

<b>PRG1</b>	<b>Programming I</b> Diploma in IT / FI / ISF Year 1 (2018/19) Semester 1	Week <b>2</b>
		<b>1</b> hour
<b>Mission 2-2: Program Errors &amp; Debugging</b>		

## OBJECTIVES

At the end of this exercise, students should be able to:

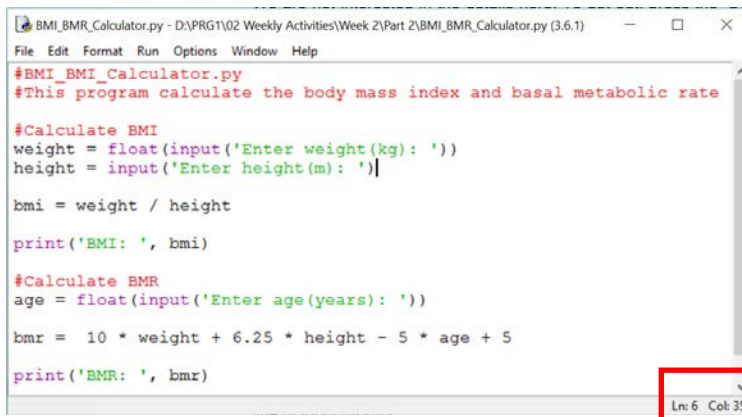
- Understand the various types of program errors
- Understand the process of debugging

## Part A. Introduction to the Debugger Tool

You will now learn how to use the **IDLE Debugger** to execute a program one statement at a time and examine the changes in the variable values.

Follow these instructions carefully:

- Download the file **Mission22-BMI\_BMR\_Calculator.py** from Coursemology.
- Open the file using IDLE.
- The display at the bottom right tells you the current line and position in the line.



```

#BMI_BMI_Calculator.py
#This program calculate the body mass index and basal metabolic rate

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = input('Enter height(m): ')

bmi = weight / height

print('BMI: ', bmi)

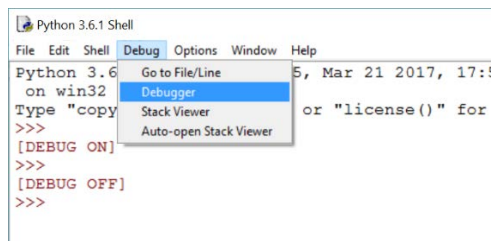
#Calculate BMR
age = float(input('Enter age(years): '))

bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
  
```

- Enable the debugger

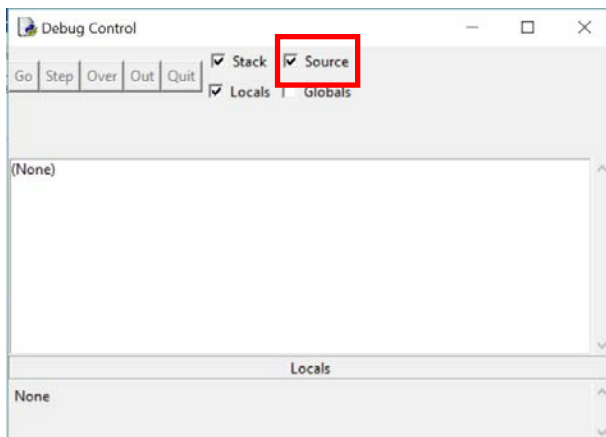
Click the Debug>Debugger menu in the Python Shell to make the *Debug control window* appear.



```

Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
Python 3.6 on win32
Type "copy" or "license()" for
>>> [DEBUG ON]
>>> [DEBUG OFF]
>>>
  
```

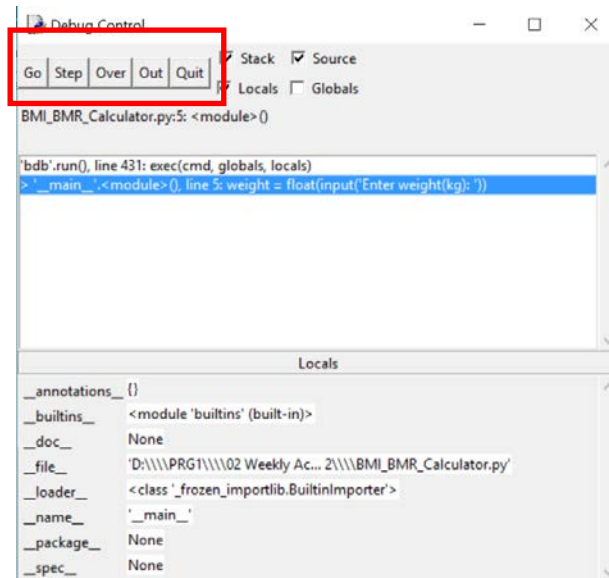
The Debug control window:



Check the 'Source' checkbox as shown above.

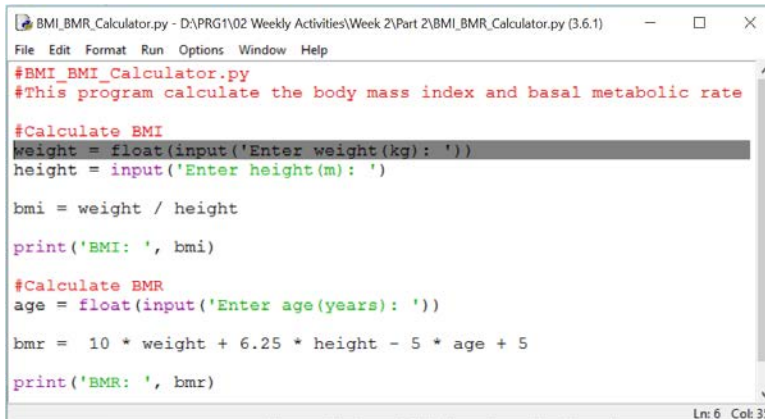
- v. Start the debugging process

Run the program by pressing F5, the *debugger* will be activated.



Notice that some buttons at top left hand corner in the Debug window are now enabled: Go, Step, Over, Out, Quit.

Looking at the program, you will see a line highlighted in grey. This is the next instruction that will be executed.



```

BMI_BMR_Calculator.py - D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI_BMR_Calculator.py (3.6.1)
File Edit Format Run Options Window Help
#BMI_BMI_Calculator.py
#This program calculate the body mass index and basal metabolic rate

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = input('Enter height(m): ')

bmi = weight / height

print('BMI: ', bmi)

#Calculate BMR
age = float(input('Enter age(years): '))

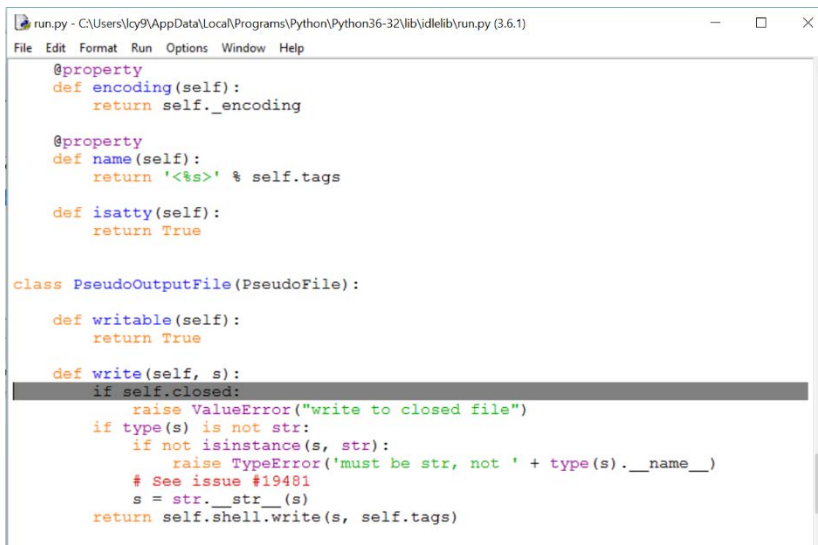
bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
Ln: 6 Col: 35
  
```

vi. Step through the program

Press the 'Step' button in Debug window to single step through the program.

When the 'Step' button is pressed, notice that the program control will jump into a function (to be learnt in subsequent topics).



```

run.py - C:\Users\cy9\AppData\Local\Programs\Python\Python36-32\lib\idlelib\run.py (3.6.1)
File Edit Format Run Options Window Help
@property
def encoding(self):
    return self._encoding

@property
def name(self):
    return '<%s>' % self.tags

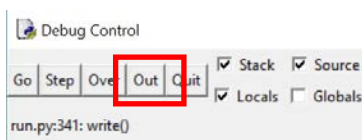
def isatty(self):
    return True

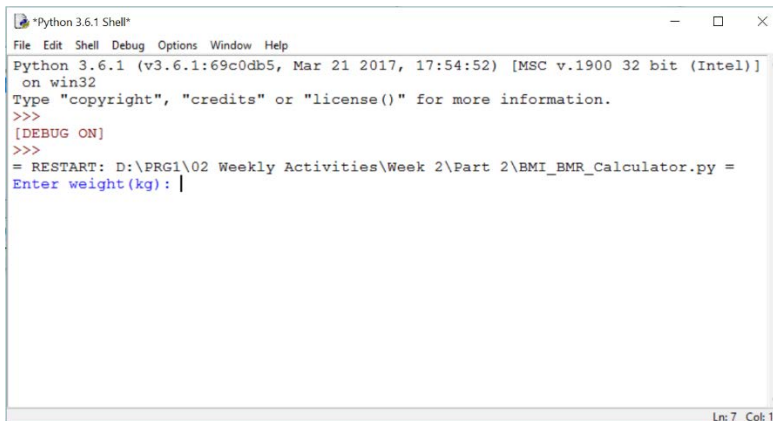
class PseudoOutputFile(PseudoFile):

    def writable(self):
        return True

    def write(self, s):
        if self.closed:
            raise ValueError("write to closed file")
        if type(s) is not str:
            if not isinstance(s, str):
                raise TypeError('must be str, not ' + type(s).__name__)
            # See issue #19481
            s = str.__str__(s)
        return self.shell.write(s, self.tags)
  
```

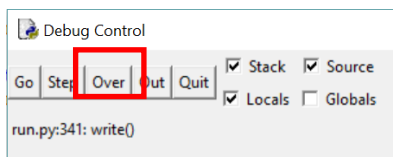
We are not interested in the details here. To get out, press the 'Out' button in Debug window, after which the input prompt for weight is shown in Python shell.






```
Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
Python 3.6.1 (v3.6.1:69c0db5, Mar 21 2017, 17:54:52) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
[DEBUG ON]
>>>
= RESTART: D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI_BMR_Calculator.py =
Enter weight(kg): |
```

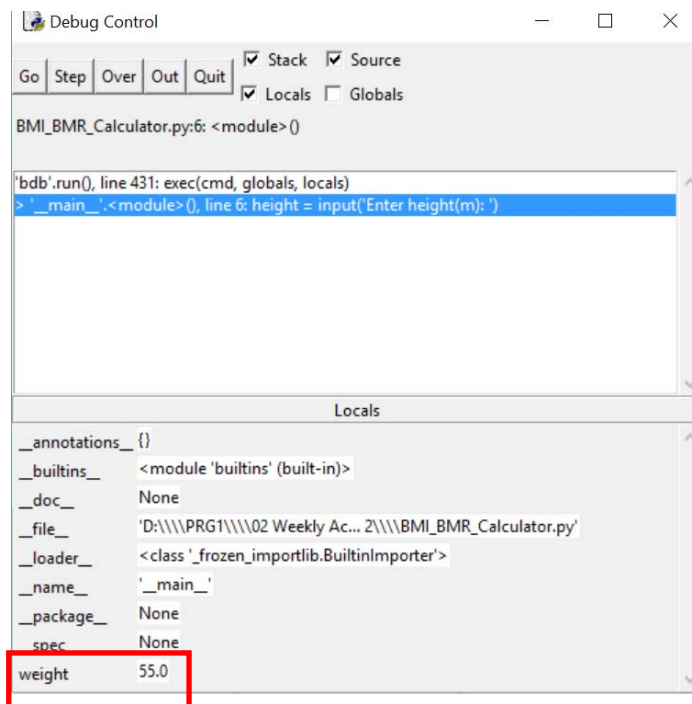
Alternatively, if you know most likely that line of code is not the cause of problem and you do not wish to see the details, press 'Over' button before executing the line of input prompt.



Enter the value for the weight as 55 and press Enter. Notice the changes in the Debug window. Weight is now 55.



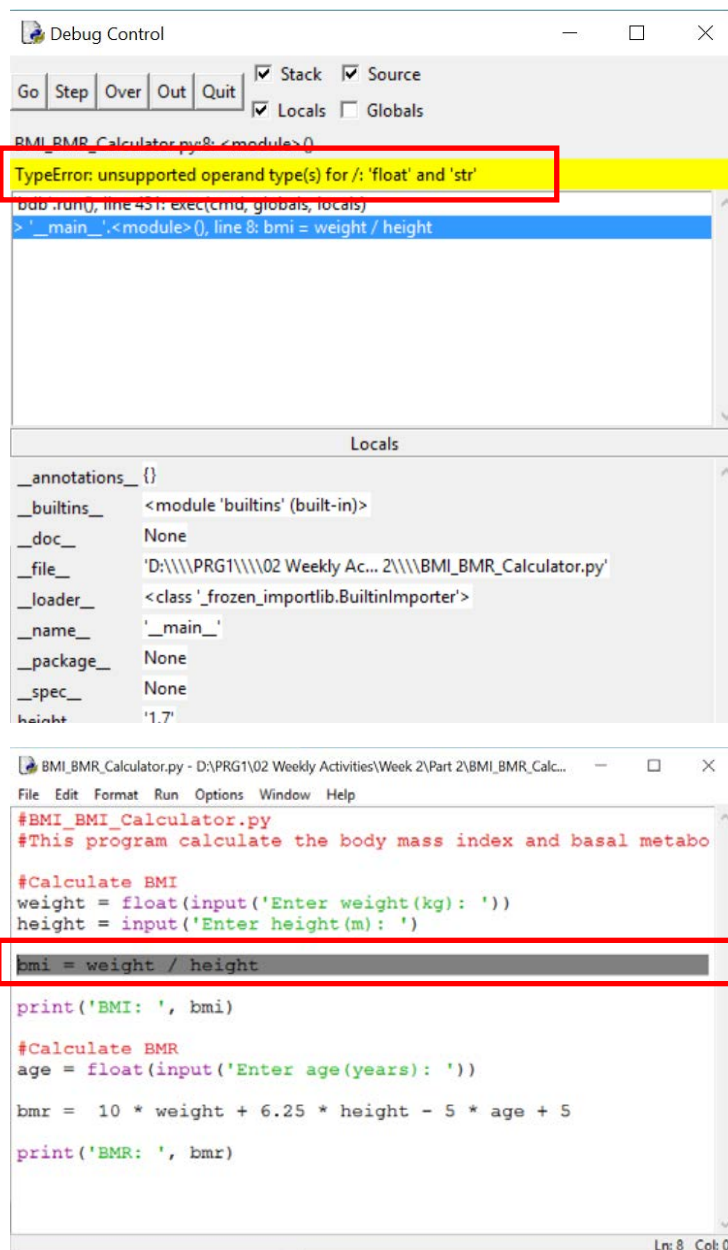
```
Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
Python 3.6.1 (v3.6.1:69c0db5, Mar 21 2017, 17:54:52) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
[DEBUG ON]
>>>
= RESTART: D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI_BMR_Calculator.py =
Enter weight(kg): 55
|
```



Continue to step through program, use 'Out' or 'Over' if necessary and enter the height:



Upon pressing 'Step' button further, the debugger produces the error and the statement that produced the error can be identified via the line highlighted in grey.

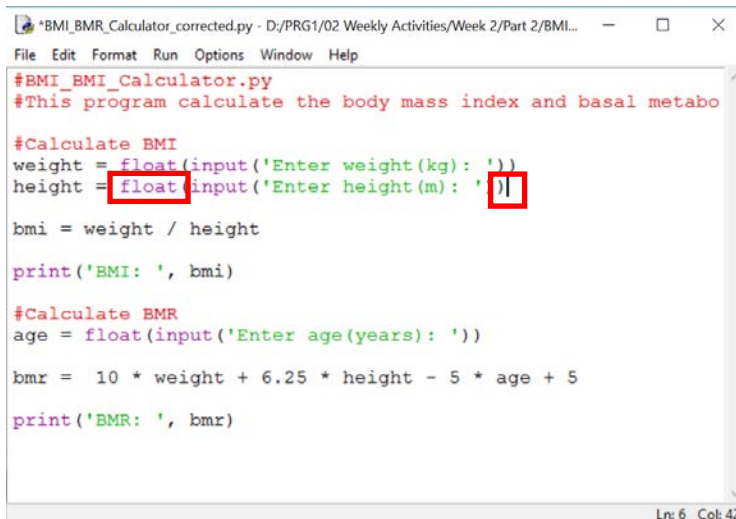


vii. Stop the debugger

Press the 'Quit' button to terminate the debugging process.

viii. Correct the error and run the debugger again

Correct the above error in the program:



```
#BMI_BMR_Calculator.py
#This program calculate the body mass index and basal metabo

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = float(input('Enter height(m): '))

bmi = weight / height

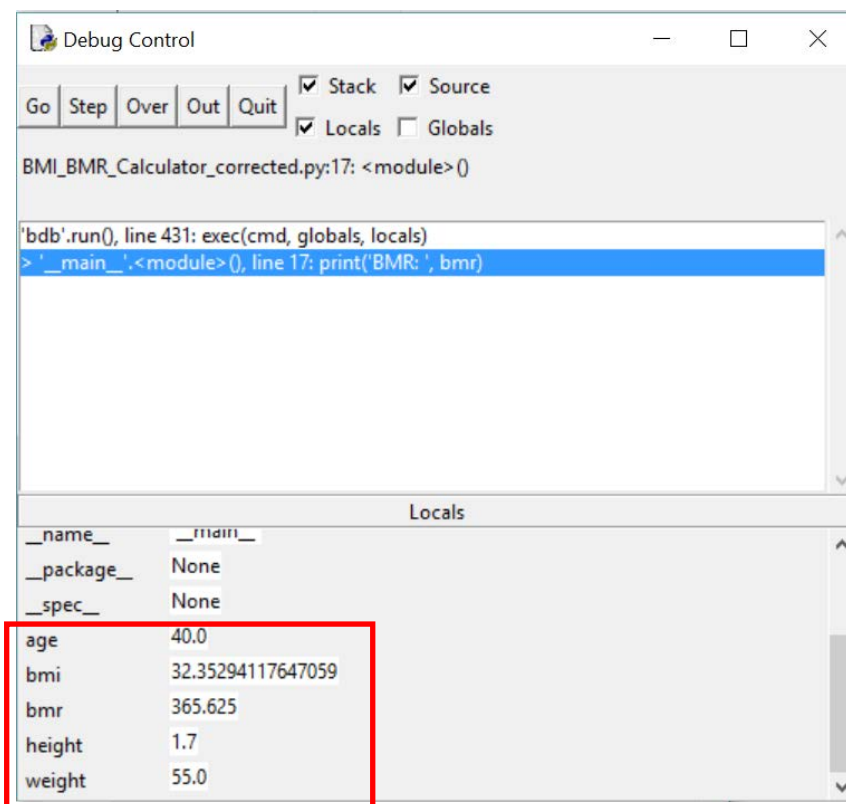
print('BMI: ', bmi)

#Calculate BMR
age = float(input('Enter age(years): '))

bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
```

What you have just done is to correct a *syntax error*. Now run the debugger again with the corrected program. Continue to step and enter the age as 40. Inspect the changes in the variables weight, height, age, bmi and bmr. Notice how the values of variables will appear in the debug window:



Debug Control

Go Step Over Out Quit ☒ Stack ☒ Source ☒ Locals ☐ Globals

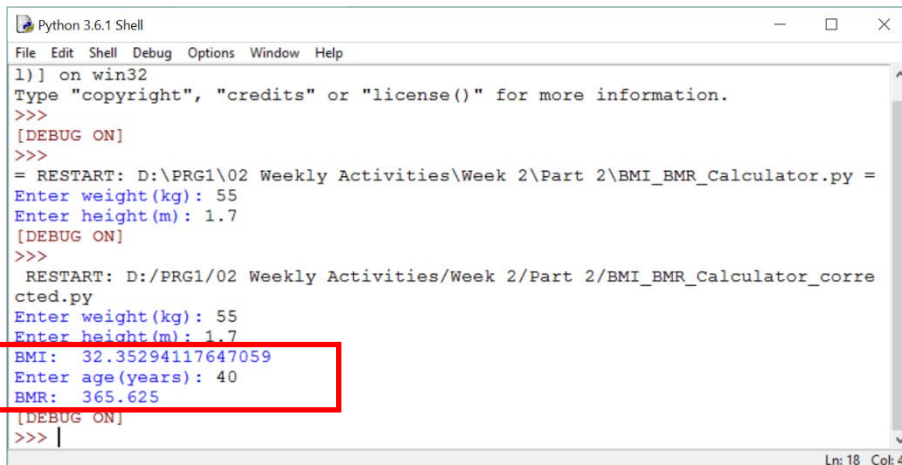
BMI\_BMR\_Calculator\_corrected.py:17: <module>()

'bdb'.run(), line 431: exec(cmd, globals, locals)  
> '.\_\_main\_\_'.<module>(), line 17: print('BMR: ', bmr)

Locals	
__name__	__main__
__package__	None
__spec__	None
age	40.0
bmi	32.35294117647059
bmr	365.625
height	1.7
weight	55.0

Step the program until all statements are executed. You should see the following output:





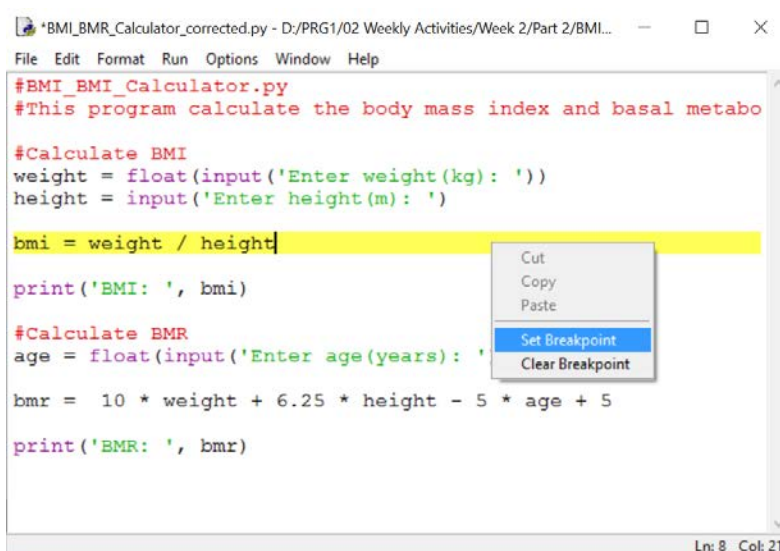
```

Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
l)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
[DEBUG ON]
>>>
= RESTART: D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI_BMR_Calculator.py =
Enter weight(kg): 55
Enter height(m): 1.7
[DEBUG ON]
>>>
RESTART: D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI_BMR_Calculator_corre
cted.py
Enter weight(kg): 55
Enter height(m): 1.7
BMI: 32.35294117647059
Enter age(years): 40
BMR: 365.625
[DEBUG ON]
>>>
Ln: 18 Col: 4
  
```

ix. Set **breakpoints** in the program.

Sometimes, we do not want to start debugging from the first line of the program, especially if you have a vague idea of which statement causes the problem. You can choose to run the program till a certain point in the code before you do more detailed investigation. This point is known as a *breakpoint*.

Now right-click on the following line in the file editor and select *Set Breakpoint* from the menu that appears. The line will be highlighted with yellow. Many breakpoints can be set in a program.



```

*BMI_BMR_Calculator_corrected.py - D:\PRG1\02 Weekly Activities\Week 2\Part 2\BMI...
File Edit Format Run Options Window Help
#BMI_BMI_Calculator.py
#This program calculate the body mass index and basal metabo

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = input('Enter height(m): ')

bmi = weight / height

print('BMI: ', bmi)

#Calculate BMR
age = float(input('Enter age(years): '))

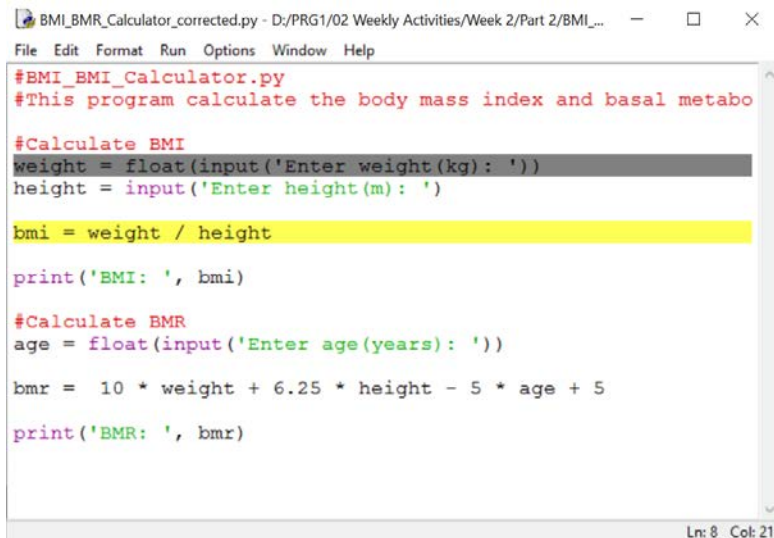
bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
Ln: 8 Col: 21
  
```

(To remove a break point, right-click on the line and select *Clear Breakpoint*.)

Now enable the debugger and run the program with F5.





```

#BMI_BMI_Calculator.py
#This program calculate the body mass index and basal metabo

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = input('Enter height(m): ')

bmi = weight / height

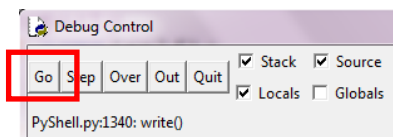
print('BMI: ', bmi)

#Calculate BMR
age = float(input('Enter age(years): '))

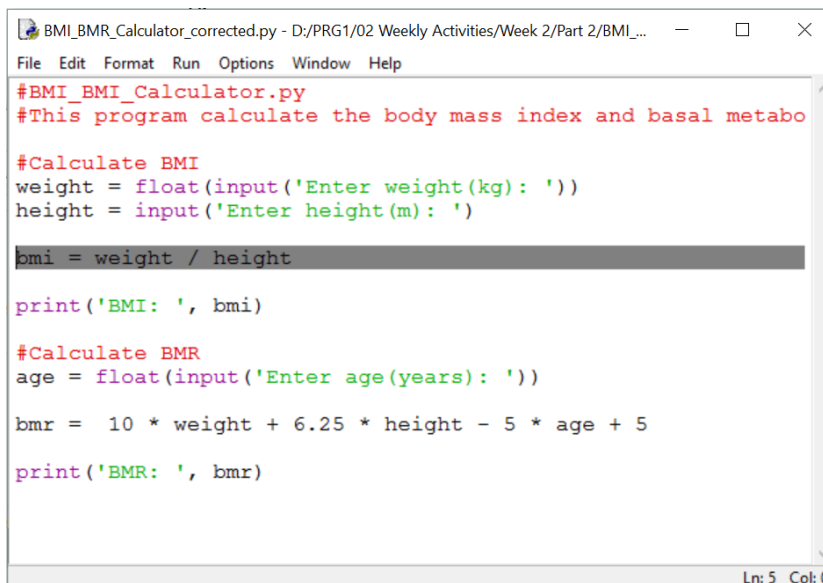
bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
  
```

Press the 'Go' button in the debug window.



Enter the weight and height as before. You will observe that the following line is highlighted in grey. The highlighted line is now the next line to be executed. By setting a breakpoint and pressing 'Go', the program continues execution without stopping until the breakpoint.



```

#BMI_BMI_Calculator.py
#This program calculate the body mass index and basal metabo

#Calculate BMI
weight = float(input('Enter weight(kg): '))
height = input('Enter height(m): ')

bmi = weight / height

print('BMI: ', bmi)

#Calculate BMR
age = float(input('Enter age(years): '))

bmr = 10 * weight + 6.25 * height - 5 * age + 5

print('BMR: ', bmr)
  
```

Continue your task of stepping through the program to trace the changes in the variables.

#### x. Trace Table

- 1) Download the file **Mission22-TraceTable.docx** from Coursemology.
  - 2) Complete the trace table in that document to record your inspection results of the variables when each statement is executed.
  - 3) Submit your completed document to Coursemology.
- xi. Observe the output of the program. It does not produce correct result although the program runs smoothly. Identify and correct the *logic errors* in the program.

Test run your code in Coursemology.

### **Part B. Correction of Program Errors**

- i. Download the file **Mission22-InterestCalculator.py** from Coursemology.
- ii. Open the InterestCalculator.py using IDLE.
- iii. Given the principal in dollars, rate and duration in years, the formula for calculation of interest is as follows:

$$\text{interest} = \text{principal} \times (\text{rate} \div 100) \times \text{duration}$$

- iv. Correct all the errors in the program. Test run your corrected program with Coursemology.