A Turtle Introduction to Python

Lesson 1

Topics

- how to setup your programming environment
- how to run your first program
- how to use comments in Python
- dealing with error messages
- how to import modules
- how to create a simple turtle program

Part 1

Thonny Introduction

What is Thonny

Thonny → the IDE (integrated development environment) we will use.

- a Python IDE for beginners
- packaged with Python → helps with setup
- download it from **thonny.org**

Important distinction:

- Python → the programming language we will use
- Thonny → the program we use to write it

Similar to:

- English → the language we use
- Microsoft Word → the program we use to write it

Python programs consists of text files called scripts.

Any text editor can write Python.

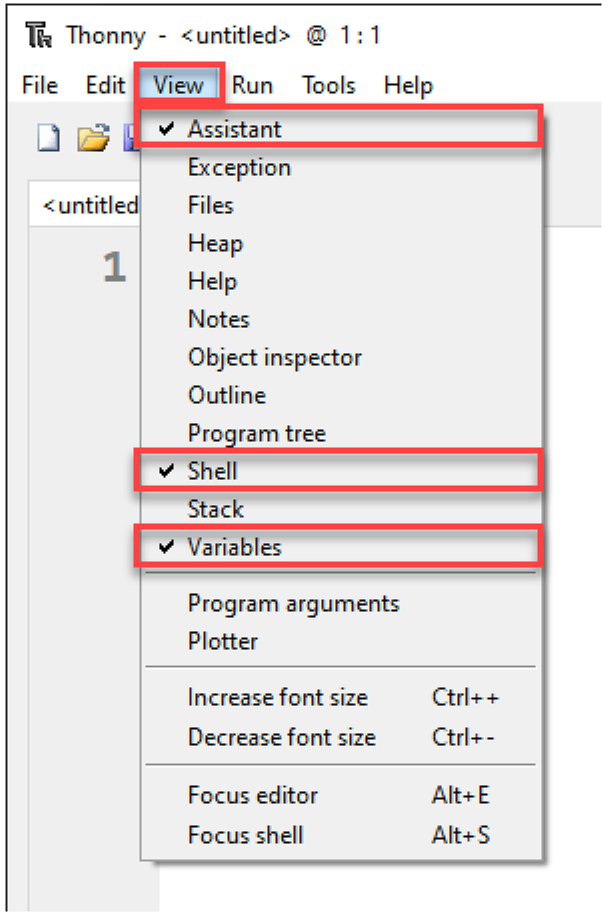
IDEs offer extra features, for example

- highlighting syntax
- debugging help

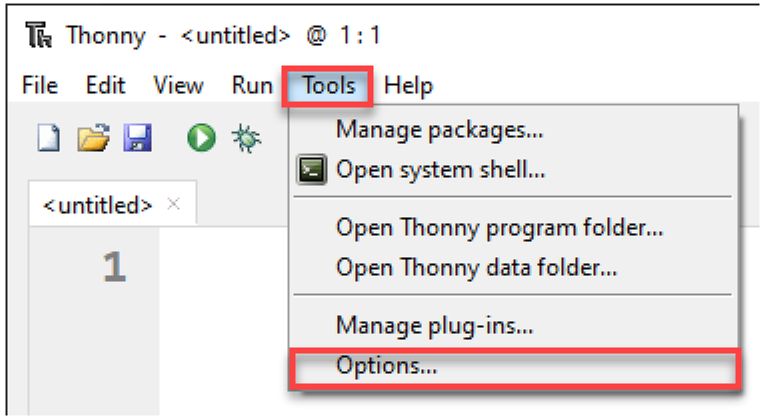
Setting up Thonny

Need to turn on features, so our IDEs looks the same.

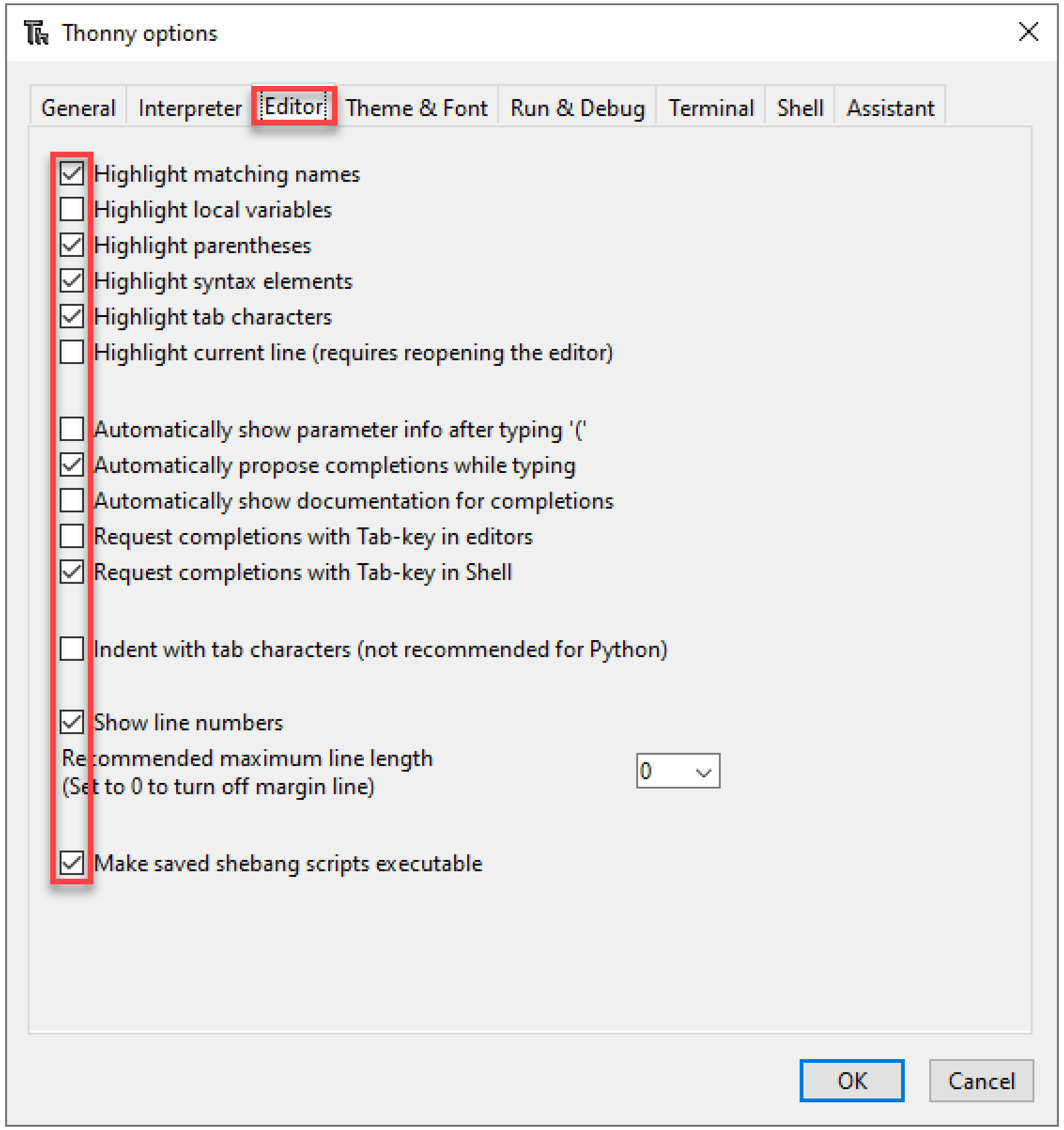
View menu → tick beside **Assistant**, **Shell** and **Variable**.



Tools → Options



Editor tab → check-boxes as below.

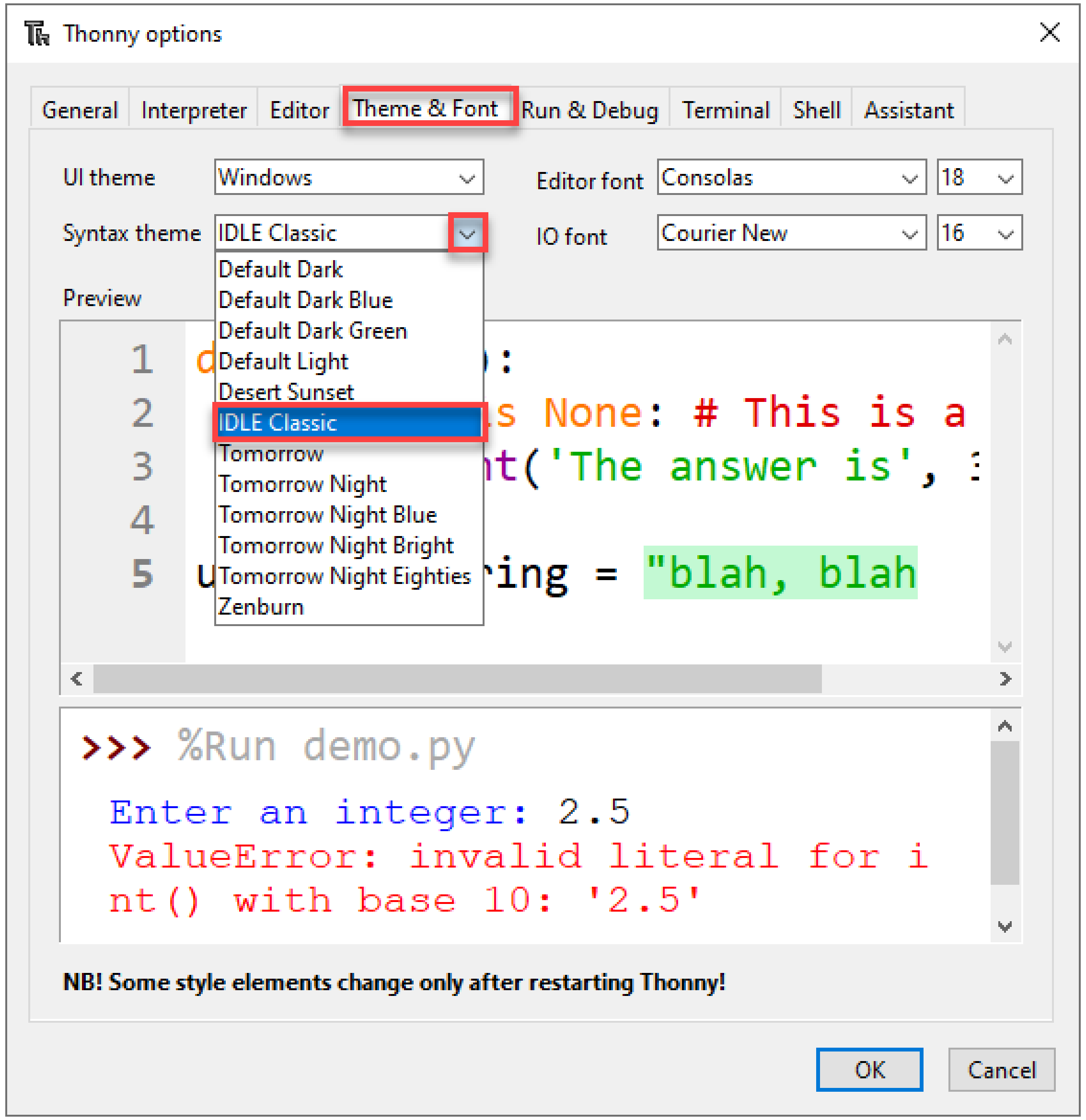


- [✓] Highlight matching names
- [ ] Highlight local variables
- [✓] Highlight parentheses
- [✓] Highlight syntax elements
- [✓] Highlight tab characters
- [ ] Highlight current line (requires reopening the editor)
- [ ] Automatically show parameter info after typing '('
- [✓] Automatically propose completions while typing
- [ ] Automatically show documentation for completions
- [ ] Request completions with Tab-key in editors
- [✓] Request completions with Tab-key in Shell
- [ ] Indent with tab characters (not recommended for Python)
- [✓] Show line numbers

Recommended maximum line length
(Set to 0 to turn off margin line) 0

- [✓] Make saved shebang scripts executable

Theme and Font tab → Syntax theme → IDLE Classic



UI theme: Windows

Syntax theme: IDLE Classic

Editor font: Consolas 18

IO font: Courier New 16

Default Dark
Default Dark Blue
Default Dark Green
Default Light
Desert Sunset
IDLE Classic
Tomorrow
Tomorrow Night
Tomorrow Night Blue
Tomorrow Night Bright
Tomorrow Night Eighties
Zenburn

Preview

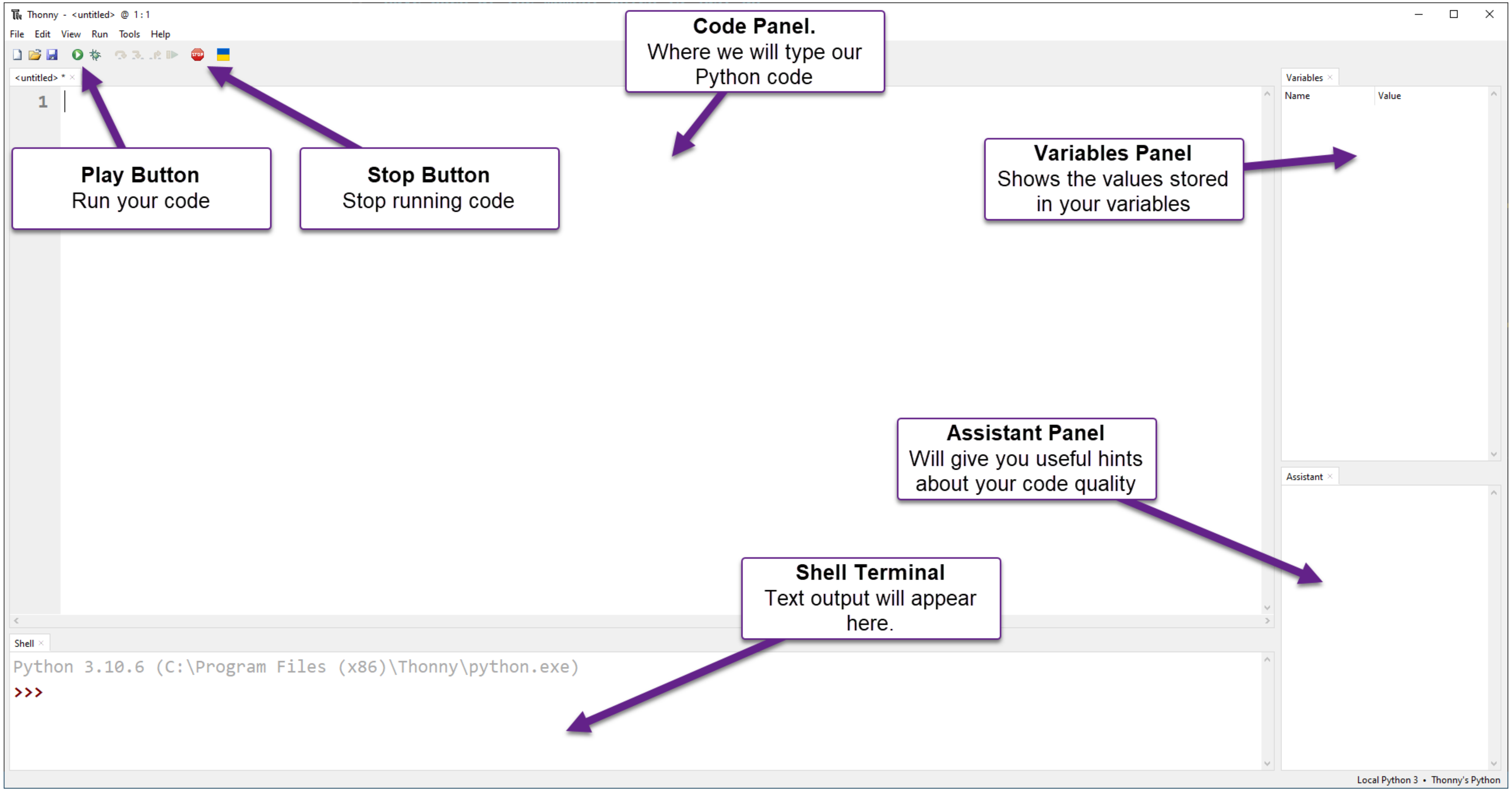
```
d                 ):
             s None: # This is a
            nt('The answer is', :

u             ring = "blah, blah
```

```
>>> %Run demo.py
 Enter an integer: 2.5
 ValueError: invalid literal for i
 nt() with base 10: '2.5'
```

NB! Some style elements change only after restarting Thonny!

The User Interface



Thonny - <untitled> @ 1 : 1
File Edit View Run Tools Help
<untitled> *
Variables
Name
Value
Assistant
Shell
Local Python 3 • Thonny's Python
Code Panel. Where we will type our Python code
Play Button Run your code
Stop Button Stop running code
Variables Panel Shows the values stored in your variables
Assistant Panel Will give you useful hints about your code quality
Shell Terminal Text output will appear here.

```
Python 3.10.6 (C:\Program Files (x86)\Thonny\python.exe)
>>>
```

First Program

For our first program we are going to make a simple program called *hello world*. This is the traditional first program to write.

Type the following code into the Code panel:

```
# Our First Program

print("Hello World")
```

PRIMM

We will use the **PRIMM** process:

PRIMM stands for:

- Predict
- Run
- Investigate
- Modify
- Make

PRIMM → reflects effective programming practices
PRIMM → encourages curiosity in programming

Apply **PRIMM** process

- Predict → what do you think will happen?
- Run → click the **Play button** (or **F5**).

```
Hello World
```

Is this what you predicted?

Let's **investigate** what happened.

Investigate

Looking at code

- only `Hello World` appears in the terminal
- completely misses `# Our First Program`.
- `#` character → the line is a **comment**

> Computers ignore comments
>
> Good way to add notes to code.

`Line 3` → `print` is purple

- Syntax highlighting
- Purple → a Python keyword
- Removing the `n` so the line → `prit("Hello World")`
- Notice `prnt` → no longer purple
- **Predict** what will happen and then **Run** the code

Error message in your **Shell**:

```
Traceback (most recent call last):
  File "<string>", line 3, in <module>
NameError: name 'prnt' is not defined
```

- `Line 1`: `Traceback (most recent call last):` → "this is where I got up to"
- `Line 2`: `File "<string>", line 3, in <module>` → file and the line of error
- `Line 3`: `NameError: name 'prnt' is not defined` → type of error.
  - `NameError` → found a word that it doesn't understand.
  - Word it doesn't understand → `prnt`.

Fix up `line 3` → `print("Hello World")`

- Notice that `print` → purple.

Continue **investigation**:

- Remove the two `"`
  - `line 3` → `print(Hello World)`
- **Predict** what will happen and then **Run** the code

Shell contains a different error:

```
Traceback (most recent call last):
  File "<string>", line 3
    print(Hello World)
          ^^^^^^^^^^^
SyntaxError: invalid syntax. Perhaps you forgot a comma?
```

- `Line 3` → specific line with the error `print(Hello World)`
- `Line 4` → `^` point to error location
- `Line 5` → `SyntaxError: invalid syntax. Perhaps you forgot a comma?`:
  - error is a `SyntaxError: invalid syntax.` → code does not follow the rules
  - suggestion → `Perhaps you forgot a comma?` (wrong in this case)

Change `line 3` → `print("Hello World")`

- `"Hello World"` turns green
- **Syntax highlighting** → `Hello World` is a **string**
- strings are a whole bunch of characters

Continue **Investigation**:

- `line 3` → remove `(` and `)` characters
- reads → `print Hello World`
- **Predict** what will happen and then **Run** the code

Error in **Shell**:

```
Traceback (most recent call last):
  File "<string>", line 3
    print "Hello World"
    ^^^^^^^^^^^^^^^^^^^
SyntaxError: Missing parentheses in call to 'print'. Did you mean print(...)?
```

- different `SyntaxError` → `Missing parentheses in call to 'print'`.
- parentheses → curved brackets
- this time hint is correct `Did you mean print(...)?`

Continue **Investigation**:

- replace the opening parenthesis `(`
    - `line 3` → `print("Hello World"`.
- **Predict** what will happen and then **Run** the code

Error in **Shell**:

```
Traceback (most recent call last):
  File "<string>", line 3
    print ("Hello World"
          ^
SyntaxError: '(' was never closed
```

- error message → failed to close parenthesis.
    - every opening parenthesis `(` needs matching closing parenthesis `)`.
- Look at code in Thonny
    - grey highlight from the `(` onwards
    - **syntax highlighting** → an opening parenthesis was not closed

Fix `line 3` → `print("Hello World")`.

Investigation concluded.

Error messages:

- don't be discouraged
- the most experienced programmers get error messages

Error messages are your friend, they help you to work out what went wrong

Modify

Time to **modify** the code.

Making the code print different things to the **Shell**.

Part 2:

Introducing turtle

First turtle program

1. Click the **New** icon
2. Type the below into the new file
3. Save it using the name `lesson_1_pt_1.py`.

```
# Our first turtle program
```

Python has limited set of commands (**functions**)

Access to extra commands (called **modules**)

- **Turtle** is one of those modules
- to access other modules → use the `import` command.

```
# Our first turtle program

import turtle
```

Create a turtle

Turtle → little arrow that you can program

Before programming need to make one

```
# Our first turtle program

import turtle

my_ttl = turtle.Turtle()
```

`my_ttl = turtle.Turtle()`

- `turtle.Turtle()` tells Python:
  - from the **turtle** module you imported (`turtle`)
  - use the command `Turtle()` to create a turtle.
- `my_ttl =` names your created turtle `my_ttl`.

Name turtle anything

- can **only be a one word name**
- replace `my_ttl` with your name

Make your turtle move

```
# Our first turtle program

import turtle

my_ttl = turtle.Turtle()

my_ttl.forward(100)
```

Predict and **run** the program

PRIMM

- **Prediction**
  - probably predicted movement to the right
  - did you predict the line?
- **Investigate** → changing things and see what happens.
- **Modify** → make lines of different length

Changing the turtle environment

Change the Turtle environment → consistent between all our computers.

- make the Turtle window the same size

```python
# Our first turtle program

import turtle

window = turtle.Screen()
window.setup(500, 500)

my_ttl = turtle.Turtle()

my_ttl.forward(100)
```

The window is called a **Screen**

`window = turtle.Screen()`

- `turtle.Screen()` → use `Screen()` from **turtle** module (`turtle.`) to create window
- `window =` give created window the name `window`

`window.setup(500,500)`

- set the size of `window`
  - 500 pixels wide
  - 500 pixels high

What are pixels?

Screen → thousands of little dots → **pixels**.

Screen measurement of 1920 x 1080 → 1,920 pixels wide and 1,080 pixels high.

Pixels → our measurement of movement on the screen

- `forward(100)` → move forward `100` pixels.

Small aesthetic change

```python
# Our first turtle program

import turtle

window = turtle.Screen()
window.setup(500, 500)

my_ttl = turtle.Turtle()
my_ttl.shape("turtle")

my_ttl.forward(100)
```

Predict and **run** the program

Change direction

Lets do more drawing

```python
# Our first turtle program

import turtle

window = turtle.Screen()
window.setup(500, 500)

my_ttl = turtle.Turtle()
my_ttl.shape("turtle")

my_ttl.forward(100)
my_ttl.left(90)
my_ttl.forward(100)
```

PRIMM

- **Predict**: What do you think will happen?
    - be specific
    - draw it on paper
- **Run**:
    - did it follow your prediction?
    - did it look the same as your drawing?
- **Investigate**:
    - try changing the values within the brackets

Exercises

Exercises are the **make** component of the **PRIMM** model

Complete exercises 1 - 3