the Fellowship of the
Ring as they navigate the dark and perilous Mines of Moria
which leads to the ancient Dwarven city of Khazad-dum.  Beware!
Numerous orc companies prowl the underdark and the demonic
Balrog will seek thee out.  Run!, don't walk to the Misty
Mountains and begin your epic quest today.

This game has been created for education proposes only and is
not meant as a challenge to the copywrite licenses of either
Tolkien Enterprises or New Line Entertainment

<Hit return/enter to continue>
```

From a CPSC 231 assignment (image courtesy of James Tam)

James Tam

Side Note, Output: Python 3 Vs. Python 2

- Python 3: to be consistent all functions require brackets to enclose the arguments/function inputs
  - E.g. `print("Sup?")`
- Python 2 does not explicitly bracket all functions
  - E.g. `print "Sup?"`
- There are other differences so **make sure you are writing programs that follow the Python 3 syntax (rules)** and not Python 2 syntax.

James Tam

Arithmetic **Operators**

- **Name of the full example:** `6operators.py`

Operator	Description	Example	
=	Assignment	num = 7	
+	Addition	num = 2 + 2	
-	Subtraction	num = 6 - 4	
*	Multiplication	num = 5 * 4	
/	Division (real number)	num = 9 / 2	4.5
//	Integer division	num = 9 // 2	4
%	Modulo (remainder)	num = 9 % 2	1
**	Exponent	num = 9 ** 2	81

James Tam

Order Of Operation

- First level of precedence: top to bottom
- Second level of precedence
  - If there are multiple operations that are on the same level then precedence goes from left to right.
  - **Name of the full example:** `7order.py`

1st	`()`	Brackets (inner before outer)
2nd	`**`	Exponent
3rd	`*, /, //, %`	Multiplication, division, modulo
4th	`+, -`	Addition, subtraction
5th	`=`	Assignment

Example

```
num = 3 * 2 ** 3

Vs.
num = (3 * 2) ** 3
```

James Tam

Order Of Operation And Style

- Even for languages where there are clear rules of precedence (e.g., Java, Python) it's good style to explicitly bracket your operations and use blank spaces as separators.

  x = (a * b) + (c / d)

- It not only makes it easier to read complex formulas but also a good habit for languages where precedence is not always clear (e.g., C++, C).

James Tam

After This Section You Should Now Know

- How to create, translate and run Python programs.
- Variables:
  - What they are used for
  - How to access and change the value of a variable
  - How information is stored differently with different types of variables,
- Output:
  - How to display messages that are a constant string or the value stored in a memory location (variable or constant) onscreen with `print()`
- How/why use triple quoted output
- What are the Python operators for common mathematical operations
- How do the precedence rules/order of operation work in Python

James Tam