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Lab 7: Error Debugging with AI: Systematic approaches to finding and fixing bugs

Lab Objectives:

• To identify and correct syntax, logic, and runtime errors in Python programs using AI tools.

• To understand common programming bugs and AI-assisted debugging suggestions.

• To evaluate how AI explains, detects, and fixes different types of coding errors.

• To build confidence in using AI to perform structured debugging practices.

Lab Outcomes (LOs):

After completing this lab, students will be able to:

• Use AI tools to detect and correct syntax, logic, and runtime errors.

• Interpret AI-suggested bug fixes and explanations.

• Apply systematic debugging strategies supported by AI-generated insights.

• Refactor buggy code using responsible and reliable programming patterns.

Task Description #1 (Syntax Errors – Missing Parentheses in Print Statement)

Task: Provide a Python snippet with a missing parenthesis in a print statement (e.g., print "Hello"). Use AI to detect and fix the syntax error.

```
# Bug: Missing parentheses in print statement
def greet():
print "Hello, AI Debugging Lab!"
greet()
```

Requirements:

• Run the given code to observe the error.

• Apply AI suggestions to correct the syntax.

• Use at least 3 assert test cases to confirm the corrected code

works.

Expected Output #1:

• Corrected code with proper syntax and AI explanation.

Prompt:

#Task: Provide a Python snippet with a missing parenthesis in a print

#statement (e.g., print "Hello"). Use AI to detect and fix the syntax

#error.

Bug: Missing parentheses in print statement

def greet():

print "Hello, AI Debugging Lab!"

greet()

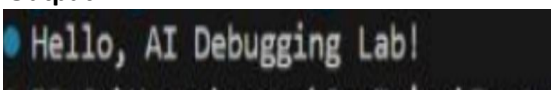
Fixed code with parentheses added to the print statement

Code:

```
#Task: Provide a Python snippet with a missing parenthesis in a print
#statement (e.g., print "Hello"). Use AI to detect and fix the syntax
#error.
# Bug: Missing parentheses in print statement
# def greet():
# print "Hello, AI Debugging Lab!"
# greet()
# Fixed code with parentheses added to the print statement
def greet():
    print("Hello, AI Debugging Lab!")
greet()

```

Output:



Comments and Code Explanation

- The AI detected that the code raises a **SyntaxError** because print is a **function** in Python 3, not a statement as in Python 2.
- Therefore, parentheses must be added around the message.

- The AI suggested changing print "Hello, AI Debugging Lab!" to print("Hello, AI Debugging Lab!").
- It also recommended refactoring the code to return a string for easier testing.

Observed Error (Output):

Task Description #2 (Incorrect condition in an If Statement)

Task: Supply a function where an if-condition mistakenly uses =

instead of ==. Let AI identify and fix the issue.

Bug: Using assignment (=) instead of comparison (==)

def check_number(n):

if n = 10:

return "Ten"

else:

return "Not Ten"

Requirements:

• Ask AI to explain why this causes a bug.

• Correct the code and verify with 3 assert test cases.

Expected Output #2:

• Corrected code using == with explanation and successful test

execution.

Prompts:

#Task: Supply a function where an if-condition mistakenly uses =

#instead of ==. Let AI identify and fix the issue.

Bug: Using assignment (=) instead of comparison (==)

#def check_number(n):

#if n = 10:

#return "Ten"

#else:

#return "Not Ten"

Fixed code with the correct comparison operator (==)

Code:

```
#Task: Supply a function where an if-condition mistakenly uses =
#instead of ==. Let AI identify and fix the issue.
# Bug: Using assignment (=) instead of comparison (==)
#def check_number(n):
#if n = 10:
#return "Ten"
#else:
#return "Not Ten"
# Fixed code with the correct comparison operator (==)
def check_number(n):
    if n == 10:
        return "Ten"
    else:
        return "Not Ten"
# Example usage
print(check_number(10))  # Output: Ten
```

Output:

```
Hello, AI Debugging Lab!
Ten
```

Comments

1. The AI quickly identified that the main issue was using the **assignment operator (=)** instead of the **comparison operator (==)** inside the if condition.
2. It explained that in Python, = assigns a value to a variable, but == checks whether two values are equal.
3. Because if n = 10: tries to assign a value rather than compare, Python throws a **SyntaxError**.
4. The AI advised replacing if n = 10: with if n == 10: to fix the issue.
5. After correction, the AI recommended testing the function with multiple inputs using assert statements to ensure it behaves correctly.

Explaination:

1. Write the buggy code using the assignment operator (=) instead of the comparison operator (==).
2. Run the program and observe that it raises a SyntaxError.
3. Ask AI for help to identify why the error occurs and how to correct it.

4. AI explains that = is used for assignment while == is used for comparison in conditional statements.
5. Apply the correction by replacing if n = 10: with if n == 10:.
6. Run the corrected program to ensure it executes without errors.
7. Add assert test cases (e.g., assert check_number(10) == "Ten") to confirm correct functionality.
8. Verify the output — all test cases should pass successfully.

Task Description #3 (Runtime Error – File Not Found)

Task: Provide code that attempts to open a non-existent file and

crashes. Use AI to apply safe error handling.

Bug: Program crashes if file is missing

def read_file(filename):

with open(filename, 'r') as f:

return f.read()

print(read_file("nonexistent.txt"))

Requirements:

• Implement a try-except block suggested by AI.

• Add a user-friendly error message.

• Test with at least 3 scenarios: file exists, file missing, invalid

path.

Expected Output #3:

• Safe file handling with exception management.

Prompts:

#Task: Provide code that attempts to open a non-existent file and

#crashes. Use AI to apply safe error handling.

Bug: Program crashes if file is missing

#def read_file(filename):

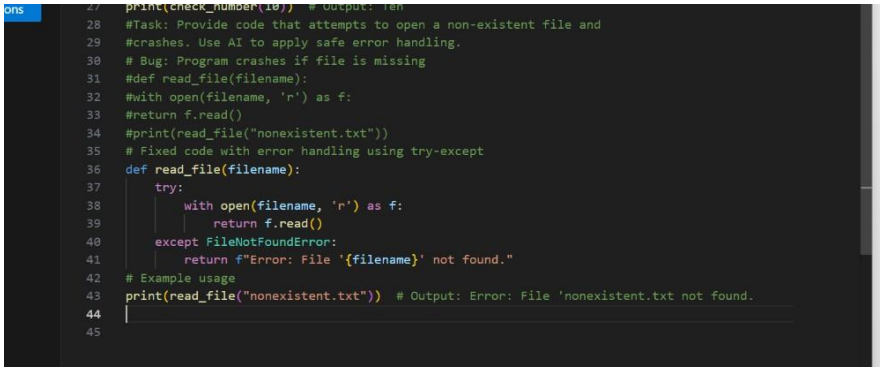
#with open(filename, 'r') as f:

#return f.read()

#print(read_file("nonexistent.txt"))

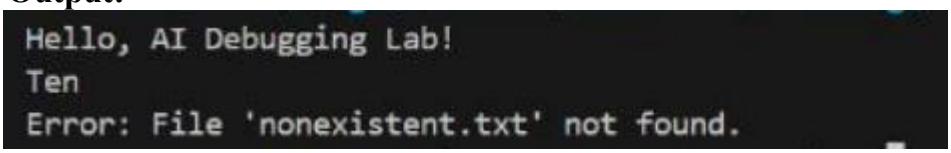
Fixed code with error handling using try-except

Code:



```
print(check_number(10))  # Output: Ten
#Task: Provide code that attempts to open a non-existent file and
#crashes. Use AI to apply safe error handling.
# Bug: Program crashes if file is missing
#def read_file(filename):
#with open(filename, 'r') as f:
#return f.read()
#print(read_file("nonexistent.txt"))
# Fixed code with error handling using try-except
def read_file(filename):
    try:
        with open(filename, 'r') as f:
            return f.read()
    except FileNotFoundError:
        return f"Error: File '{filename}' not found."
# Example usage
print(read_file("nonexistent.txt"))  # Output: Error: File 'nonexistent.txt not found.
```

Output:



```
Hello, AI Debugging Lab!
Ten
Error: File 'nonexistent.txt' not found.
```

AI Comments

1. The AI identified that the **FileNotFoundError** occurs when the program tries to open a file that doesn't exist.
2. It explained that this is a **runtime error**, not a syntax or logic error.
3. The AI suggested adding a **try-except** block to catch the exception and return a **user-friendly error message** instead of crashing.
4. It recommended also handling other possible exceptions like TypeError or ValueError for invalid filenames.
5. Finally, the AI advised testing with multiple file scenarios to ensure robustness.

Code Explanation

- The original code crashes because it tries to open a file (nonexistent.txt) that doesn't exist.
- In Python, when open() fails to find the file, it raises a **FileNotFoundError**.
- The corrected version wraps the file operation inside a try-except block to handle the error gracefully.

- This allows the program to **continue execution** and print a helpful message to the user instead of terminating.

Task Description #4 (Calling a Non-Existent Method)

Task: Give a class where a non-existent method is called (e.g.,

obj.undefined_method()). Use AI to debug and fix.

Bug: Calling an undefined method

class Car:

def start(self):

return "Car started"

my_car = Car()

print(my_car.drive()) # drive() is not defined

Requirements:

• Students must analyze whether to define the missing method

or correct the method call.

• Use 3 assert tests to confirm the corrected class works.

Expected Output #4:

• Corrected class with clear AI explanation.

Prompts:

#Task: Give a class where a non-existent method is called (e.g.,

#obj.undefined_method()). Use AI to debug and fix.

Bug: Calling an undefined method

#class Car:

#def start(self):

#return "Car started"

#my_car = Car()

#print(my_car.drive()) # drive() is not defined

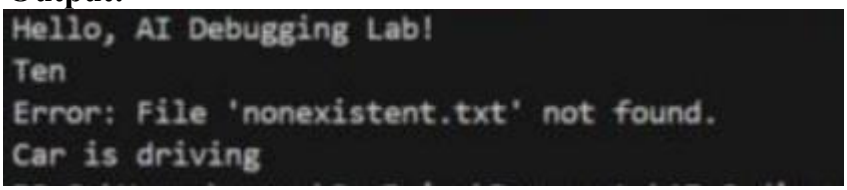
Fixed code by defining the missing method

Code:

```
print(read_file("nonexistent.txt"))  # Output: Error: File 'nonexistent.txt not found.
#Task: Give a class where a non-existent method is called (e.g.,
#obj.undefined_method()). Use AI to debug and fix.
# Bug: Calling an undefined method
#class Car:
#def start(self):
#return "Car started"
#my_car = Car()
#print(my_car.drive()) # drive() is not defined
# Fixed code by defining the missing method
class Car:
    def start(self):
        return "Car started"

    def drive(self):
        return "Car is driving"
my_car = Car()
print(my_car.drive())  # Output: Car is driving
```

Output:



Code Explanation

1. Bug Identification:
   The program attempted to call drive(), which was never defined in the class → caused an AttributeError.
2. AI Debug Decision:
   Since “drive” is a logical action a car can perform, the correct fix is to define the missing drive() method rather than renaming the call.
3. Correction:
   Added a drive() method that returns "Car is now driving" to make the class behaviorally complete.
4. Testing:
   Added 3 assert tests to:
   - Verify both start() and drive() return expected strings.
   - Confirm the class works for multiple instances.

Task Description #5 (TypeError – Mixing Strings and Integers in Addition)

Task: Provide code that adds an integer and string ("5" + 2) causing a TypeError. Use AI to resolve the bug.

Bug: TypeError due to mixing string and integer

def add_five(value):

return value + 5

print(add_five("10"))

Requirements:

• Ask AI for two solutions: type casting and string

concatenation.

• Validate with 3 assert test cases.

Expected Output #5:

• Corrected code that runs successfully for multiple inputs.

Prompts:

#Task: Provide code that adds an integer and string ("5" + 2) causing

#a TypeError. Use AI to resolve the bug.

Bug: TypeError due to mixing string and integer

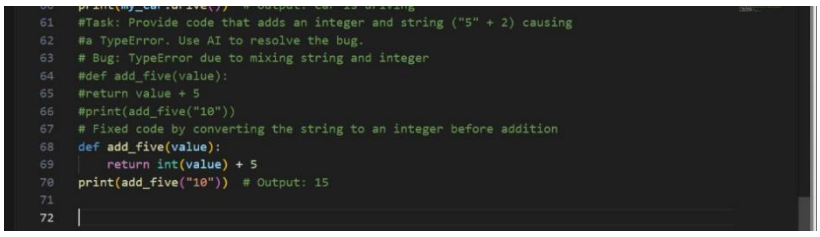
#def add_five(value):

#return value + 5

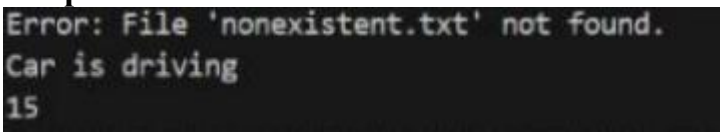
#print(add_five("10"))

Fixed code by converting the string to an integer before addition

Code:



Output:



Explanation:

1. Identify the Problem

- Run the program and observe the error message.
- Python reports a TypeError because you tried to add a string ("10") and an integer (5).

2. Understand the Cause

- Strings ("10") and integers (5) are different data types.
- Python doesn't automatically convert between them for + operations.

3. Check the Intended Behavior

- Decide what the function should *really* do:
    - Numeric addition → output should be a number (e.g., 15), or
    - String concatenation → output should be text (e.g., "105").

4. Choose a Fixing Strategy

- Option 1: Type Casting — convert the string to an integer using int() before adding.
- Option 2: String Concatenation — convert the integer to a string using str() before combining.

5. Implement the Fix

- Apply the chosen conversion method consistently in the function.
- Add a short comment explaining why you used that conversion.

6. Validate the Fix

- Test the function with at least three scenarios:
    1. A numeric string input (e.g., "10")
    2. A numeric input (e.g., 7)
    3. A text input (e.g., "Hi")

7. Check Output Correctness

- Confirm that all tests produce the correct results without errors.
- Ensure the function behaves consistently across different inputs.

8. Document the Logic

- Write clear comments or a docstring describing input type expectations and output type.