# Chapter 2: Variables and Data Types

**Letting Python remember and understand different kinds of information.**

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## Introduction

In Chapter 1, Python talked to us using `print()`.
Now it's time to teach Python how to **remember things**.

How does it do that? With **variables**.
And how does it understand what kind of thing it's remembering? With **data types**.

> Think of a variable as a box with a label.
> The data type tells you what's inside the box.

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## What Are Variables?

A variable is a name for a value stored in memory.
It lets you **save information** to use later.

```
name = "Ravi"
age = 14

print(name)
print(age)
```

### Output:

```
Ravi
14
```

→ Use the `=` sign to assign a value to a variable.
→ Variables can change their value any time.

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## Dynamic Typing in Python

Python is **dynamically typed** — it figures out the type **automatically**.

You don't need to say `int`, `str`, or anything else when assigning a value.

```
x = 10        # x is an integer
print(type(x))

x = "hello"   # now x is a string
print(type(x))
```

### Output:

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

→ A variable can **change type** as your program runs.

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## Basic Data Types

Here are the most common types in Python:

| Type | Name | Example |
|---|---|---|
| `str` | String | `"Hello"` |
| `int` | Integer | `25` |
| `float` | Floating-point | `3.14` |
| `bool` | Boolean | `True`, `False` |

Notes:

- Strings go inside **quotes**
- Booleans are written with **capital T/F**
- Don't use quotes around `True` or `False` (that would make them strings)

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## Type Checking with `type()`

Want to check the type of a variable? Use the `type()` function:

```
name = "Python"
score = 99
pi = 3.141
is_happy = True

print(type(name))
print(type(score))
print(type(pi))
print(type(is_happy))
```

### Output:

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

→ `type()` shows exactly what Python sees.

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## Type Casting (Changing Types)

Sometimes you get a value in one type and need to convert it to another.
This is called **type casting**.

### Examples:

```
int("5")       # → 5 as an integer
float("3.14")  # → 3.14 as a float
str(42)        # → "42" as a string
bool(0)        # → False
bool("text")   # → True
```

> Booleans:
>
> - `0`, `""`, `None` → `False`
> - Everything else → `True`

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## ❗ Casting Errors

If you try to convert something that doesn't match, you'll get an error:

```
int("hello")  # ❌ ValueError
```

→ Always check the value before converting!

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## Mini Quiz or Challenge

1. What is the output of:

```
print(type("123"))
```

2. Convert `99.5` to an integer and print it.
3. Convert `True` to a string and print it.
4. What happens if you try `int("Python")`?

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## Tips, Mistakes, and Mini Rules

✓ Use clear, meaningful variable names
✓ `input()` always gives a **string** (will be explained later)
✓ Use `type()` to check what Python thinks a value is
✓ Use type casting (`int()`, `float()`, `str()`, `bool()`) when needed

✗ Don't name your variables `print`, `int`, or `str` — those are keywords!

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## Summary Recap

- Variables store information
- Python automatically figures out data types
- Common types: `str`, `int`, `float`, `bool`
- Use `type()` to check type
- Use `int()`, `float()`, `str()`, `bool()` to convert values
- Variables can change type (dynamic typing)

```
age = "15"        # string
age = int(age)    # now it's a number
```

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## Mini-Project Exercise

🎯 *Build a tiny program that asks for your name and age,*
*then shows how old you'll be next year.*

```
name = input("What is your name? ")
age = int(input("How old are you? "))

print("Hi", name + "! Next year, you'll be", age + 1)
```

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## Practice Exercises

### ✅ Basic Problems

1. Create a variable `school` and assign your school name
2. Store your birth year in a variable and print your current age
3. Convert the string `"9.5"` to a float and print it
4. Create a variable `is_ready` and set it to `True`
5. Use `type()` to show the type of any 3 variables

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### 🚀 Intermediate Problems

**A1.** Ask the user their height in feet. Convert to inches (`1 foot = 12 inches`)
**A2.** Ask the user their birth year and calculate age (assume current year is 2025)
**A3.** Take one variable each of: integer, float, string, and boolean from the user and print their types

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