Mini-Lesson 3: DeBugging

Alex Lan

Agenda

- Reading error messages
- De-Bugging Tips
- VS Code Debugger
- Appendix: Common Errors

Reading Error Messages

Traceback

- the sequence of function calls that led to the error.
- Start at the bottom: the last line usually gives the error type and description (e.g., `TypeError: unsupported operand type`)
- The lines above show you the “call stack” - the path your code took to get to the error (which line, which function)

Example

```
1 def calculate_total(value_1, value_2):
2     return value_1 + value_2
3
4 # This will cause the TypeError
5 result = calculate_total(10, "twenty")
6 print(result)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-1-7c15da5d3ecb> in <module>
      3
      4 # This will cause the TypeError
----> 5 result = calculate_total(10, "twenty")
      6 print(result)

<ipython-input-1-7c15da5d3ecb> in calculate_total(value_1, value_2)
      1 def calculate_total(value_1, value_2):
----> 2     return value_1 + value_2
      3
      4 # This will cause the TypeError
      5 result = calculate_total(10, "twenty")

TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

Debugging Techniques

Use ChatGPT

- Copy the full error message (traceback) - don’t just copy the last line
- Include relevant code context - show the function or code block where the error occurs
- Be specific about what you’re trying to do.
- Understand what ChatGPT suggests before using it. ChatGPT can be wrong.

Example prompt structure: “I’m getting this Python error: [paste error]. I’m trying to [describe goal]. Here’s my code: [paste relevant code].”

Print Statements

- Use `print()` to output variable states at different points in your code

```
1  def multiplier(a, b, c):
2    """
3    Multiply each variable by each other in order then sum
4    """
5    mult_1 = a * b
6    mult_2 = a ** c
7    mult_3 = b * c
8
9    return mult_1 + mult_2 + mult_3
10
11 print (multiplier(2, 3, 5))
```

```
53
```

That's wrong, we were expecting 6 + 10 + 15 = 21

Print Statements

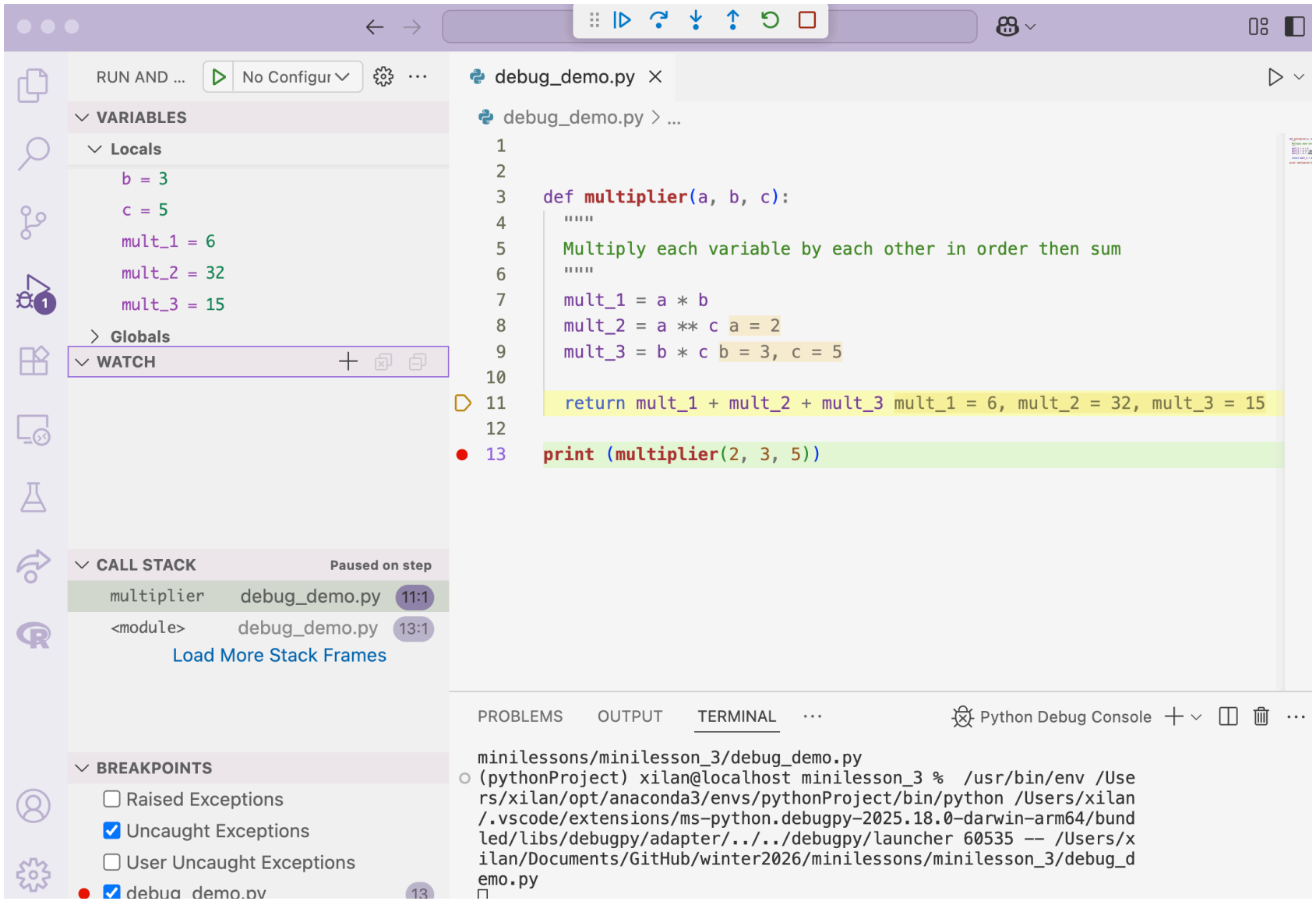
```
 1 def multiplier(a, b, c):
 2   """
 3   Multiply each variable by each other in order then sum
 4   """
 5   mult_1 = a * b
 6   print(f"mult_1 = {mult_1}")
 7   mult_2 = a ** c
 8   print(f"mult_2 = {mult_2}")
 9   mult_3 = b * c
10   print(f"mult_3 = {mult_3}")
11
12   return mult_1 + mult_2 + mult_3
13
14 print (multiplier(2, 3, 5))
```

```
mult_1 = 6
mult_2 = 32
mult_3 = 15
53
```

Looks like our issue is in mult_2

VS Code Debugger

Debugging with VScode



Key elements in the debugger

- Breakpoint (red dot): where the debugging execution will pause
- Debug icon (left sidebar): Click to open the debug panel
- Yellow line: Shows the next line to execute
- Debug controls (top arrows):
  - Step Over (arrow over dot): Execute current line
  - Step Into (arrow down): Go into function calls
  - Step Out (arrow up): Exit current function and continue

VS Code debugger: the workflow

1. Set a breakpoint: click the left margin next to a line number
2. Open Run and Debug: your code runs until it hits the breakpoint.
3. Step through execution: use the top debug controls.
4. Inspect state: check Variables / Watch / Call Stack
    - Variables: everything in the current scope
    - Watch: expressions you pin that update each time you step
    - Call Stack: how you got here (which functions were called)

Recap

- Read error messages (tracebacks)
  - Start at the bottom line for the error type + message
- Debugging techniques
  - Use ChatGPT effectively: paste the full traceback + relevant code + your goal
  - Use print statements to check intermediate values
- VS Code debugger
  - Set a breakpoint, Run and Debug, step through, inspect debug panel

Appendix: Common Python Errors

Syntax Error

- Missing closing parentheses, brackets, or quotes:

```
1 print("Hello World  # Incorrect
2 print("Hello World")  # Correct
```

```
  File "<ipython-input-4-5dae628a90fc>", line 1
    print("Hello World  # Incorrect
                                    ^
SyntaxError: EOL while scanning string literal
```

Indentation Error

- Indentation errors in loops or conditionals:

```
for i in range(5):
print(i)  # Incorrect: no indentation

for i in range(5):
    print(i)  # Correct
```

```
  File "<ipython-input-5-4b6f59675b9c>", line 2
    print(i)  # Incorrect: no indentation
    ^
IndentationError: expected an indented block
```

Logical Error: ‘and’ vs ‘&’ in element-wise comparisons:

```
1 df = pd.DataFrame({'A': [0, 1, 2], 'B': [5, 6, 7]})
2
3 df[(df['A'] > 1) and (df['B'] > 2)]  # Incorrect
4 df[(df['A'] > 1) & (df['B'] > 2)]  # Correct
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-7-9c42d3102bec> in <module>
      1 df = pd.DataFrame({'A': [0, 1, 2], 'B': [5, 6, 7]})
      2
----> 3 df[(df['A'] > 1) and (df['B'] > 2)]  # Incorrect
      4 df[(df['A'] > 1) & (df['B'] > 2)]  # Correct

~/opt/anaconda3/lib/python3.8/site-packages/pandas/core/generic.py in __nonzero__(s
   1327
   1328     def __nonzero__(self):
-> 1329         raise ValueError(
   1330             f"The truth value of a {type(self).__name__} is ambiguous. "
   1331             "Use a.empty, a.bool(), a.item(), a.any() or a.all()."

ValueError: The truth value of a Series is ambiguous. Use a.empty, a.bool(), a.item
```

AttributeError

- Using a wrong method (`.average()` on a DataFrame):

```
1 df['A'].average()  # Incorrect, should use df.mean()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-8-b52adb53a114> in <module>
----> 1 df['A'].average()  # Incorrect, should use df.mean()

~/opt/anaconda3/lib/python3.8/site-packages/pandas/core/generic.py in __getattr__(s
   5137             if self._info_axis._can_hold_identifiers_and_holds_name(name):
   5138                 return self[name]
-> 5139             return object.__getattribute__(self, name)
   5140
   5141     def __setattr__(self, name: str, value) -> None:

AttributeError: 'Series' object has no attribute 'average'
```

KeyError: access a column that doesn't exist

```
1 df['C']  # KeyError, C is not in the DataFrame
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
~/opt/anaconda3/lib/python3.8/site-packages/pandas/core/indexes/base.py in get_loc(
   2894             try:
-> 2895                 return self._engine.get_loc(casted_key)
   2896             except KeyError as err:

pandas/_libs/index.pyx in pandas._libs.index.IndexEngine.get_loc()

pandas/_libs/index.pyx in pandas._libs.index.IndexEngine.get_loc()

pandas/_libs/hashtable_class_helper.pxi in pandas._libs.hashtable.PyObjectHashTable

pandas/_libs/hashtable_class_helper.pxi in pandas._libs.hashtable.PyObjectHashTable

KeyError: 'C'

The above exception was the direct cause of the following exception:

KeyError                                  Traceback (most recent call last)
<ipython-input-9-3ae91f975e46> in <module>
```

```
----> 1 df['C']  # KeyError, C is not in the DataFrame

~/opt/anaconda3/lib/python3.8/site-packages/pandas/core/frame.py in __getitem__(sel
   2900             if self.columns.nlevels > 1:
   2901                 return self._getitem_multilevel(key)
-> 2902             indexer = self.columns.get_loc(key)
   2903             if is_integer(indexer):
   2904                 indexer = [indexer]

~/opt/anaconda3/lib/python3.8/site-packages/pandas/core/indexes/base.py in get_loc(
   2895                 return self._engine.get_loc(casted_key)
   2896             except KeyError as err:
-> 2897                 raise KeyError(key) from err
   2898
   2899         if tolerance is not None:

KeyError: 'C'
```

Quarto Rendering Errors

- For Quarto you must check the terminal for error messages

```
⊗ joaquinpinto@MacBook-Pro-4 minilesson4 % quarto render debugging_presentation.qmd

  Starting myenv kernel...Traceback (most recent call last):
    File "/Applications/quarto/share/jupyter/jupyter.py", line 21, in <module>
      from notebook import notebook_execute, RestartKernel
    File "/Applications/quarto/share/jupyter/notebook.py", line 15, in <module>
      from yaml import safe_load as parse_string
  ModuleNotFoundError: No module named 'yaml'
```