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# **Selected Programming Language: Introduction to Python**

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CS 427

Faculty of Science, Department of Mathematics

Ref:

Richard L. Halterman, **LEARNING TO PROGRAM WITH PYTHON**, 2011

<http://python.cs.southern.edu/pythonbook/pythonbook.pdf>

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# Chapter 1

## The Context of Software Development

# The Context of Software Development

- ▶ The concepts of computer programming are logical and mathematical in nature.
- ▶ In theory, computer programs can be developed without the use of a computer.

# Software

- ▶ A computer program is an example of computer software.
- ▶ One can refer to a program as a piece of software as if it were a tangible object, but software is actually quite intangible. It is stored on a medium.
- ▶ A hard drive, a CD, a DVD, and a USB pen drive are all examples of media upon which software can reside.

# Development Tools

- ▶ Software can be represented by printed words and symbols that are easier for humans to manage than binary sequences.
- ▶ Tools exist that automatically convert a higher-level description of what is to be done into the required lower-level code.
- ▶ Higher-level programming languages like Python allow programmers to express solutions to programming problems in terms that are much closer to a natural language like English.

# Development Tools

- ▶ The programmers today, especially those concerned with high-level applications, usually do not worry about the details of underlying hardware platform and its machine language.
- ▶ One might think that ideally such a conversion tool would accept a description in a natural language, such as English, and produce the desired executable code.
- ▶ This is not possible today because natural languages are quite complex compared to computer programming languages.
- ▶ Programs called compilers that translate one computer language into another have been around for 60 years, but natural language processing is still an active area of artificial intelligence research.
- ▶ Natural languages, as they are used by most humans, are inherently ambiguous.

# Development Tools

- ▶ Fortunately, programming languages provide a relatively simple structure with very strict rules for forming statements that can express a solution to any program that can be solved by a computer.
- ▶ A program called *an interpreter* translates the Python code into machine code.
- ▶ The higher-level language code is called *source code*. The interpreted machine language code is called *the target code*.
- ▶ The interpreter translates the source code into the target machine language.



# Development Tools

- ▶ The beauty of higher-level languages is this: the same Python source code can execute on different target platforms.
- ▶ The target platform must have a Python interpreter available, but multiple Python interpreters are available for all the major computing platforms.
- ▶ The human programmer therefore is free to think about writing the solution to the problem in Python, not in a specific machine language.

# Development Tools

- ▶ Programmers have a variety of tools available to enhance the software development process:
  - ▶ Editors
  - ▶ Compilers
  - ▶ Interpreters
  - ▶ Debuggers
  - ▶ Profiler
- ▶ Many developers use integrated development environments (IDEs). An IDE includes editors, debuggers, and other programming aids in one comprehensive program.
- ▶ IDLE is a very simple IDE for Python.

# Writing a Python Program

- ▶ Python programs must be written with a particular structure.
- ▶ The syntax must be correct, or the interpreter will generate error messages and not execute the program.
- ▶ We will consider two ways in which we can run a syntax
  1. enter the program directly into IDLE's interactive shell and
  2. enter the program into IDLE's editor, save it, and run it.

## **IDLE's interactive shell**

- ▶ IDLE is a simple Python integrated development environment available for Windows, Linux, and Mac OS X. You may type one line Python program directly into IDLE and press enter to execute the program.
- ▶ Since it does not provide a way to save the code you enter, the interactive shell is not the best tool writing larger programs.
- ▶ The IDLE interactive shell is useful for experimenting with small snippets Python code.

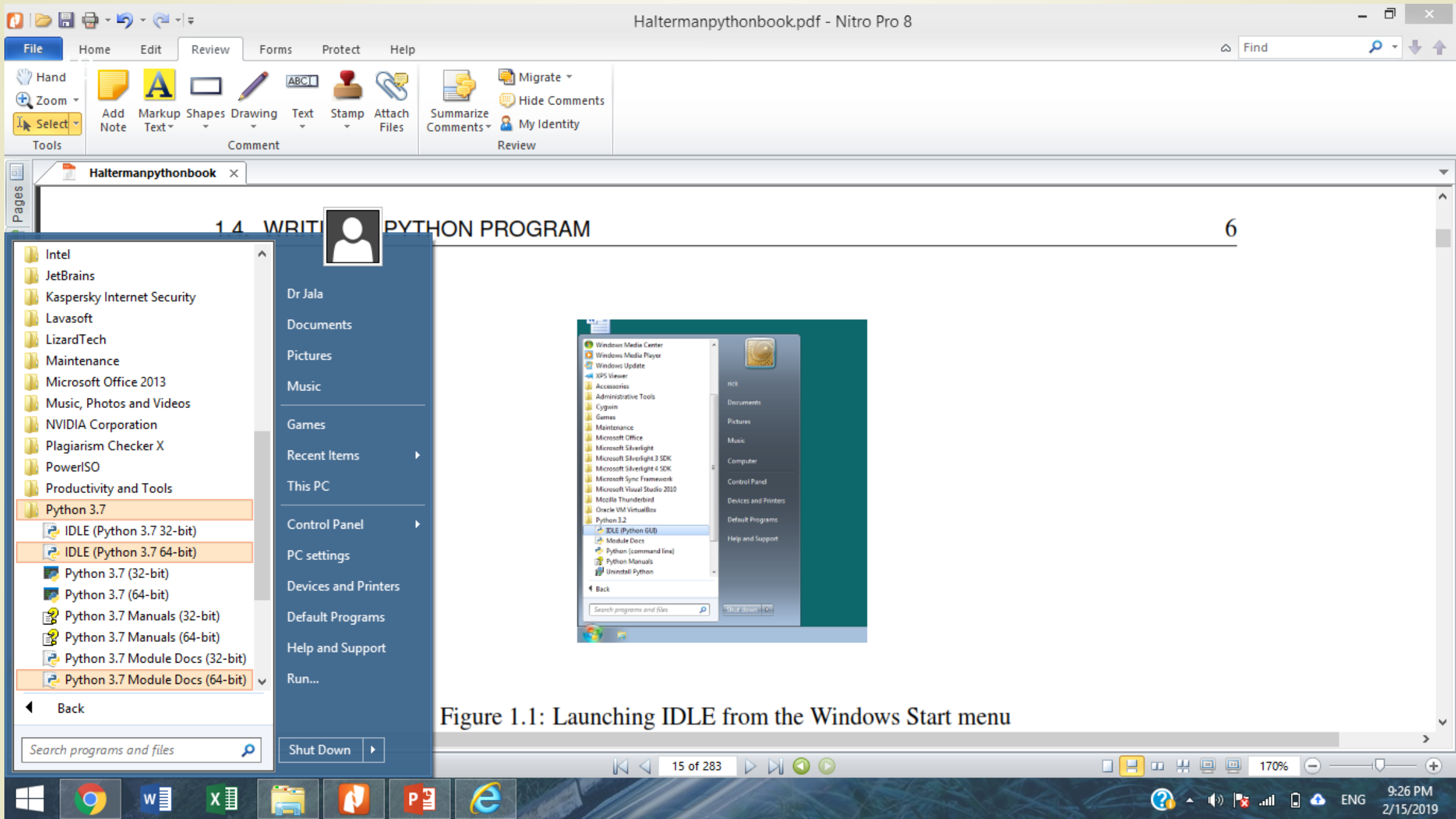


Figure 1.1: Launching IDLE from the Windows Start menu

Haltermanpythonbook.pdf - Nitro Pro 8

File Home Edit Review Forms Protect Help

Hand Zoom Select Tools

Add Markup Shapes Drawing Text Stamp Attach Summarize Hide Comments My Identity

Pages Bookmarks Comments

Python 3.7 (64-bit)

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
```

the Windows Start menu

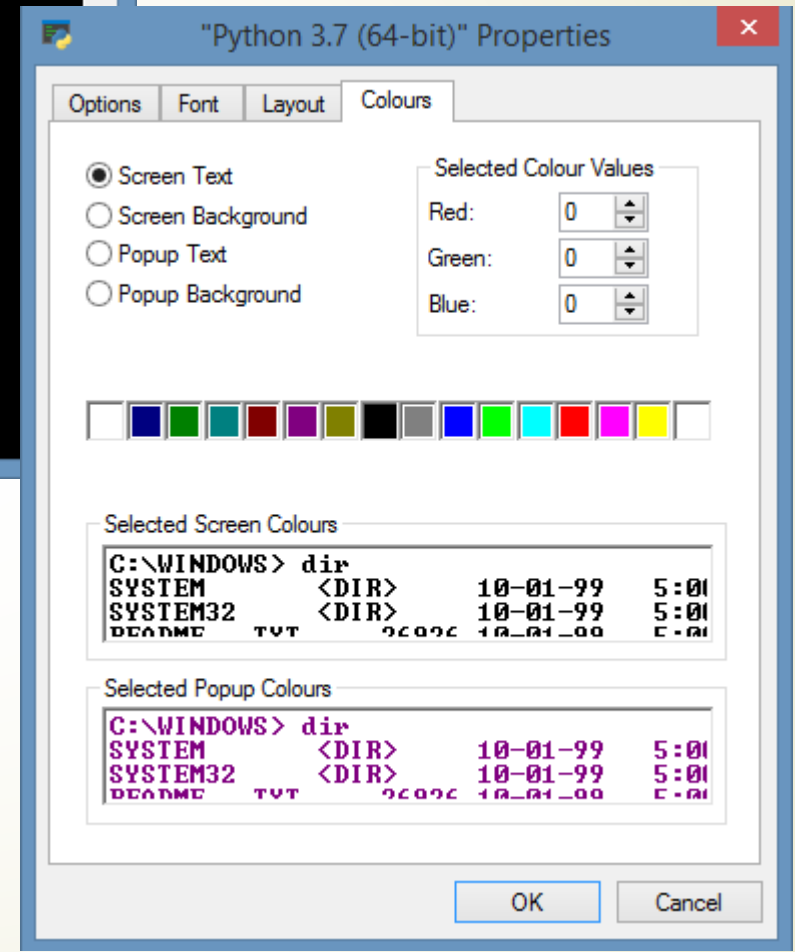
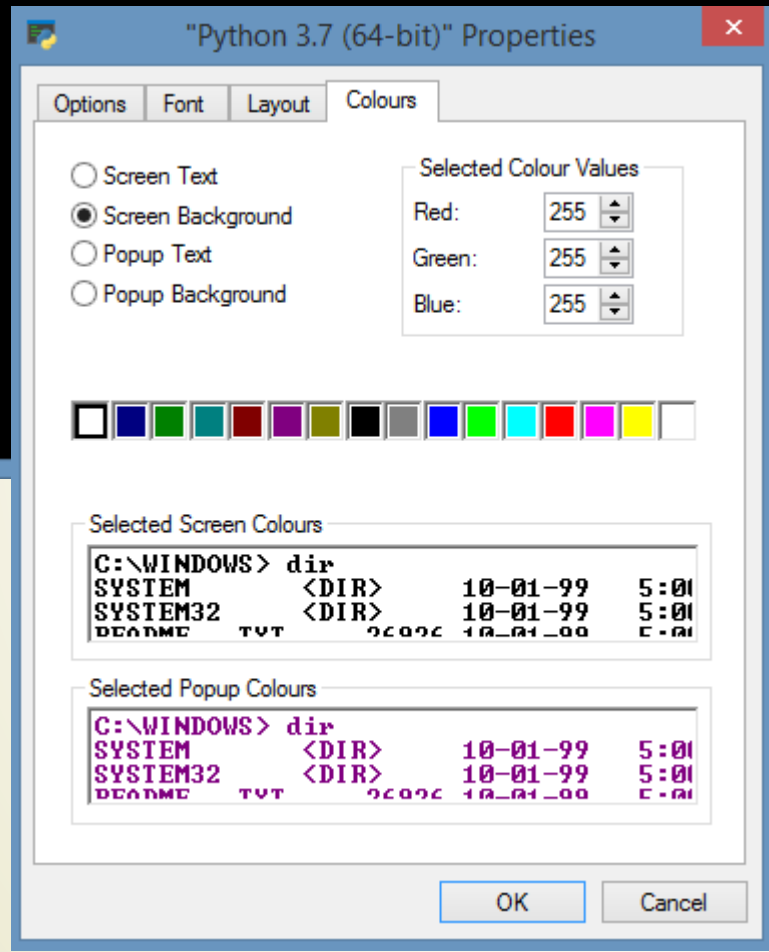
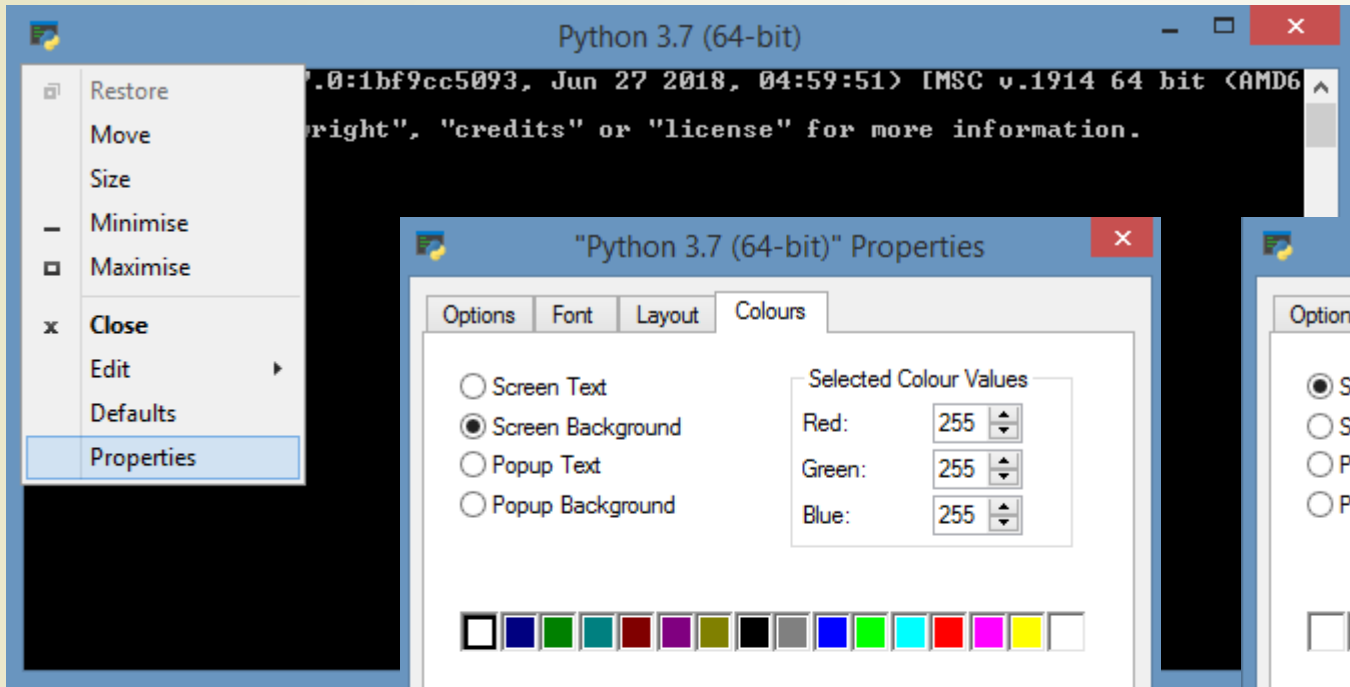
Python Shell

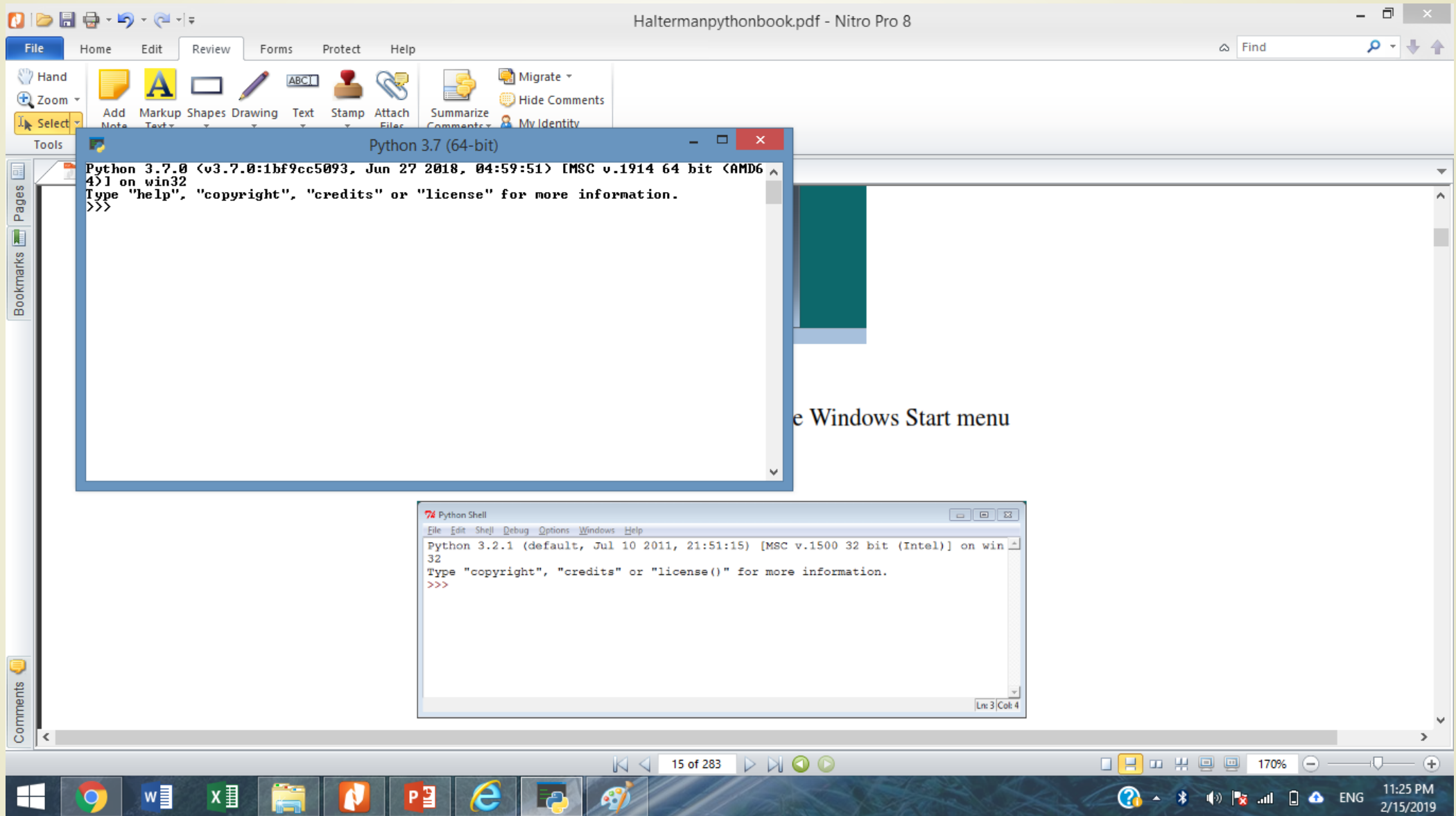
```
Python 3.2.1 (default, Jul 10 2011, 21:51:15) [MSC v.1500 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
```

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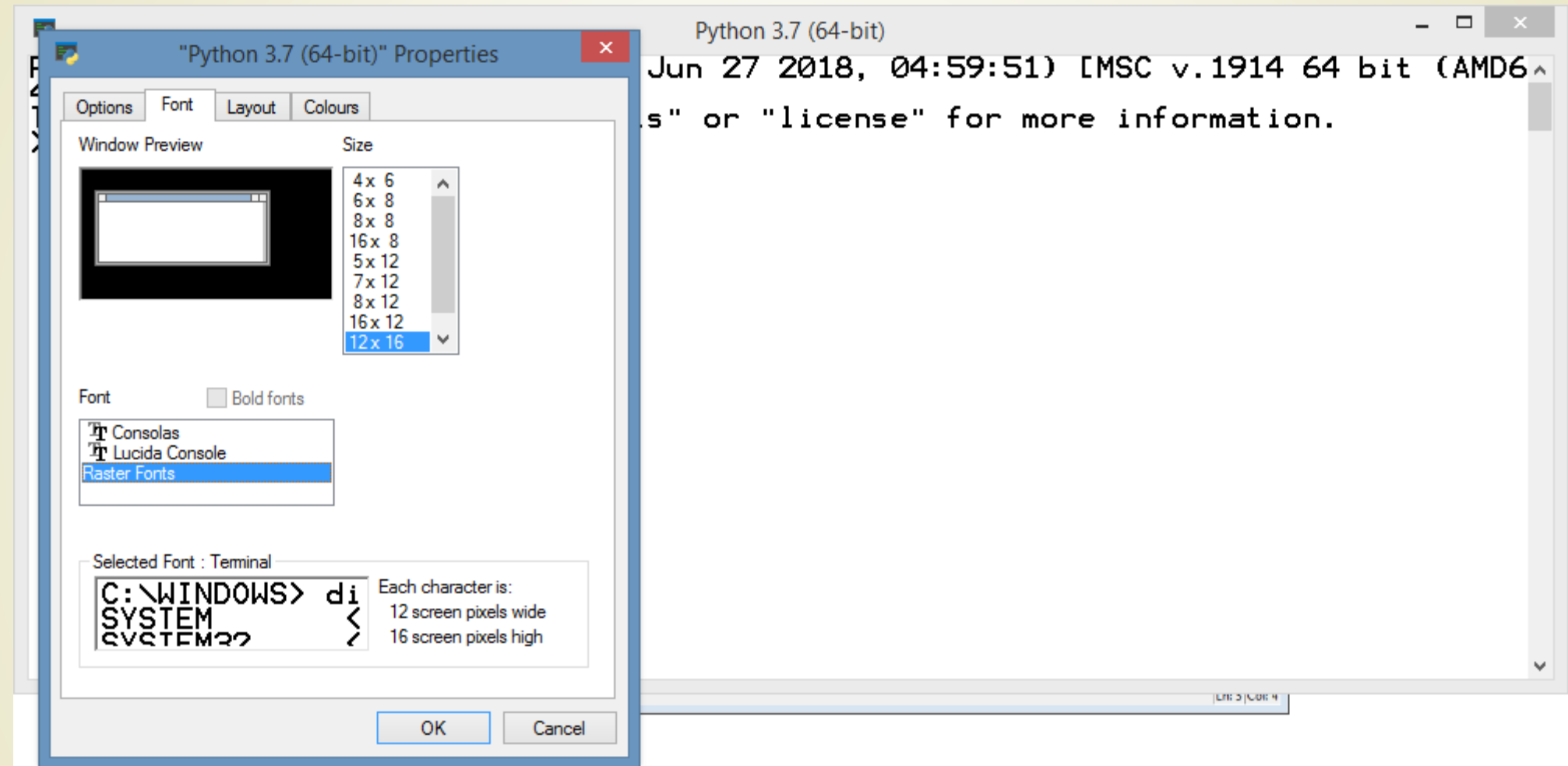
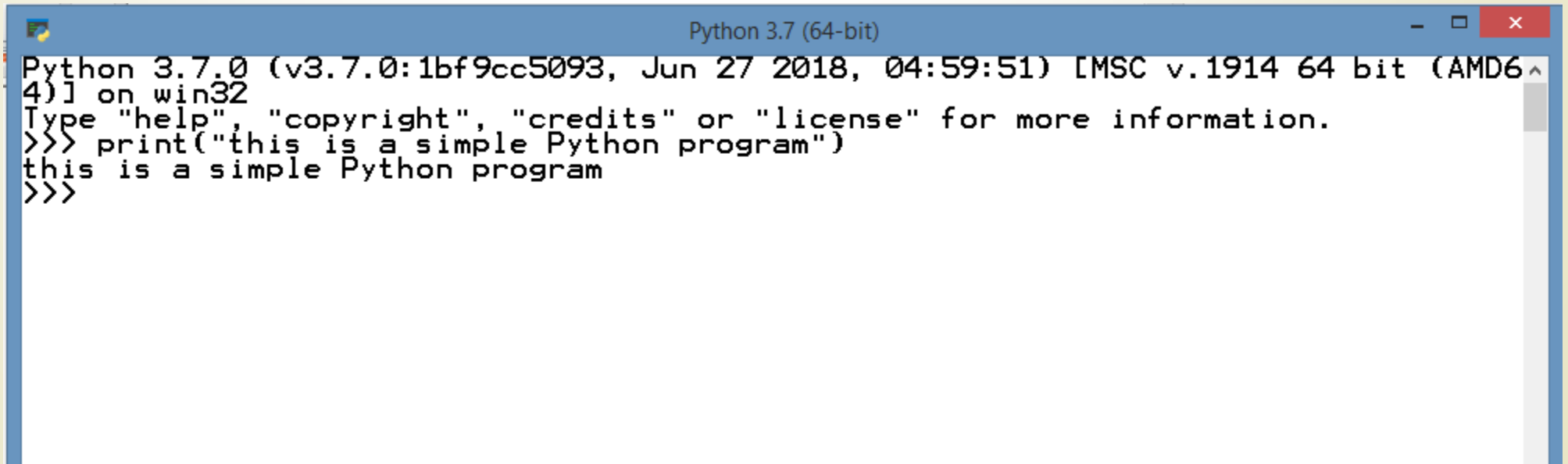


Figure 1.2: The IDLE interpreter Window

# Example

```
print("This is a simple Python program")
```

- ▶ This is a Python statement. A statement is a command that the interpreter executes.
- ▶ This statement prints the message .
- ▶ This is a simple Python program on the screen.



```
Python 3.7 (64-bit)
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> print("this is a simple Python program")
this is a simple Python program
>>>
```

# Example

```
print("This is a simple Python program")
```

- ▶ A statement is the fundamental unit of execution in a Python program.
- ▶ Statements may be grouped into larger chunks called blocks, and blocks can make up more complex statements.
- ▶ Higher-order constructs such as functions and methods are composed of blocks.
- ▶ The statement makes use of a built in function named print. Python has a variety of different kinds of statements that may be used to build programs.

## IDLE's editor

- ▶ IDLE has a built in editor.
- ▶ You can save your program using the Save option in the File menu
- ▶ The extension .py is the extension used for Python source code.
- ▶ We can run the program from within the IDLE editor by pressing the F5 function key or from the editor's Run menu: Run→Run Module.
- ▶ The output appears in the IDLE interactive shell window.

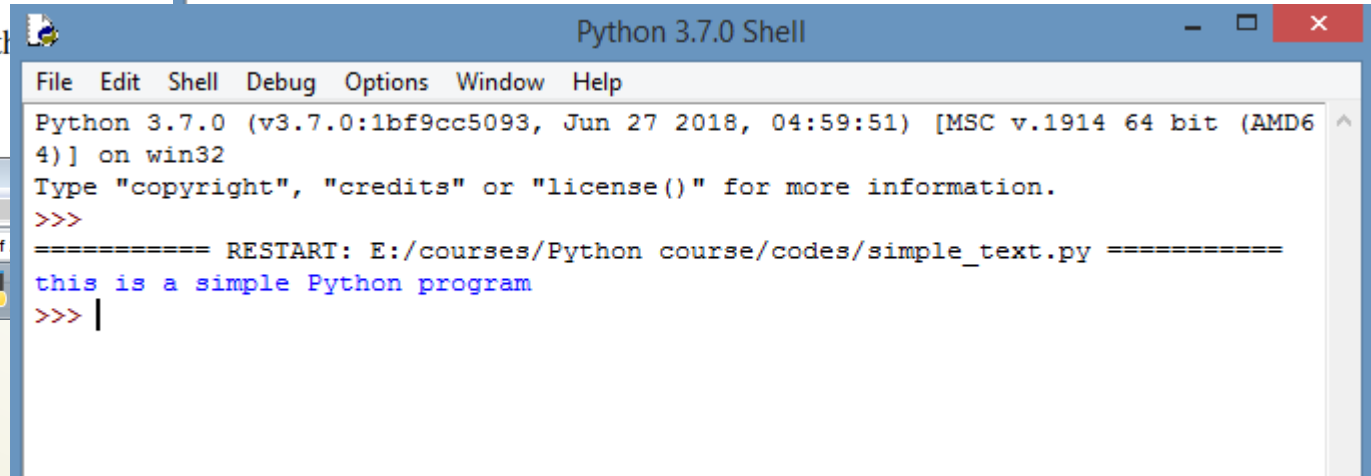
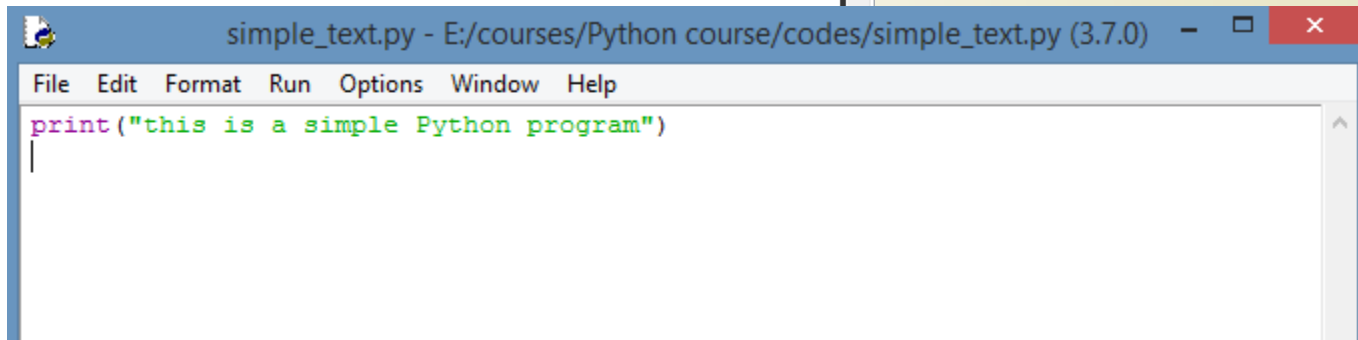
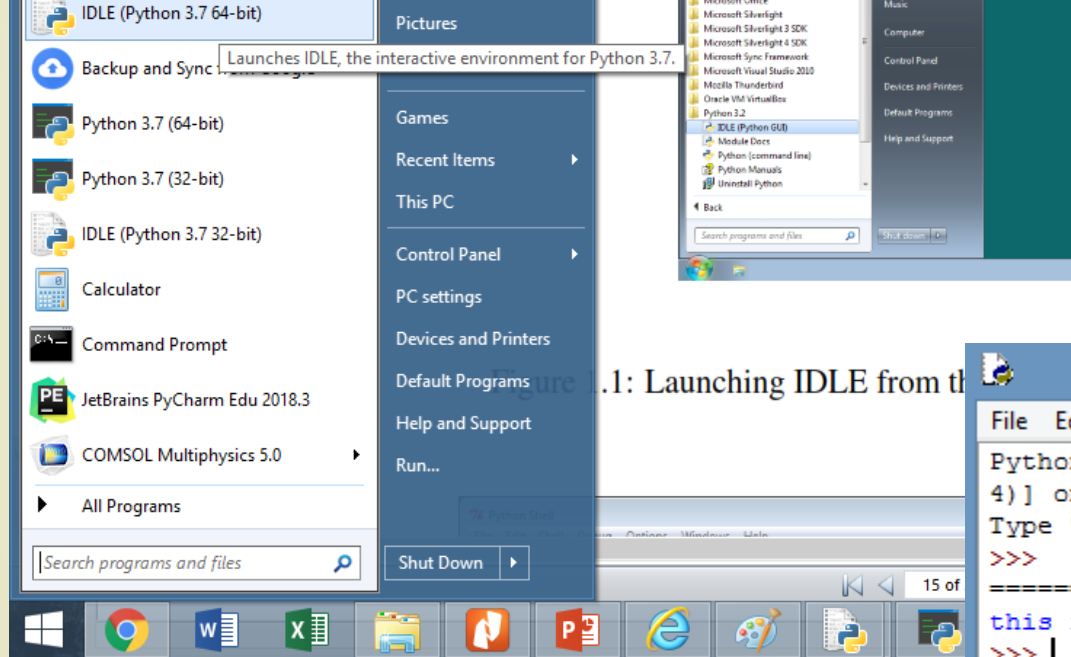
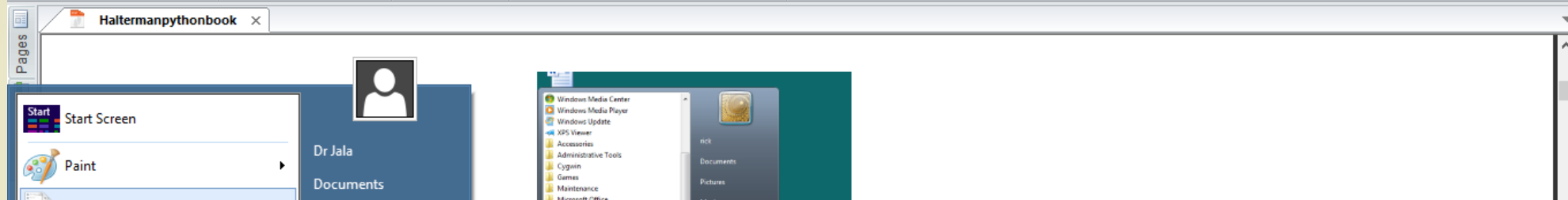
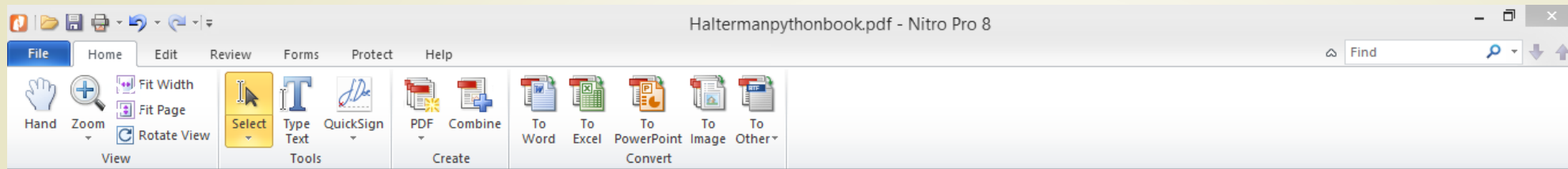


Figure 1: Launching IDLE from the Start menu

## **IDLE's editor**

- ▶ The editor allows us to save our programs and conveniently make changes to them later.
- ▶ The editor understands the syntax of the Python language and uses different colors to highlight the various components that comprise a program.
- ▶ Much of the work of program development occurs in the editor.

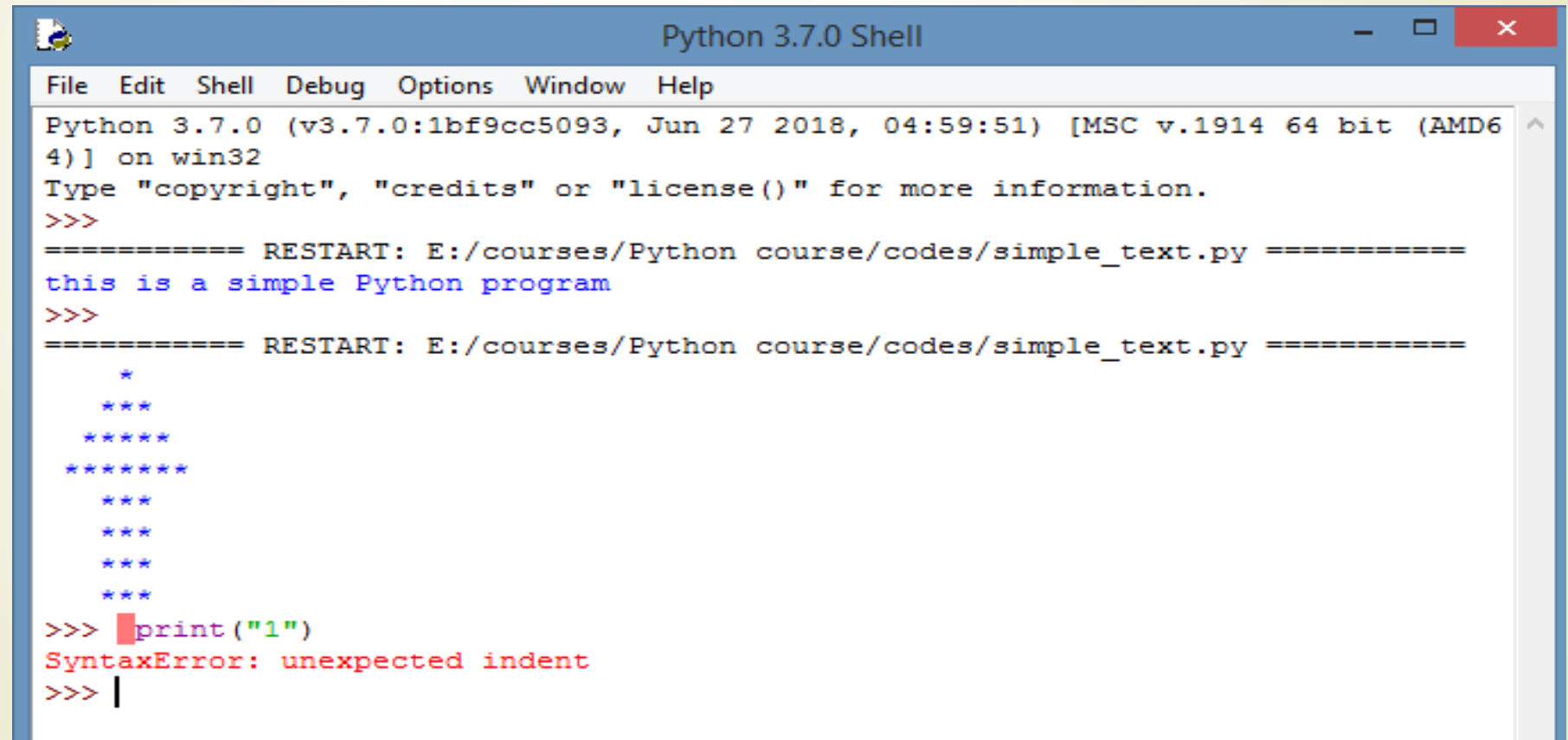
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```
simple_text.py - E:/courses/Python course/codes/simple_text.py (3.7.0)
File Edit Format Run Options Window Help
print (" * ")
print (" *** ")
print (" ***** ")
print (" ***** ")
print (" *** ")
print (" *** ")
print (" *** ")
print (" *** ")

Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: E:/courses/Python course/codes/simple_text.py =====
this is a simple Python program
>>>
===== RESTART: E:/courses/Python course/codes/simple_text.py =====
 *
 ***
 *****
 *****
 ***
 ***
 ***
 ***
>>> |
```

If you try to enter each line one at a time into the IDLE interactive shell, the program's output will be intermingled with the statements you type. In this case the best approach is to type the program into an editor, save the code you type to a file, and then execute the program. Most of the time we use an editor to enter and run our Python programs. The interactive interpreter is most useful for experimenting with small snippets of Python code.

The statements form a block of Python code. It is important that no *whitespace* (*spaces or tabs*) come before the beginning of each statement. In Python the indentation of statements is significant and must be done properly.



```
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
===== RESTART: E:/courses/Python course/codes/simple_text.py =====
this is a simple Python program
>>>
===== RESTART: E:/courses/Python course/codes/simple_text.py =====
*
***
*****
*****
***
***
***
***
>>> print("1")
SyntaxError: unexpected indent
>>> |
```





**Thank you**