Programming Fundamentals
Lab 01

Python Building Blocks

Comp 102 — Forman Christian University

Spring 2026

Estimated Time: ∼**3 hours** — Based on Lectures 2 & 3

How to Use This Lab

This lab is a **walkthrough tutorial**—it is designed to guide you through learning, not to test you. Work through each section at your own pace:

- **Predict** — Write down what you think will happen *before* touching the computer.
- **Type** — Enter the code in Thonny's **Code Editor** (top pane) and press **Run** (or **F5**).
- **Verify** — Compare your prediction with the actual result. If they differ, figure out *why*.
- Exercises are graded by difficulty:
  - ★ Easy — Immediate practice. Follow the pattern you just saw.
  - ★★ Medium — Requires some thinking. Combines concepts.
  - ★★★ Hard — Stretch goal. It is OK to need help!
- **Ask for help** whenever you are stuck for more than 5 minutes.

1 Scalar Objects & Types (~15 min)

Ref: Lecture 2 — Scalar Objects slides

Exercise 1 ★ Easy

Type the following in the Thonny Shell. Predict the output of each **before** you type it.

```
>>> type(42)
>>> type(3.14)
```

Your predictions: _____ _____

Exercise 2 ★ Easy

Predict the output, then verify:

```
>>> type(True)
>>> type(None)
```

Your predictions: _____ _____

Exercise 3 ★★ Medium

Careful! Predict the output of each, then verify:

```
>>> type(9.0)
>>> type(7)
>>> type(False)
```

Why is `type(9.0)` not `int`, even though 9 is a whole number?

Exercise 4 ★★ Medium

Without running, predict the type returned by each. Then verify:

```
>>> type(0)
>>> type(0.0)
>>> type(-3.5)
```

Your predictions: _____ _____

_____

Exercise 5 ★★★ Hard

Without running any code, predict the **type** of the result of each expression. Then verify with `type(...)`.

```
>>> 3 + 4.0
>>> 10 / 2
>>> 10 // 2
```

Your predictions: _____ _____

_____

Hint: Think about what happens when you mix ***`int`*** *and* ***`float`*** *in an operation.*

2 Type Conversions (~15 min)

Ref: Lecture 2 — Type Casting slides

Exercise 6 ★ Easy

Predict the value, then verify in the Shell:

```
>>> float(5)
>>> int(3.0)
```

Your predictions: _____ _____

Exercise 7 ★ Easy

Predict the value, then verify:

```
>>> float(True)
>>> int(False)
```

Your predictions: _____ _____

Exercise 8 ★★ Medium

Tricky! Predict the value of each. Pay close attention to the difference:

```
>>> int(7.9)
>>> round(7.9)
```

Your predictions: _____ _____
Why are they different?

Exercise 9 ★★ Medium

Predict the value and type:

```
>>> int(3.1) + int(4.9)
>>> round(3.1) + round(4.9)
```

Your predictions: _____ _____

Exercise 10 ★★★ Hard

Trace through this expression step by step. Write down each intermediate result:

```
>>> float(round(int(9.7) + 0.6))
```

Step 1: `int(9.7)` = _____
Step 2: `___ + 0.6` = _____
Step 3: `round(___)` = _____
Step 4: `float(___)` = _____

3 Arithmetic Expressions (~25 min)

Ref: Lecture 2 — Expressions slides

Exercise 11 ★ Easy

Predict the value of each expression, then verify:

```
>>> 3 + 4
>>> 10 - 6
```

Your predictions: _____ _____

Exercise 12 ★ Easy

Predict the value of each expression, then verify:

```
>>> 10 / 2
>>> 2 ** 3
```

Your predictions: _____ _____

Exercise 13 ★ Easy

Predict the value of each expression, then verify:

```
>>> 7 % 3
>>> 10 % 5
```

Your predictions: _____ _____

Exercise 14 ★ Easy

Predict the value of each expression, then verify:

```
>>> 15 // 4
>>> 7 // 2
```

Your predictions: _____ _____

Exercise 15 ★★ Medium

Operator precedence matters! Predict the value of each:

```
>>> 3 + 4 * 2
>>> (3 + 4) * 2
```

Your predictions: _____ _____
Why are they different?

Exercise 16 ★★ Medium

Predict the **type** returned by each:

```
>>> type(4 * 3)
>>> type(4.0 * 3)
```

Your predictions: _____ _____

Exercise 17 ★★ Medium

Predict the value:

```
>>> (13 - 4) / (12 * 12)
```

Your prediction: _____
Hint: What does the / operator always return?

Exercise 18 ★★ Medium

Predict the value of each:

```
>>> 5 % 2
>>> 2 ** 5
>>> 17 % 5
```

Your predictions: _____ _____ _____

Exercise 19 ★★ Medium

Right-to-left! The `**` operator is right-associative. Predict the value:

```
>>> 2 ** 3 ** 2
```

Your prediction: _____
Hint: This evaluates as `2 ** (3 ** 2)`*, not* `(2 ** 3) ** 2`*.*

Exercise 20 ★★★ Hard

Trace through this expression step by step on paper, then verify:

```
>>> (13 - 4) / (2 * 3) + 5 % 3 ** 2
```

Show your work:

4 Call Expressions & Imports (~20 min)

Ref: Lecture 2 — Call Expressions slides

Exercise 21 ★ Easy

Predict the output, then verify:

```
>>> max(3, 5)
>>> max(10, 2, 7)
```

Your predictions: _____ _____

Exercise 22 ★ Easy

Predict the output, then verify:

```
>>> min(1, 2, 3)
```

```
>>> min(8, 5)
```

Your predictions: _____ _____

Exercise 23 ★★ Medium

Order matters! Predict the output of each:

```
>>> pow(2, 10)
>>> pow(10, 2)
```

Your predictions: _____ _____
What does `pow(a, b)` compute?

Exercise 24 ★★ Medium

Type these two lines in the Shell:

```
>>> from math import sqrt
>>> sqrt(144)
```

Your prediction for `sqrt(144)`: _____
What is the **type** of the result? _____

Exercise 25 ★★★ Hard

First, type this import in the Shell:

```
>>> from operator import add, mul, sub
```

Now trace through this nested expression step by step:

```
>>> add(mul(2, 3), pow(2, sub(5, 2)))
```

Step 1: `mul(2, 3)` = _____
Step 2: `sub(5, 2)` = _____
Step 3: `pow(2, ___)` = _____
Step 4: `add(___, ___)` = _____

5 Variables & Assignment (~25 min)

Ref: Lecture 2 — Variables slides

Exercise 26 ★ Easy

Type in the Shell:

```
>>> x = 10
>>> print(x)
```

What do you see? _____

Exercise 27 ★ Easy

Type in the Shell:

```
>>> greeting = "Hello"
>>> print(greeting)
```

What do you see? _____

Exercise 28 ★ Easy

Which of the following are **valid** variable names in Python? Write **Valid** or **Invalid** next to each:

(a) `my_age` _____

(b) `2fast` _____

(c) `_count` _____

(d) `my-name` _____

(e) `lunchPrice` _____

Exercise 29 ★ Easy

Type in the Shell:

```
>>> pi = 3.14
>>> radius = 5
>>> area = pi * radius ** 2
>>> print(area)
```

What does `print(area)` display? _____

Exercise 30 ★★ Medium

Predict the value of `x` after this code runs:

```
>>> x = 5
>>> x = x + 1
>>> print(x)
```

Your prediction: _____

Exercise 31 ★★ Medium

Predict the value of `y` after this code:

```
>>> x = 3
>>> y = x * 2
>>> x = 10
>>> print(y)
```

Your prediction: _____
Does changing x *afterward affect* y*?*

Exercise 32 ★★ Medium

Trace through this code. What is the value of `feet` at the end?

```
>>> meters = 100
>>> feet = 3.2808 * meters
```

```
>>> meters = 200
>>> print(feet)
```

Your prediction: _____

Why doesn't `feet` *update when* `meters` *changes?*

Exercise 33 ★★ Medium

Predict the value of `b`:

```
>>> a = 5
>>> b = a
>>> a = 10
>>> print(b)
```

Your prediction: _____

Exercise 34 ★★ Medium

Trace through carefully. What are the final values of `x` and `y`?

```
>>> x = 2
>>> y = x + 1
>>> x = y + 1
>>> y = x + 1
>>> print(x, y)
```

Your prediction for `x`: _____ `y`: _____

Exercise 35 ★★★ Hard

Given `x = 1` and `y = 2`, swap their values so that `x` becomes 2 and `y` becomes 1. You **must not** type the numbers 1 or 2 directly — use a **temporary variable**.

```
x = 1
y = 2

# Write your swap code below:



# After your code, x should be 2 and y should be 1
print(x, y)     # Should print: 2 1
```

Write your solution:

6 Strings — Basics (~20 min)

Ref: Lecture 3 — Strings slides

Exercise 36 ★ Easy

Type in the Shell:

```
>>> name = "Python"
>>> print(name)
>>> len(name)
```

What does `len(name)` return? _____

Exercise 37 ★ Easy

Type in the Shell:

```
>>> first = "Hello"
>>> second = "World"
>>> print(first + " " + second)
```

What do you see? _____

Exercise 38 ★★ Medium

Predict the value of `s1`:

```
>>> b = ":"
>>> c = ")"
>>> s1 = b + 2*c
>>> print(s1)
```

Your prediction: _____

Exercise 39 ★★ Medium

Predict the values:

```
>>> word = "ab"
>>> result = word * 3
>>> print(result)
>>> print(len(result))
```

`result` = _____ `len(result)` = _____

Exercise 40 ★★★ Hard

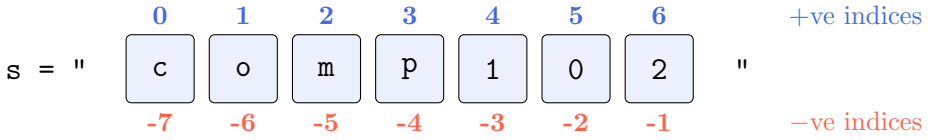
Predict the value of `s2`:

```
>>> f = "a"
>>> g = "b"
>>> h = "3"
>>> s2 = (f + g) * int(h)
>>> print(s2)
```

Step 1: `f + g` = _____
Step 2: `int(h)` = _____
Step 3: ___ * ___ = _____

7 String Indexing & Slicing (~25 min)

Ref: Lecture 3 — Indexing & Slicing slides



Exercise 41 ★ Easy

Using `s = "comp102"`, predict the value of each:

```
>>> s = "comp102"
>>> s[0]
>>> s[3]
```

Your predictions: _____ _____

Exercise 42 ★ Easy

Predict the value of each:

```
>>> s = "comp102"
>>> s[4]
>>> s[6]
```

Your predictions: _____ _____

Exercise 43 ★ Easy

Predict the value of each slice:

```
>>> s = "abcdefgh"
>>> s[2:5]
>>> s[0:3]
```

Your predictions: _____ _____

Exercise 44 ★ Easy

Predict the value:

```
>>> s = "abcdefgh"
>>> s[:4]
>>> s[5:]
```

Your predictions: _____ _____

Exercise 45 ★★ Medium

Negative indexing! Predict the value of each:

```
>>> s = "comp102"
>>> s[-1]
>>> s[-3]
```

Your predictions: _____ _____

Exercise 46 ★★ Medium

Predict the value:

```
>>> s = "abcdefgh"
>>> s[::2]
>>> s[1::2]
```

Your predictions: _____ _____
What does the step of 2 do?

Exercise 47 ★★ Medium

Predict the value:

```
>>> s = "abcdefgh"
>>> s[::-1]
```

Your prediction: _____
What does a step of −1 do?

Exercise 48 ★★ Medium

Predict the value:

```
>>> s = "ABC d3f ghi"
>>> s[3:len(s)-1]
```

Step 1: `len(s)` = _____
Step 2: `len(s) - 1` = _____
Step 3: `s[3:___]` = _____

Exercise 49 ★★ Medium

Predict the value:

```
>>> s = "ABC d3f ghi"
>>> s[4:0:-1]
```

Your prediction: _____
Hint: With a negative step, you go from index 4 ***down to*** *(but not including) index 0.*

Exercise 50 ★★★ Hard

Two challenges:
(a) Predict the value:

```
>>> s = "abcdefgh"
>>> s[6:1:-2]
```

Your prediction: _____
(b) Strings are **immutable** — you cannot change individual characters. Given `s = "cat"`, write an expression that produces the string `"rat"` using `s`, **without** typing any of the letters `a` or `t` directly.
Hint: Concatenate a new first character with a slice of `s`.

8 Input / Output (~20 min)

Ref: Lecture 3 — I/O slides

Remember

`input()` **always** returns a **string**, even if the user types a number. You must cast it with `int()` or `float()` if you want to do arithmetic.

Exercise 51 ★ Easy

Write the following in Thonny's **code editor** (not the Shell) and run it:

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

What appears in the output? _____

Exercise 52 ★ Easy

Write and run this program:

```
name = input("What is your name? ")
print("Hello, " + name + "!")
```

If you enter `Ali`, what does it print? _____

Exercise 53 ★★ Medium

Write and run this program. Enter `5` when asked:

```
num = int(input("Enter a number: "))
result = num * 3
print(result)
```

What does it print? _____
What would happen if you removed the `int()` cast?

Exercise 54 ★★ Medium

Predict first! If the user enters `4`, what does each line print?

```
x = input("Number: ")
print(x * 3)
print(int(x) * 3)
```

Line 2 prints: _____ Line 3 prints: _____
Why are they different?

Exercise 55 ★★★ Hard

Write a program that:

1. Asks the user to enter a verb (e.g., `run`)
2. Prints `I can ___ better than you!` (replacing `___` with the verb)
3. Prints the verb 5 times in a row, separated by spaces

Example output (if user enters `run`):

```
I can run better than you!
run run run run run
```

Write your code:

9 f-strings (~10 min)

Ref: Lecture 3 — f-strings slides

Exercise 56 ★ Easy

Predict what this prints, then verify:

```
name = "Ali"
print(f"Hello, {name}!")
```

Your prediction: _____

Exercise 57 ★ Easy

Predict what this prints, then verify:

```
x = 10
y = 20
print(f"{x} + {y} = {x + y}")
```

Your prediction: _____

Exercise 58 ★★ Medium

Predict what this prints:

```
word = "Python"
print(f"{word} has {len(word)} letters")
```

Your prediction: _____

Exercise 59 ★★ Medium

Predict what this prints:

```
a = 7
b = 3
print(f"{a}/{b} = {a/b}")
```

Your prediction: _____

Exercise 60 ★★★ Hard

Predict what the following code prints if the user enters `3` and `4`:

```
base = int(input("Base: "))
exp = int(input("Exponent: "))
result = base ** exp
print(f"{base}^{exp} = {result}")
```

Your prediction: _____

10 Capstone Challenges (~15 min)

These problems combine everything you have learned. Write your solutions in Thonny's code editor.

Exercise 61 ★★ Medium

Temperature Converter. Write a program that:

1. Asks the user for a temperature in Celsius
2. Converts it to Fahrenheit using: $F = \frac{9}{5}C + 32$
3. Prints both values using an f-string

Example (user enters `37`):

```
37 C is 98.6 F
```

Write your code:

Exercise 62 ★★ Medium

Tip Splitter. Write a program that:

1. Asks for the bill amount
2. Asks for the number of friends
3. Adds a 15% tip to the bill
4. Splits the total equally and prints each person's share

Example (user enters `80` and `4`):

```
Each person pays: 23.0
```

Write your code:

Exercise 63 ★★ Medium

Initials. Write a program that:

1. Asks for a first name and a last name
2. Prints the user's initials in uppercase, separated by a dot

Example (user enters `ali` and `khan`):

```
A.K.
```

Hint: look up what `.upper()` does to a string.
Write your code:

Exercise 64 ★★★ Hard

Time Breakdown. Write a program that:

1. Asks the user for a total number of seconds
2. Converts it to hours, minutes, and remaining seconds
3. Prints the result

Example (user enters `3672`):

```
1 hour(s), 1 minute(s), 12 second(s)
```

Hint: use integer division (`//`) and modulo (`%`).
Write your code:

Exercise 65 ★★★ Hard

Swap Halves. Write a program that:

1. Asks the user for a word (assume it has an even number of letters)
2. Prints the word with its two halves swapped

Example (user enters `abcdef`):

```
defabc
```

Hint: use `len()` and slicing.
Write your code:

Exercise 66 ★★★ Hard

Distance Between Two Points. Write a program that:

1. Asks for four values: `x1`, `y1`, `x2`, `y2`
2. Computes the Euclidean distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
3. Prints the result

Example (user enters `0`, `0`, `3`, `4`):

```
Distance: 5.0
```

Hint: recall that $\sqrt{x} = x^{0.5}$ in Python.
Write your code:

Exercise 67 ★★★ Hard

Digit Sum (3-digit number). Write a program that:

1. Asks the user for a 3-digit number
2. Computes the sum of its three digits **without using strings**
3. Prints the result

Example (user enters `472`):

```
4 + 7 + 2 = 13
```

Hint: use `//` and `%` to extract each digit.
Write your code:

Self-Assessment Checklist

Before you leave, check off what you can do:

☐ I can identify the type of a Python literal (`int`, `float`, `bool`, `NoneType`)

- ☐ I can convert between types using `int()`, `float()`, `str()`, and `round()`
- ☐ I know the difference between `int(7.9)` and `round(7.9)`
- ☐ I can evaluate arithmetic expressions with correct operator precedence
- ☐ I can use built-in functions (`max`, `min`, `pow`) and import from modules
- ☐ I can assign variables and trace through code with re-binding
- ☐ I understand that re-assigning a variable does **not** update previous calculations
- ☐ I can create, concatenate, and repeat strings
- ☐ I can index strings with positive and negative indices
- ☐ I can slice strings using `[start:stop:step]`
- ☐ I know that `input()` always returns a string
- ☐ I can use f-strings to format output with expressions