Selection (If-Then-Else)

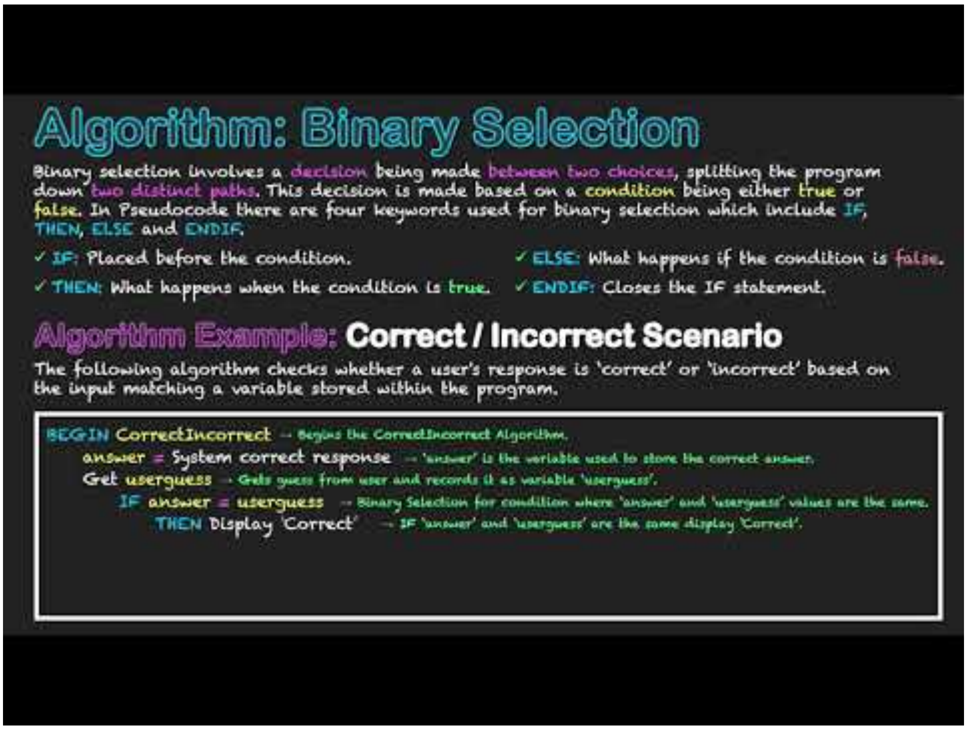
Description: Learn to design algorithms with conditional logic using flowcharts and pseudocode, and master decision-making structures.

Duration: 20-30 minutes
Learning Mode: Read explanations, watch videos, complete exercises

📺 Watch: Binary Selection (If-Then-Else)

Watch this video to understand binary selection (if-then-else) before continuing with the lesson.

Video: https://www.youtube.com/watch?v=jf2P5aF6PxI



Algorithm: Binary Selection

Binary selection involves a decision being made between two choices, splitting the program down two distinct paths. This decision is made based on a condition being either true or false. In Pseudocode there are four keywords used for binary selection which include IF, THEN, ELSE and ENDIF.

- ✓ IF: Placed before the condition.
- ✓ THEN: What happens when the condition is true.
- ✓ ELSE: What happens if the condition is false.
- ✓ ENDIF: Closes the IF statement.

Algorithm Example: Correct / Incorrect Scenario

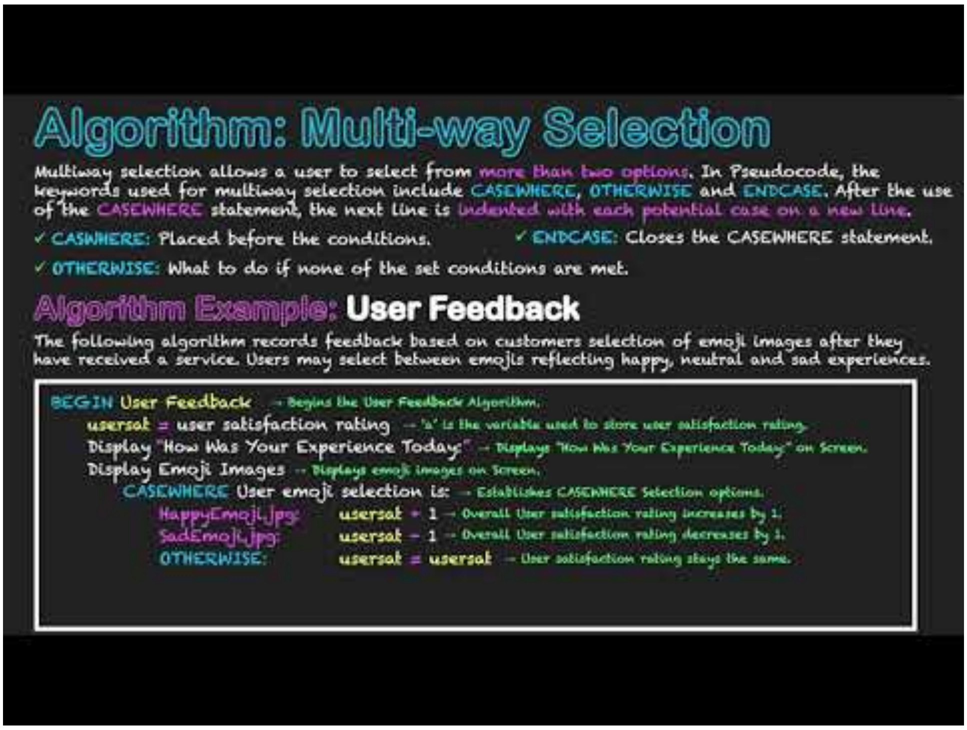
The following algorithm checks whether a user's response is 'correct' or 'incorrect' based on the input matching a variable stored within the program.

```
BEGIN CorrectIncorrect → Begins the CorrectIncorrect Algorithm.
    answer = System correct response → 'answer' is the variable used to store the correct answer.
    Get userguess → Gets guess from user and records it as variable 'userguess'.
        IF answer = userguess → Binary Selection for condition where 'answer' and 'userguess' values are the same.
            THEN Display 'Correct' → IF 'answer' and 'userguess' are the same display 'Correct'.
```

📺 Watch: Multiway Selection

Watch this video to understand multiway selection (if-elseif-else) structures.

Video: https://www.youtube.com/watch?v=gVtntHa80rU



Algorithm: Multi-way Selection

Multiway selection allows a user to select from more than two options. In Pseudocode, the keywords used for multiway selection include CASEWHERE, OTHERWISE and ENDCASE. After the use of the CASEWHERE statement, the next line is indented with each potential case on a new line.

✓ CASWHERE: Placed before the conditions.

✓ ENDCASE: Closes the CASEWHERE statement.

✓ OTHERWISE: What to do if none of the set conditions are met.

Algorithm Example: User Feedback

The following algorithm records feedback based on customers selection of emoji images after they have received a service. Users may select between emojis reflecting happy, neutral and sad experiences.

```
BEGIN User Feedback   → Begins the User Feedback Algorithm.
    usersat = user satisfaction rating   → 's' is the variable used to store user satisfaction rating.
    Display "How Was Your Experience Today:"   → Displays "How Was Your Experience Today:" on Screen.
    Display Emoji Images   → Displays emoji images on Screen.
        CASEWHERE User emoji selection is:   → Establishes CASEWHERE Selection options.
            HappyEmoji.jpg:     usersat + 1   → Overall User satisfaction rating increases by 1.
            SadEmoji.jpg:       usersat - 1   → Overall User satisfaction rating decreases by 1.
            OTHERWISE:          usersat = usersat   → User satisfaction rating stays the same.
```

Selection (If-Then-Else)

Learning Objectives

- Understand **selection** as a fundamental control structure
- Design algorithms with **decision points** using flowcharts
- Use IF/ELSE and IF/ELSEIF/ELSE in pseudocode
- Apply **boolean logic** to conditions
- Choose the right selection structure for a problem

What is Selection?

Selection allows an algorithm to choose different paths based on conditions.

Without selection, algorithms would be linear — doing the same thing every time.
Selection gives algorithms **intelligence** to respond to different situations.

When to Use Selection:

- Categorizing data (grade letters, age groups)
- Validating input (is the value acceptable?)
- Handling special cases (divide by zero, empty lists)
- Making decisions (should we continue or stop?)

🧪 Recognizing Selection Problems

Question: Which problem requires selection (branching) in its algorithm?

- **A)** Calculate the sum of 10 numbers
- **B)** Print each item in a list
- **C)** Determine if a number is positive, negative, or zero
- **D)** Repeat a message 5 times

Show Answer

Answer: C

Explanation: Determining if a number is positive, negative, or zero requires checking conditions and branching to different outputs. The other problems are sequential (sum), iteration (print each, repeat), not selection.

Binary Selection Flowchart (HSC Standard)

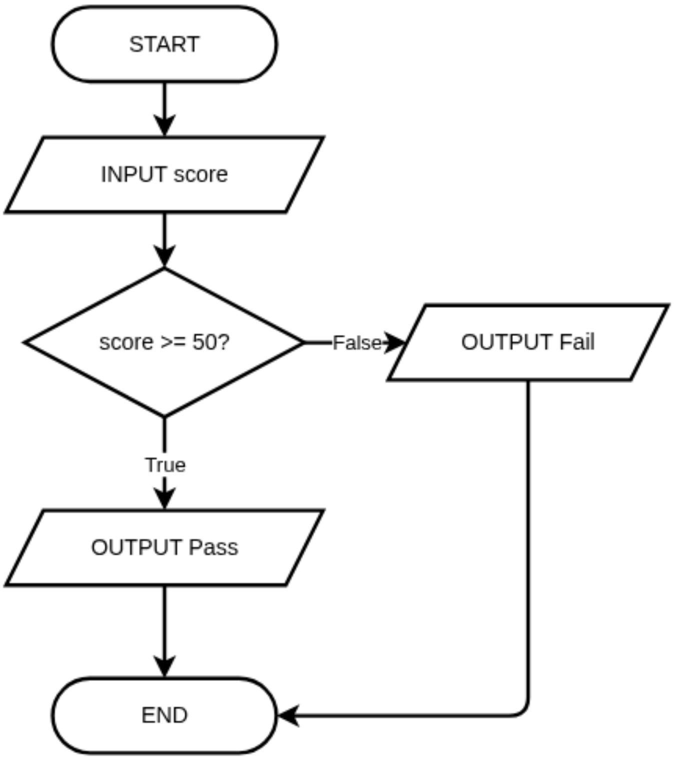
Binary selection has exactly **two paths**: one for when the condition is TRUE, and one for when it's FALSE.

Key Flowchart Rules:

- Use a **diamond (rhombus)** shape for decisions
- Label the two exits **True** and **False** (or Yes/No)
- Both paths must **merge back** to a single flow line

📊 Binary Selection Flowchart: Pass or Fail

Binary Selection (IF-THEN-ELSE): Decision diamond has exactly two exits labeled True/False. True flows down, False branches right. Both paths merge at END — NESA HSC standard



Writing Selection in Pseudocode (HSC Standard)

```
BEGIN PassFail
    INPUT score
    IF score >= 50 THEN
        OUTPUT "Pass"
    ELSE
        OUTPUT "Fail"
    ENDIF
END PassFail
```

Key Elements:

- `IF condition THEN` — starts the selection
- `ELSE` — what happens if condition is false (optional)
- `ENDIF` — marks the end of the selection block (required!)

🧪 Quick Check: Selection Syntax

Question: In pseudocode, what keyword ends an IF statement?

- **A)** END

- **B)** ENDIF
- **C)** ELSE
- **D)** STOP

Show Answer

Answer: B

Explanation: In pseudocode, IF statements end with ENDIF. This clearly marks where the conditional block finishes.

Boolean Logic in Conditions

Boolean expressions evaluate to either TRUE or FALSE. They control which branch executes.

Comparison Operators:

Operator	Meaning	Example	Result
`=`	Equal to	`5 = 5`	TRUE
`<>`	Not equal	`5 <> 3`	TRUE
`<`	Less than	`3 < 5`	TRUE
`>`	Greater than	`5 > 3`	TRUE
`<=`	Less than or equal	`5 <= 5`	TRUE
`>=`	Greater than or equal	`6 >= 5`	TRUE

Logical Operators (Combining Conditions):

Operator	Meaning	Example	Result
`AND`	Both must be true	`(5 > 3) AND (10 > 8)`	TRUE
`OR`	At least one true	`(5 > 3) OR (2 > 8)`	TRUE
`NOT`	Reverses true/false	`NOT (5 > 10)`	TRUE

🧪 Boolean Logic Practice

Question: If `age = 17` and `hasLicense = TRUE`, what is the result of: `(age >= 18) AND hasLicense`?

- **A)** TRUE — because hasLicense is TRUE
- **B)** FALSE — because age >= 18 is FALSE
- **C)** TRUE — because one condition is TRUE
- **D)** Error — you can't combine these conditions

Show Answer

Answer: B

Explanation: AND requires BOTH conditions to be TRUE. Since age >= 18 is FALSE (17 is not >= 18), the whole expression is FALSE regardless of hasLicense.

🧪 Choosing AND vs OR

Question: You're designing a login algorithm. A user can access the system if they have a valid password OR if they're an admin. Which condition is correct?

- **A)** validPassword AND isAdmin
- **B)** validPassword OR isAdmin
- **C)** validPassword = isAdmin
- **D)** NOT validPassword AND NOT isAdmin

Show Answer

Answer: B

Explanation: The word 'or' in the requirement means EITHER condition grants access. Use OR when any single condition is sufficient. Use AND when all conditions must be met.

Multiway Selection (IF-ELSEIF-ELSE)

Sometimes you need more than two branches. Use `ELSEIF` (else if):

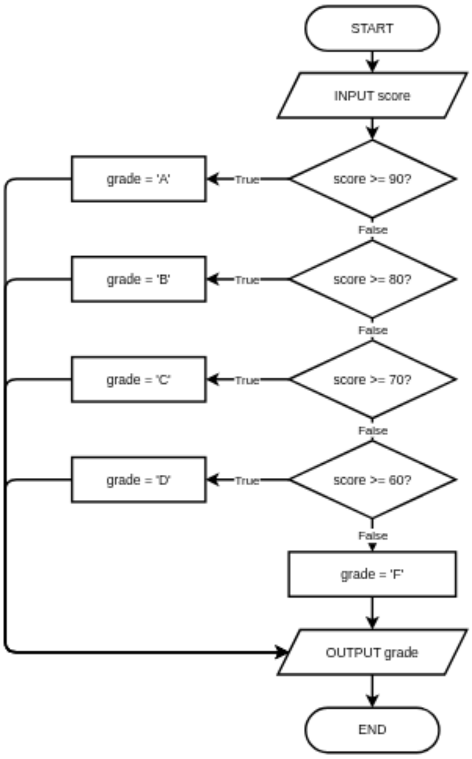
```
IF score >= 85 THEN
    OUTPUT "High Distinction"
ELSEIF score >= 75 THEN
    OUTPUT "Distinction"
ELSEIF score >= 50 THEN
    OUTPUT "Pass"
ELSE
    OUTPUT "Fail"
ENDIF
```

Key Points:

- Conditions are checked **in order** from top to bottom
- The **first true condition** executes, then the algorithm skips to ENDIF
- `ELSE` catches **all remaining cases**
- There is still only **one ENDIF** at the end

📊 Multiway Selection Flowchart: Grade Categories

Multiway Selection (IF-ELSEIF-ELSE): Chain of decisions where only ONE path executes. False leads to next check, all paths merge at the end — NESA HSC standard


START
INPUT score
score >= 90?
True
grade = 'A'
False
score >= 80?
True
grade = 'B'
False
score >= 70?
True
grade = 'C'
False
score >= 60?
True
grade = 'D'
False
grade = 'F'
OUTPUT grade
END

✍️ Practice: Grade Calculator

Write pseudocode that converts a numeric score to a letter grade: - 90 or above: "A" - 80-89: "B" - 70-79: "C" - 60-69: "D" - Below 60: "F"

Remember to check conditions from **highest to lowest** so more specific conditions are checked first.

Starter Code:

```
BEGIN GradeCalculator
    OUTPUT "Enter score:"
    INPUT score

    // Determine the grade using IF-ELSEIF-ELSE

    OUTPUT grade
END GradeCalculator
```

Hints: - Start with the highest grade (90+) and work down - Use ELSEIF for each additional condition - The ELSE catches everything below 60 - Don't forget ENDIF at the end

```
# Write your pseudocode here as Python comments
# Remember to use proper indentation and HSC conventions

"""
BEGIN GradeCalculator
    OUTPUT "Enter score:"
    INPUT score

    // Determine the grade using IF-ELSEIF-ELSE

    OUTPUT grade
END GradeCalculator
"""
```

Example Answer

```
# Example solution
BEGIN GradeCalculator
    OUTPUT "Enter score:"
    INPUT score

    IF score >= 90 THEN
        SET grade TO "A"
    ELSEIF score >= 80 THEN
        SET grade TO "B"
    ELSEIF score >= 70 THEN
        SET grade TO "C"
    ELSEIF score >= 60 THEN
        SET grade TO "D"
    ELSE
        SET grade TO "F"
    ENDIF

    OUTPUT grade
END GradeCalculator
```

✍️ Practice: Temperature Checker

Write pseudocode that: 1. Gets a temperature from the user 2. If temperature >= 30, output "Hot" 3. If temperature >= 20 but less than 30, output "Warm" 4. If temperature >= 10 but less than 20, output "Cool" 5. Otherwise, output "Cold"

Starter Code:

```
BEGIN TemperatureChecker

END TemperatureChecker
```

Hints: - Use ELSEIF for multiple conditions - Check from highest to lowest temperature - Don't forget ENDIF at the end

```
# Write your pseudocode here as Python comments
# Remember to use proper indentation and HSC conventions

"""
BEGIN TemperatureChecker

END TemperatureChecker
"""
```

Example Answer

```
# Example solution
BEGIN TemperatureChecker
    OUTPUT "Enter temperature:"
    INPUT temp

    IF temp >= 30 THEN
        OUTPUT "Hot"
    ELSEIF temp >= 20 THEN
        OUTPUT "Warm"
    ELSEIF temp >= 10 THEN
        OUTPUT "Cool"
    ELSE
        OUTPUT "Cold"
    ENDIF
END TemperatureChecker
```

CASEWHERE Selection

When you're checking a single variable against **exact values** (not ranges), use `CASEWHERE`:

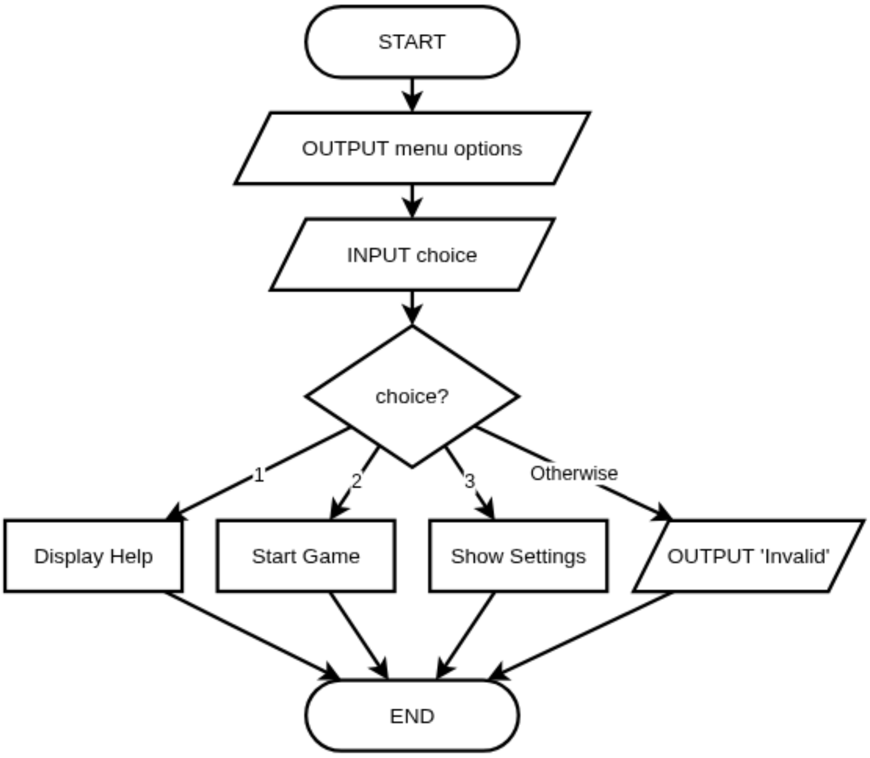
```
CASEWHERE dayNumber
    1: dayName = "Monday"
    2: dayName = "Tuesday"
    3: dayName = "Wednesday"
    4: dayName = "Thursday"
    5: dayName = "Friday"
    OTHERWISE: dayName = "Weekend"
ENDCASE
```

When to Use CASEWHERE vs IF-ELSEIF:

Use CASEWHERE when...	Use IF-ELSEIF when...
Checking **exact values**	Checking **ranges**
Menu options (1, 2, 3, 4)	Score >= 90
Day of week (Mon, Tue...)	Temperature >= 30
Single variable	Multiple variables

📊 CASEWHERE Flowchart: Menu Selection

CASEWHERE Flowchart: Multiple branches from one decision, each labeled with its value. OTHERWISE handles unmatched cases — NESA HSC standard



🧪 Selecting the Right Structure

Question: You need to categorize ages: Child (0-12), Teen (13-17), Adult (18-64), Senior (65+). Which structure is most appropriate?

- **A)** Simple IF-THEN
- **B)** IF-THEN-ELSE
- **C)** IF-ELSEIF-ELSE chain
- **D)** CASEWHERE

Show Answer

Answer: C

Explanation: Age categories are RANGES, not exact values, so CASEWHERE won't work. We need to check multiple conditions in sequence, making IF-ELSEIF-ELSE the right choice.

🧪 Algorithm Design: Edge Cases

Question: Your algorithm divides a number by user input. What edge case MUST your selection handle?

- **A)** User enters a very large number
- **B)** User enters a negative number
- **C)** User enters zero (division by zero)
- **D)** User enters a decimal number

Show Answer

Answer: C

Explanation: Division by zero causes an error and must be handled with selection: IF divisor = 0 THEN handle error ELSE perform division. This is a critical edge case in algorithm design.

Nested Selection: Decisions within Decisions

Sometimes you need to make a decision based on the outcome of another decision.

```
IF hasTicket THEN
    IF age >= 18 THEN
        OUTPUT "Welcome to the adult section"
    ELSE
        OUTPUT "Welcome to the family section"
    ENDIF
ELSE
    OUTPUT "Please purchase a ticket first"
ENDIF
```

Design Tip:

- Keep nesting to a maximum of 2-3 levels for readability
- Consider using ELSEIF chains as an alternative
- Complex nested logic may indicate you need to decompose the problem

📝 Reflection: Selection in Everyday Life

Describe a real-life situation where you make a decision based on a condition. Write it as an IF-THEN-ELSE statement in plain English. Then identify: Is it binary selection, multi-way selection, or nested selection?

Example Answer

When I'm deciding what to wear: IF the temperature is below 15 degrees THEN I wear a jacket and long pants ELSEIF it's below 25 degrees THEN I wear a light sweater ELSE I wear a t-shirt and shorts. This is a multi-way selection (IF-ELSEIF-ELSE) because there are more than two possible outcomes based on ranges of temperature.

🧪 Condition Order Matters

Question: What's wrong with this algorithm?

```
IF score >= 50 THEN grade = "Pass"
ELSEIF score >= 80 THEN grade = "High Distinction"
ENDIF
```

- **A)** Nothing — it works correctly
- **B)** The ELSEIF will never execute for scores >= 80
- **C)** It needs an ELSE clause
- **D)** The syntax is incorrect

Show Answer

Answer: B

Explanation: A score of 85 would match the FIRST condition (85 >= 50), so it gets "Pass" and the second check never runs. Always check for the more SPECIFIC/restrictive conditions FIRST.

Implementing Selection in Python

Now that you understand selection in pseudocode and flowcharts, here's how it works in Python:

Pseudocode vs Python Comparison:

Pseudocode	Python
`IF condition THEN`	`if condition:`
`ELSEIF condition THEN`	`elif condition:`
`ELSE`	`else:`
`ENDIF`	(indentation ends the block)

Key Python Differences:

- Uses `:` instead of `THEN`
- Uses `elif` instead of `ELSEIF`
- **Indentation** (spaces) shows what's inside the if/else
- No `ENDIF` needed — Python uses indentation to end blocks

🐍 Practice: Age Checker

Write a Python program that: 1. Asks the user for their age 2. If they are 18 or older, print "You are an adult" 3. Otherwise, print "You are a minor"

Remember: `input()` returns a string, so you need to convert it to an integer using `int()` before comparing numbers. For example: `age = int(input("Enter age: "))`

This demonstrates binary selection (IF-THEN-ELSE) in Python.

Hints: - input() always returns a string - use int(input(...)) to convert it to a number for comparisons - The condition is: age >= 18 - Remember the colon : after if and else - Indent the code inside if/else with 4 spaces

```
# Get the user's age (remember: input() returns a string!)

# Check if adult or minor
```

Example Solution

```
# Example solution
# Get the user's age
age = int(input("Enter your age: "))

# Check if adult or minor
if age >= 18:
    print("You are an adult")
else:
    print("You are a minor")
```

✅ Lesson Complete!

You've completed this lesson. Make sure you:

- ✓ Watched all videos
- ✓ Read all explanations
- ✓ Completed all exercises
- ✓ Answered all quiz questions

Ready for the next lesson? Continue to the next notebook!