Teaching London Computing

Topic 1.3
Python Variables

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Aims

- Understand the idea of a variable
- Using metaphors to explain variables
- Using variables to breakdown complex expressions
- Assignment statements

- Stages of understanding 'variables'

Program Variable

- **Understanding 1:** Variables is a name for a value

- Names are really important
  - Name $\leftarrow\rightarrow$ meaning

- Value can change

Which are the following everyday values are like variables?

- Your height
- Your age
- The credit on your oyster

Using a Variable

- A variable can be used instead of a value:

```
greeting = "Hello"
planet = "World"
print(greeting, planet)
```

- The output is:

```
'Hello World'
```

- The variables are: 'greeting' and 'planet'
  - *Any names*

Decomposition using Variable

- How to break a complex calculation down into simpler steps?
  - Recurring question in programming

```
>>> km_mile = (1760 * 36 * 2.54) / 100 / 1000
>>> km_mile
1.609344
```

```
>>> inch_mile = 1760 * 36
>>> cm_mile = inch_mile * 2.54
>>> m_mile = cm_mile / 100
>>> km_mile = m_mile / 1000
>>> km_mile
1.609344
```

Errors

- A variable must be given a value before it is used:

```
>>> area = length * width
Traceback (most recent call last):
  File "<pyshell#4>", line 1, in <module>
    area = length * width
NameError: name 'length' is not defined
```

- Notice:
  - The message is complex – read it carefully
  - Only the first error is mentioned

Assignment

- The statement to set a variable is call 'assignment'

```
>>> x = 10
```

- … can be read as '10 is assigned to x'

- How do you read?

```
>>> x = y
```

Warning: assignment is not equals

Assignment II

- "x is assigned the value of y" or "the value of y is assigned to variable x"

```
>>> x = y
```

- How are the two variables used?
  - Variable 'x' changes value; the value of 'y' stays the same
  - The value of 'y' is used (or read); an error occurs if 'y' has never been given a value.
  - It does not matter if 'x' has no value before the statement; if it does, it is lost

Quiz – I

- What is the value of 'x' after these statements have been executed?

```
x = 5
x = x + 3
```

- You can check the answer using the Python shell

Variable as a Memory Location

- **Understanding 2:** A variable is a location in the computer's memory

- Python takes care of 'where' to put the values

Name	Value
subject	"CS"
number	4
activity	"FUN"

Quiz – II

- What is the values of 'x' and 'y' after these statements have been executed?
    - Each box is a separate problem

```
x = 3
y = 2
x = x + y
```

```
x = 3
y = 2 + x
x = x + y
```

```
x = 3
y = 2
x = x + y
y = x - 2
```

Which understanding is needed?

- You can check the answers using the Python shell

Summary

- A variable gives a name to a value
  - Choose a meaningful name
- Reading and Assignment
  - A variable can be read in an expression
  - A variable can be changed in an assignment statement
- Use variables
  - To replace a complex expression with several simpler ones
  - *To hold an 'input' string from the user*

We already did this