# 📘 Chapter 6: Control Flow (Decision Making)

> *"Without decisions, your code is just instructions. With decisions, it starts to think."*

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## 🎯 What You'll Learn

- How to use `if`, `elif`, and `else` to make decisions
- How Python chooses which path to follow
- How to use nested conditions (like questions inside questions)
- Why indentation matters in Python
- What the `pass` keyword does
- Debugging common errors beginners face

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## 🧠 Introduction: Control Flow = The Brain of Your Code

In real life:

- If you're hungry → eat.
- If it's raining → take an umbrella.
- Else → go outside and enjoy.

In Python, we teach the computer to **do the same** using:

```
if
elif
else
```

That's called control flow — telling the program "Do this if that is true, otherwise do something else."

## 🔍 The if Statement

```
age = 18

if age >= 18:
    print("You are an adult.")
```

🧠 Concept: Python checks the condition.
If it's True, it runs the indented block.
If it's False, it skips it.

## 🧭 Flowchart

```
          [age >= 18?]
               |
           Yes / \ No
           /       \
[print("You are an adult.")]  (skip)
```

## 🔄 if and else

```python
temperature = 15

if temperature > 20:
    print("It's warm.")
else:
    print("It's cold.")
```

🎯 Think of it like a fork in the road:

```
       [condition]
         /    \
     True     False
     /          \
[do this]     [do that]
```

## 🌿 Using elif (Else If)

```python
marks = 85

if marks >= 90:
    print("Grade: A")
elif marks >= 80:
    print("Grade: B")
elif marks >= 70:
    print("Grade: C")
else:
    print("Grade: D or below")
```

## ⚙️ How Python Evaluates:

```
Check condition 1 → if True, stop.
Else → check condition 2 → if True, stop.
Else → keep checking…
```

## 🧭 Flowchart

```
[marks >= 90?]——Yes—▶ A
        |
       No
[marks >= 80?]——Yes—▶ B
        |
       No
[marks >= 70?]——Yes—▶ C
        |
       No
            ▶ D or below
```

## 📦 Nested Conditionals

```python
age = 20
has_id = True

if age >= 18:
    if has_id:
        print("Entry allowed.")
    else:
        print("Show ID.")
else:
    print("Too young.")
```

🧠 Think of it like layers of checking:
First: “Are you 18+?”
Then: “Do you have ID?”

🔄 Visual:

```
[age >= 18?]
     |
    Yes
     ↓
[has_id?]—Yes—▶ "Entry allowed"
     |
    No
     ↓
"Show ID"

Else → "Too young"
```

## ✍️ The pass Statement

Used when you want to define a condition or block but leave it empty for now.

```python
if logged_in:
    pass  # I'll write this later
else:
    print("Please log in")
```

✅ `pass` = do nothing
Useful during planning or temporary stubs.

## ⬅️ Why Indentation Matters

❌ Wrong

```python
if True:
print("This will error")
```

✅ Right

```python
if True:
    print("This is correct")
```

Python needs proper indentation to know which code belongs inside the block.
Standard = 4 spaces or 1 tab

## ⚠️ Common Mistakes

| ❌ Mistake | ✅ Fix | 🧠 Why |
|---|---|---|
| `if x = 5:` | `if x == 5:` | `=` is assignment; `==` is compare |
| Missing colon `:` | Add colon at end | Python needs it to start block |
| No indentation | Indent block | Python uses spaces to define scope |

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# 🧪 Mini Quiz (10 Questions)

1. What does `elif` stand for?
2. What happens if all `if` and `elif` are false?
3. Write an if statement to check if a number is negative.
4. What's wrong with this?

```python
if 5 > 3
    print("Yes")
```

5. Why is indentation important in Python?
6. What does `pass` do?
7. Create a nested `if` to check if a user is adult and has ID.

8. What will this print?

```
x = 5
if x > 10:
    print("Big")
else:
    print("Small")
```

9. What is the output of:

```
x = 10
if x == 10:
    print("Ten")
```

10. Fix this code:

```
if name = "John":
print("Hello")
```

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## 📝 Basic Practice (15 Questions)

- Check if a number is even or odd
- Check if someone is eligible to vote (18+)
- Ask for a number and print if it's + / - / 0
- Ask for temperature and classify as cold/warm/hot
- Take two numbers and print the larger one
- Use nested `if` to check if a user has passed and has ID
- Use `pass` in a dummy condition
- Ask for time. If <12 → "Good morning"
- Check if a number is divisible by both 3 and 5
- Check if a number is between 10 and 100
- Use if-elif-else to assign letter grades
- Check if someone is a teenager (13–19)
- Ask name and print only if it starts with "A"
- If year is leap year (basic logic only)
- Ask user input. If empty → "Please enter something"

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## 🚀 Intermediate Practice (10 Problems)

- Ask for name and age. If age ≥ 18 and name isn't empty → "Access granted"
- Ask for 3 subject marks → Grade A/B/C/D

- Temp ranges:
  - <0: "Freezing"
  - 0–15: "Cold"
  - 16–25: "Cool"
  - 26+: "Warm"
- If one number is exactly double the other → "Nice match!"
- If number > 50 and even → "Perfect!"
- Ask for age. If < 13 → "Child", if 13–19 → "Teen", else → "Adult"
- Ask for username and password. If both correct → "Login successful"
- Ask for a color. If it's "red", "blue", or "green" → valid color
- Check if a year is divisible by 4 and not 100 unless also 400
- Simulate traffic light: red → stop, green → go, yellow → wait

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## 🧠 Fix-the-Bug Challenges (5)

```
if age > 18
    print("OK")
```

```
x = 10
if x == 10
print("Ten")
```

```
if user = "admin":
    print("Welcome")
```

```
temp = 30
if temp < 20:
    print("Cold")
else
    print("Hot")
```

```
if name == "Alice":
print("Hi")
```

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## 🎯 Mini Project: Smart Greeter

Ask the user:

- Name
- Time (24-hr format)

Use logic:

- If time < 12 → "Good morning, [name]"
- If time < 18 → "Good afternoon, [name]"
- Else → "Good evening, [name]"