📘 Python Basics: Variables, Data Types & Typecasting

🔹 1. Variables in Python

- Variables act like **containers** that hold values in memory.
- You give the container a name, and store a value in it.

```
name = "Rahul"   # string
age = 21         # integer
height = 5.8     # float
```

🔹 2. Data Types in Python

Python has many data types, but the most common are:

String (`str`) – Text enclosed in quotes.

```
text = "Hello"
```

1. ✅ Strings are **immutable** (cannot be changed after creation).

Integer (`int`) – Whole numbers.

```
num = 10
```

2.

Float (`float`) – Numbers with decimals.

```
pi = 3.14
```

3.

🔹 3. Identifying Data Types

Use the `type()` **function**:

```
print(type("Hello"))   # <class 'str'>
print(type(25))        # <class 'int'>
print(type(3.5))       # <class 'float'>
```

🔹 4. Errors with Mixed Data Types

If you mix types incorrectly, Python raises a **TypeError**.

```
x = 7       # int
y = "8"     # str
print(x + y)  # ❌ TypeError
```

🔹 5. Type Conversion

There are two kinds:

✅ Implicit Conversion

- Python converts smaller types to bigger types automatically.

```
a = 5
b = 2.5
print(a + b)          # 7.5
print(type(a + b))    # float
```

✅ Explicit Conversion (Typecasting)

- User manually changes type with functions: `int()`, `float()`, `str()`

```
num_str = "100"
num_int = int(num_str)   # string → int

pi = 3.14
```

```
pi_str = str(pi)          # float → string
```

🔹 6. Input & Output

- `print()` is used for output.
- `input()` takes user input as **string** by default.

```
name = input("Enter your name: ")
age = int(input("Enter your age: "))  # convert to int
print(f"Hello {name}, you are {age} years old.")
```

🔹 7. Debugging

- Always read the **last line of an error message** → it tells you what went wrong.
- Common errors:
    - **TypeError** (wrong type operation)
    - **ValueError** (invalid value for type conversion)

📝 Practice Problems

1. Ask user for name & age → print greeting.
2. Add two numbers given by user.
3. Print type of `"Python"`, `25`, and `3.14`.
4. Try adding `7 + "8"` → fix the error.
5. Find area of a circle using radius input.

❓ Quiz

MCQs (Single Correct)

1. `type("5")` returns:
    - A) int
    - B) str ✅
    - C) float
    - D) list
2. Strings in Python are:
    - A) Mutable
    - B) Immutable ✅
3. Adding an `int` and a `float` results in:
    - A) int
    - B) float ✅

Arrange in Order

Steps for taking integer input:
`input()` → store in variable → `int()` conversion → `print()` ✅

Multi-Correct

Which can cause a `TypeError`?

- `"5" + 10` ✅
- `int("abc")` ✅
- `"Hello" + "World"` ❌ (works fine)

✨ Key Takeaways

- Variables store values, data types define their nature.
- Use `type()` to check types.
- Be careful when mixing data types.
- Implicit conversion is automatic; explicit needs typecasting.
- Input always comes as string → convert if needed.
- Debugging errors is a normal part of programming.