Hyperiondev

TASK

Your First Computer Program and Using Variables

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Introduction

WELCOME TO THE TASK ON YOUR FIRST COMPUTER PROGRAM AND USING VARIABLES!

In this task, you are introduced to the Python programming language. Python is a widely used programming language. It is consistently ranked in the top 10 most popular programming languages as measured by the **TIOBE Programming Community Index**. Many familiar organisations make use of Python, such as *Wikipedia*, *Google*, *Yahoo!*, *NASA,* and *Reddit* (which is written entirely in Python).

Python is a high-level programming language, along with other popular languages such as Java, C#, and Ruby. High-level programming languages are closer to human languages than machine code. They're called "high-level" as they are several steps removed from the actual code that runs on a computer's processor.

This task is a gentle introduction to Python, where you will be asked to create a simple program. In doing so, you will become familiar with the structure of a Python program.

You will also be introduced to the concept of variables and more complex programming problems that can be solved using these. A *variable* is a computer programming term that is used to refer to the storage locations for data in a program. Each variable has a name which can be used to refer to some stored information known as a *value*. By completing this task you will gain an understanding of variables and how to declare and assign values to them, as well as the different types of variables and how to convert between types.

A note from the Hyperion Team

Hope you're excited to start learning such a popular and fun programming language!

A brief history of Python:

Python is named after the Monty Python comedy group. It was created by **'Benevolent Dictator For Life'** Guido van Rossum in 1991. At the time when Guido van Rossum began implementing the Python language, he was also reading the published scripts from *Monty Python's Flying Circus* (a BBC comedy series from the seventies). His inspiration for Python stemmed from the desire to create a simple scripting language and his experience with the ABC programming language.

Guido van Rossum

WHY PYTHON?

Python is a powerful, widely used programming language. In comparison with Java, Python is a more recent, efficient, and arguably faster programming language. The syntax (the way the code is written) is very similar to Java.

Here are a few more reasons to use Python:

- **Simple, yet powerful:** looking at languages like C++ and Java can flummox and scare the beginner, but Python is intuitive, with a natural way of presenting code. Python's succinctness and economy of language allows for speedy development and less hassle over useful tasks. This makes Python easy on the eyes and mind.

- **From child's play to big business:** while Python is simple enough to be learned quickly (even by kids), it is also powerful enough to drive many big businesses. Python is used by some of the biggest tech firms such as *Google*, *Yahoo!*, *Instagram*, *Spotify*, and *Dropbox*, which should speak volumes about the job opportunities out there for Python developers**.**

- **Python is on the web:** Python is a very appealing language of choice for web development. Sites such as *Pinterest* and *Instagram* make use of the versatility, rapidity, and simplicity of Django (a web development framework written in Python).

- **Even *Dropbox* was built using Python:** *Dropbox* must save massive quantities of files while supporting similarly massive amounts of user growth. Did you know that 99.9% of *Dropbox* code is written in Python? Using Python has helped *Dropbox* gain more than a hundred million users. Using only a few hundred lines of Python code, they were able to scale up massively in user numbers. Learn from *Dropbox* and use Python!

🔥Know this – Python is hot!🔥

The demand for Python programmers is only growing. Python boasts the highest year-on-year increase in terms of demand by employers (as reflected in job descriptions put up online) as well as popularity among developers. Python developers are one of the highest-paid categories of programmers! The demand for Python is only set to grow further with its extensive use in analytics, data science, and machine learning.

ZEN OF PYTHON

The Zen of Python, written in 1999 by Tim Peters, mentions all the software principles that influence the design of the Python language.

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one — and preferably only one — obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
*Although never is often better than *right* now.*
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea — let's do more of those!

Ever need to recall these principles? Try entering this into your Python interpreter:

```
import this
```

SETTING UP YOUR DEVELOPMENT ENVIRONMENT

If you still need to **set up your development environment**, please follow the instructions on **GitHub**. If you run into any trouble, submit a query via your dashboard for assistance.

Once you have set up your development environment, you are ready to start programming in Python! You will use Visual Studio Code (VS Code) as your integrated development environment (IDE) to open all text files (.txt) and Python files (.py). You can visit the **Python overview** page to learn how to use VS Code with Python. If you've never programmed before, we strongly recommend that you watch the **introductory videos**. If you have a particular problem **Stack Overflow** has a number of posts about VS Code.

Take note:

Opt-out telemetry in VS Code refers to the practice of automatically collecting usage data from users of the software, and sharing it with the VS Code developers to help them identify bugs, improve performance and make other changes that will benefit users. If you have concerns about your privacy, data, and usage habits, please turn it off by using the instructions from:

https://code.visualstudio.com/docs/getstarted/telemetry#_disable-telemetry-reporting.

WHAT IS PROGRAMMING?

Programmers write statements of code to create *programs*. Programs are executable files that perform the instructions given by the programmer.

Code can be written in different programming *languages*, such as Python, Java, and C++. In this course, you will start by learning Python.

After writing Python commands or code, you need to save them in a Python file. A Python file has the following file naming format:

*filename****.py***

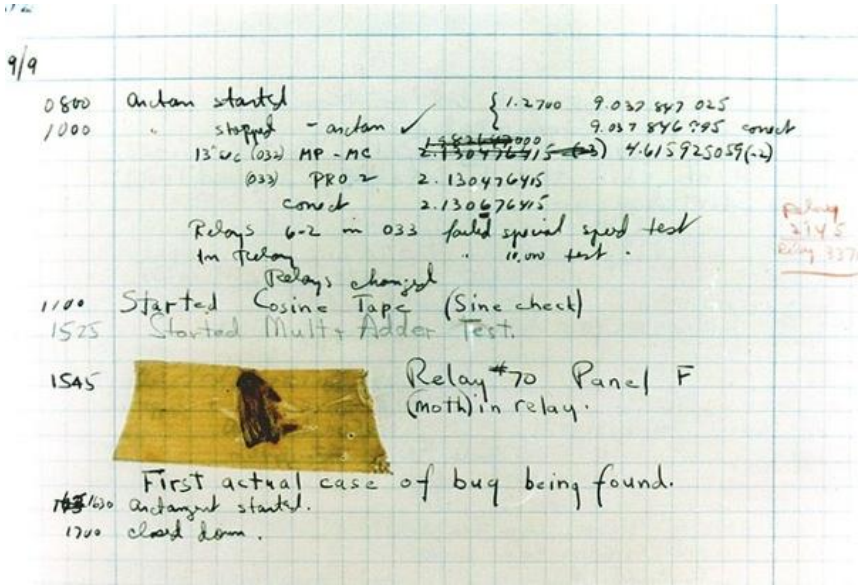
The filename can be any valid filename and **.py** is the file extension.

You can then 'run' the Python file. In this process, the Python program you have written is executed and displays the outcomes that may result based on what the code statements say. Information about how to 'run' Python files is given in the example file (**example.py**) that accompanies this task. We will now show you how to write some basic code in Python, and perform some basic operations.

A note from Riaz...

Sorry to interrupt, but did you know that the first computer "bug" was named after a real bug? Yes, you read that right! While the term "bug" in the meaning of a technical error was first coined by Thomas Edison in 1878, it was only 60 years later that someone else popularised the term.

In 1947, Grace Hopper, a US Navy admiral, recorded the first computer 'bug' in her logbook as she was working on a Mark II computer. A moth was discovered stuck in a relay and thus hindering the operation. She proceeded to remove the moth, thereby 'debugging' the system, and taped it in her logbook. In her notes, she wrote, "First actual case of bug being found."



Riaz Moola, *Founder and CEO*

THE *PRINT()* FUNCTION

You may want your program to display or output information to the user. The most common way to view program output is to use the `print` function. To use `print`, we enter the `print` command followed by one or more arguments in brackets. Understanding this requires understanding what arguments are parameters are, and revising what variables are.

Remember from earlier in this task that a **variable** is a computer programming term that is used to refer to the storage locations for data in a program. Each variable has a name which can be used to refer to some stored information known as a **value**.

A **parameter** is a variable in a function (or method) definition. When a function is actually called, the **arguments** are the *data you pass into* the function's parameters. The same is true of a method.

Now you have the concepts straight, let's review how `print` works. We enter the `print` command into a Python file followed by one or more arguments in brackets. In programming, a **command** is an instruction given by a user telling a computer to do something. Together a command and an argument are known as a **statement**. Consider the Python statement below:

```
print("Hello, World!")
```

When you run this program, the computer will output the argument “Hello, World!” that was passed in to the input parameter. Note that the argument is enclosed in double quotes ("..."). This is because "Hello, World!" is a **string** or a list of characters. You’ll learn more about strings and other variable types later in this task.

Note that the Python Shell (the window that is displayed when you run a Python program) only shows the output of the program. Other statements in your code that don’t create output will be executed but not displayed in the Python Shell.

SYNTAX RULES

All programming languages have *syntax* rules. Syntax is the "spelling and grammar rules" of a programming language and determines how you write correct, well-formed statements.

A common syntax error you could make in the print statement we looked at above is forgetting to add a closing quotation mark at the end of the string parameter ("). Remember that all opening quotation marks (") require a closing one! Another common syntax error that you could make in the above example is forgetting to add a closing bracket ‘)’. Remember that all opening brackets ‘(’ require a matching closing one, ‘)’!

Any program you write must be exactly correct. All code is case sensitive. This means that *'Print'* is not the same as *'print'*. If you enter an invalid Python command, misspell a command, or misplace a punctuation mark, you will get a syntax error when trying to run your Python program.

Errors appear in the Python shell when you try to run a program and it fails. Be sure to *read all errors carefully* to discover what the problem is. Error reports in the Python shell will even tell you what line of your program had an error. The process of resolving errors in code is known as *debugging*.

HOW TO GET INPUT

Sometimes you want a user to enter data, through the keyboard, that will be used by your program. To do this, we use the *input* command.

The *input* command, in the example below, will show the text "Enter your name: " in the output box of the program. The program will then halt until the user enters something with their keyboard and presses enter.

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

The variable *name* stores what the user entered into the box as a **string**. Storing and declaring variables doesn't produce any output.

WHAT ARE VARIABLES?

Let's consider variables in a little more depth. To be able to perform calculations and instructions, we need a place to store values in the computer's memory. This is where variables come in. A *variable* is a way to store information. It can be thought of as a type of "container" that holds information.

Variables in programming work the same as variables in mathematics. We use them in calculations to hold values that can be changed. In maths, variables are named using letters, like *x* and *y*. In programming, you can name variables whatever you like, as long as you don't pick something that is a keyword in the programming language. It is best to name them something useful and meaningful to the program or calculation you are working on. For example, *num_learners* could contain the number of learners in a class, or *total_amount* could store the total value of a calculation.

In Python, we use the following format to create a variable and assign a value to it:

```
variable_name = value_you_want_to_store
```

Check out this example:

```
num = 2
```

In the code above, the variable named *num* is assigned the integer (also known as a whole number) 2. Hereafter when you type the word *num*, the program will refer to the appropriate space in memory and retrieve the value 2 that is stored there.

We use variables in calculations to hold values that can be changed. You can name a variable anything you like as long as you follow the rules shown below. However, as previously stated, it is good practice to give your variables meaningful names.

Below is an example of bad naming conventions vs good naming conventions.

- `my_name = "Tom"` # Good variable name
- `variableOne = "Tom"` # Bad variable name
- `string_name = "Tom"` # Good variable name
- `h4x0r = "Tom"` # Bad variable name

Here, `my_name` and `string_name` are examples of descriptive variables as they reveal what their functions are and what content they store, whereas `variableOne` and `h4x0r` are terrible names because they are not descriptive.

A note from the Hyperion Team

Now that you are a little more familiar with Python and creating basic programs, we would like to show you some stuff to help you on your journey to becoming a seasoned programmer.

Creating excellent content requires good tools and equipment. This applies equally well to programming. There are some great tools and resources available online that you can start using as soon as possible, if you have not already, to make the coding process just that much more convenient. **Here** is a link to the Hyperion Blog where you will find essential utilities and resources for programmers.

A note from our coding mentor

Jared

Variable Naming Rules

It is very important to give variables descriptive names that reference the value being stored. Here are the naming rules:

1. Variable names must start with a letter or an underscore.
2. The remainder of the variable name can consist of letters, numbers, and underscores.
3. Variable names are case sensitive so Number and number are each different variable names.
4. You cannot use a Python keyword (reserved word) as a variable name. A reserved word has a fixed meaning and cannot be redefined by the programmer. For example, you would not be allowed to name a variable *print* since Python already recognises this as a keyword.

Variable Naming Style Guide

The way you write variable names will vary depending on the programming language you are using. For example, the **Java** style guide recommends the use of camel case — where the first letter is lowercase, but each subsequent word is capitalised with no spaces in between (e.g. thisIsAGoodExampleOfCamelCase)

The style guide provided for **Python** code, **PEP 8**, recommends the use of snake case — all lowercase with underscores in between instead of spaces (e.g. this_is_a_good_example_of_snake_case). You should use this type of variable naming for your Python tasks.

In maths, variables only deal with numbers, but in programming, we have many different types of variables and each variable type deals with a specific type of information.

VARIABLE DATA TYPES

There are five major types of data that variables can store. These are **strings**, **chars**, **integers**, **floats**, and **booleans**.

- **string:** A string consists of a combination of characters. For example, it can be used to store the surname, name, or address of a person.

- **char**: Short for **char**acter. A char is a single letter, number, punctuation mark or any other special character. It can be used for storing the grade symbol (A-F) of a pupil, for example, and strings can be thought of as lists of chars in situations in which this approach is useful.

- **integer:** An integer is a whole number, or number without a decimal or fractional part. For example, it can be used to store the number of items you would like to purchase, or the number of students in a class.

- **float:** We make use of a float data type when working with numbers that contain decimals. For example, it can be used to store measurements or monetary amounts.

- **boolean:** Can only store one of two values, namely TRUE or FALSE.

The situation you are faced with will determine which variable you need to use. For example, when dealing with money or mathematical calculations you would likely use **integers** or **floats**. When dealing with sentences or displaying instructions to the user you would make use of **strings**. When dealing with decisions that have only two possible outcomes you would use **booleans**, as the scenario could only either be True or False.

Variables store data and the type of data that is stored by a variable is intuitively called the *data type*. In Python, we do not have to declare the data type of the variable when we declare the variable. This is known as “weak-typing”. This is because Python detects the variable's data type by reading how data is assigned to the variable:

- strings are detected by quotation marks " ".
- integers are detected by the lack of quotation marks and the presence of digits or other whole numbers.
- floats are detected by the presence of decimal point numbers.
- booleans are detected by either True or False.

So, if you enter numbers, Python will automatically know you are using integers or floats. If you enter a sentence, Python will detect that it is storing a string.

Take heed that types can be converted from one to another. You need to take care when setting a string with numerical information.

For example, consider this:

```
number_str = "10"
print(number_str*2) # Prints 1010- prints string twice
print(int(number_str)*2) # Prints 20 because the string 10 is cast to number 10
```

Watch out here! Since you defined 10 within quotation marks, Python figures this is a string. It's not stored as an integer even though 10 is a number, as numbers can also be made into a string if you put them between quotation marks. Now, because 10 is declared as a string here, we will be unable to do any arithmetic calculations with it - the program treats it as if the numbers are letters. In the above example, when we ask Python to print the string times 2, it helpfully prints the string twice. If we want to print the value of the number 10 times 2, we have to *cast* the string variable to an integer by writing `int(number_string)`.

There is also a way that you can determine what data type a variable is: with the `type()` built-in function. For example:

```
mystery_1 = "10"
mystery_2 = 10.6
mystery_3 = "ten"
mystery_4 = True

print(type(mystery_1))
print(type(mystery_2))
print(type(mystery_3))
print(type(mystery_4))
```

Output:

```
<class 'str'>
<class 'int'>
<class 'str'>
<class 'bool'>
```

The output shows us the data type of each variable in the inverted commas.

CASTING

In the string printing example above, you saw something we called *casting*. Casting basically means taking a variable of one particular data type and "turning it into" another data type. Putting the 10 in quotation marks will automatically convert it into a string, but there is a more formal way to change between variable types. This is known as *casting* or type conversion.

Casting in Python is pretty simple. All you need to know is which data type you want to convert to and then use the corresponding function.

- **`str()`** — converts variable to a string
- **`int()`** — converts variable to an integer
- **`float()`** — converts variable to a float

```
number = 30
number_str = "10"
print(number + int(number_str)) # Prints 40
```

This example converts **`number_str`** into an integer so that we can add two integers together and print the total. We cannot add a string and an integer together.

You can also convert the variable type entered via **`input()`**. **By default, anything entered into an `input()` is a string**. To convert input to a different data type, simply use the desired casting function.

```
num_days = int(input("How many days did you work this month?"))
pay_per_day = float(input("How much is your pay per day?"))
salary = num_days * pay_per_day
print("My salary for the month is USD:{}".format(salary))
```

When writing programs, you'll have to decide what variables you will need.

Take note of what is in the brackets on line 4 above. When working with strings, we are able to put variables into our strings with the *format* method. To do this, we use curly braces { } as placeholders for our values.
Then, after the string, we put **`.format(variable_name)`**. When the code runs, the curly braces will be replaced by the value in the variable specified in the brackets after the *format* method. Let's briefly turn our attention to the benefits of using the f-string in comparison to the format method.

Working with the f-string:

The syntax for working with the f-string is quite similar to what is shown above in the format method. Notice that we declare the variables upfront and we don't need to tag on the .format method at the end of our string. Also note the ***f*** at the beginning of the string:

```
num_days = 28
pay_per_day = 50
print(f"I worked {num_days} days this month. I earned ${pay_per_day} per day.")
```

Output:

```
'I worked 28 days this month. I earned $50 per day.'
```

f-strings provide a less verbose way of interpolating values inside string literals. If you'd like to learn a little more about f-strings, you can **read more about them here**.

If you wanted to use the `str.format()` method, you could do so as follows:

Example 1: insert values using index references

```
print("You worked {0} this month and earned ${1} per day".format(num_days = 22,
pay_per_day = 50))
```

Example 2: insert values using empty placeholders

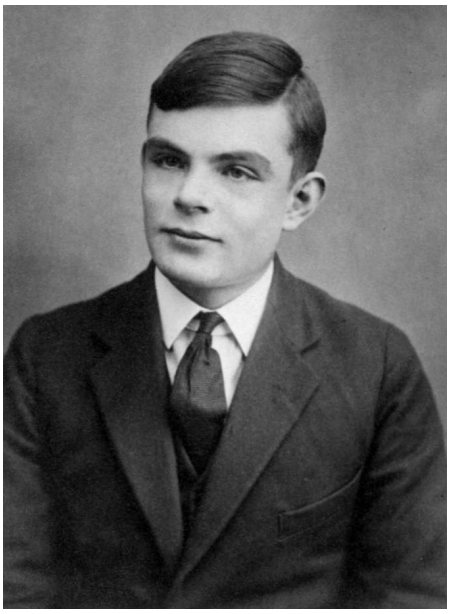
```
print("You worked {} this month and earned ${} per day".format(num_days = 22,
pay_per_day = 50))
```

Hey there, have you heard about Alan Turing?

Alan Turing (1912 – 1954) was a British mathematician, logician, and cryptographer. He is considered by many to be the father of modern computer science. He designed and built some of the earliest electronic, programmable, digital computers.

Father of modern day computing

During the Second World War, Alan Turing was recruited by the military to head a classified mission at Bletchley Park. This mission was to crack the Nazi's Enigma machine code which was used to send secret military messages. Many historians believe that breaking the Enigma code was key to bringing the war to an end in Europe. Turing published a paper in 1936 that is now recognised as the foundation of computer science.



Source: ***Wikipedia***

Instructions

This lesson is continued in the example files (**example_first_program.py** and **example_variables.py**) provided in this task folder. Open these files using VS Code. The context and examples provided in the examples should help you understand some simple basics of Python.

You may run the examples to see the output. The instructions on how to do this are inside the file. Feel free to write and run your own example code before attempting the task, to become more comfortable with Python.

Try to write comments in your code to explain what you are doing in your program (read the example files for more information).

You are not required to read the entirety of **Additional Reading.pdf**. It is purely for extra reference. That said, don't simply disregard it!

Compulsory Task 1

Follow these steps:

- Create a new Python file in the Dropbox folder for this task, and call it **hello_world.py**.
- Please first provide pseudo code as comments in your Python file, outlining how you will solve this problem (you'll need to read the rest of this compulsory task first of course!).
- Now, inside your **hello_world.py** file, write Python code to take in a user's name using `input()` and then print out the name.
- Use the same input and output approach to take in a user's age and print it out.
- Finally, print the string "Hello World!" on a new line (the new line will happen by default if you use a separate print statement to the one you used immediately above to print out the age).

Compulsory Task 2

Follow these steps:

- Create a new Python file in the Dropbox folder for this task, and call it **details.py**
- As in compulsory task 1, please first provide pseudo code as comments in your Python file, outlining how you will solve this problem.
- Use an `input()` command to get the following information from the user.
    - Name
    - Age
    - House number
    - Street name
- Print out a single sentence containing all the details of the user.
- For example:
    - This is John Smith. He is 28 years old and lives at house number 42 on Hamilton Street.

Compulsory Task 3

Follow these steps:

- Create a new Python file in this folder called **conversion.py**
- As in the previous compulsory tasks, please first provide pseudo code as comments in your Python file, outlining how you will solve this problem.
- Declare the following variables:
    - *num1* = 99.23
    - *num2* = 23
    - *num3* = 150
    - *string1* = "100"
- Convert them as follows:
    - *num1* into an integer

    - *num2* into a float
    - *num3* into a string
    - *string1* into an integer
- Print out all the variables on separate lines

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