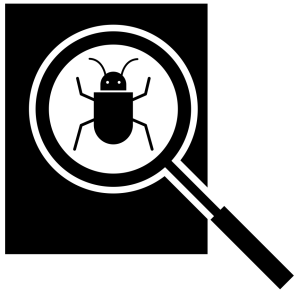
Debugging

ICS2O - Unit 2 - Lesson 6

When you write your code and something goes wrong, what do you do?

Programs don’t always run correctly.



Debugging is the process of finding the problems in your code and fixing them.

This process requires a LOT of Critical Thinking and problem solving. It takes a LOT of practice.

How do people feel about debugging?

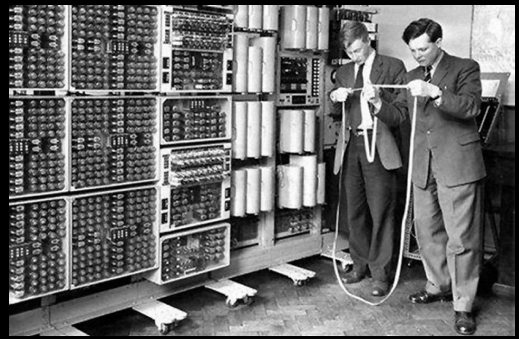
How do people feel about debugging?

How do people feel about debugging?

Why is it called “debugging”?

The origin of the word “Debugging” comes from the original computers which were so large that they took up entire rooms. In 1947 one computer at Harvard stopped working because a moth had flown in. People had to literally go inside the computer and clean it out or “debug” it.

But the word “Bug” actually has been used for a long time to describe problems in machines and bad things in general. Bugbear and Boogeyman are examples.

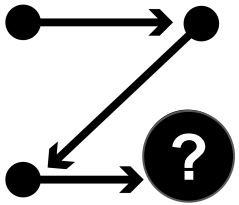


https://www.bbc.com/bitesize/articles/ztkx6sg

Three Types of Programming Errors

1. Syntax Errors

2. Runtime Errors



3. Semantic / Logic Errors

Syntax Errors

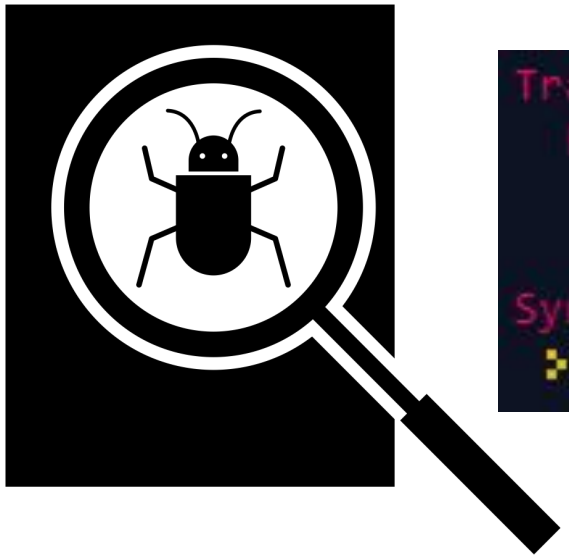
Like SPELLING errors in your code.

The compiler will check to make sure all the lines of code are in the correct language. If there is an error, it will not let the program run.

You MUST fix all the errors or remove those lines of code from your program before it will run.

#1 Solution

ALWAYS READ WHAT THE ERROR MESSAGE SAYS!



```
Traceback (most recent call last):
  File "python", line 4
    print("error"
                ^
SyntaxError: unexpected EOF while parsing
 >
```

The error will be usually either be on that line or on the line BEFORE it.

Common Syntax Errors

Forgot a colon “ : ”

Using = instead of == for conditionals or assignment

Forgot a (or a)

Indentation is wrong (Python Only)

A list of common syntax errors: (they call them runtime errors but that is not accurate)
https://inventwithpython.com/blog/2012/07/09/16-common-python-runtime-errors-beginners-find/

Syntax Error

```
1  print("this")
2  print("is")
3  print("an")
4  print("error"
```

```
[GCC 4.8.2] on linux
>
Traceback (most recent call last):
  File "python", line 4
    print("error"
                 ^
SyntaxError: unexpected EOF while parsing
>
```

Solution

Just add the missing)

Syntax Error - Example 1

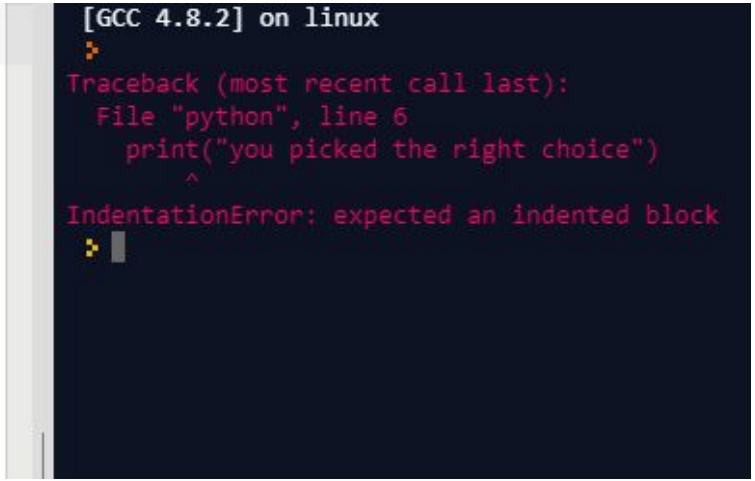
https://repl.it/@LanzSingbeil/ICS2O-DebuggingSample1

Solution

Syntax Error - Example 2

IndentationError: expected an indented block

```
1  myChoice = input("Do you go left or
   right?")
2  if myChoice == "left":
3    print("hmmm...")
4
5    if myChoice == "right":
6    print("you picked the right choice")
```



https://repl.it/@LanzSingbeil/ICS2O-Debugging-UnexpectedIndentedBlock

Solution

Unindent the second “if” and change it to elif.

Runtime Errors

Like GRAMMAR errors in your code.

If something stops working AFTER the code is run, that is called a runtime error.

The program will stop immediately.

The compiler only checks to make sure that all lines of code are written in the correct language. It won’t check that all the lines actually make SENSE.

Common Runtime Errors

NAME ERROR: _____ is not defined.

Misspelling the name of a variable will cause this problem if you try to use it later on.

TYPE ERRORS for example: “can’t concatenate str to int”

Runtime Errors Example 1

https://repl.it/@LanzSingbeil/ICS2O-DebuggingSample-RuntimeErrors-2

Solution?

Change the variable name

Use str() to fix the concatenation or use ,

Solutions

1. READ WHAT THE ERROR SAYS
2. Go back and see if you can find the problem.
3. If you CAN'T find it right away, try to comment out parts of the code that you think might be broken and try running again.

    a. See the BLOCK COMMENTING TRICK on the next slide

4. You can use this technique to "narrow in" on the area that isn't working correctly.

The Block Commenting Trick

Comment out all selected lines

Arrays Examples.py - D:\lanzs\Desktop\ICS2O\Unit 3 - Python (advanced)\Arrays Examples.py (3.7.0)

File Edit Format Run Options Window Help

```
olymp                Canada", "Malaysia", "E
print                s[0])
print                s[1])
print                s[2])
print                s[3])
print                s[4])
print                s[5])
```

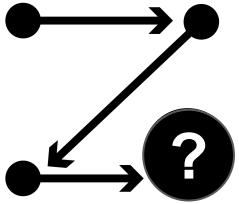
Indent Region	Ctrl+]
Dedent Region	Ctrl+[
Comment Out Region	Alt+3
Uncomment Region	Alt+4
Tabify Region	Alt+5
Untabify Region	Alt+6
Toggle Tabs	Alt+T
New Indent Width	Alt+U
Format Paragraph	Alt+Q
Strip Trailing Whitespace	

```
print(olympicCountries[6])


print(len(olympicCountries))

for x in olympicCountries:
  print(x)


length = len(olympicCountries)
```

Arrays Examples.py - D:\lanzs\Desktop\ICS2O\Unit 3 - Python (advanced)\Arrays Examples.py (3.7.0)

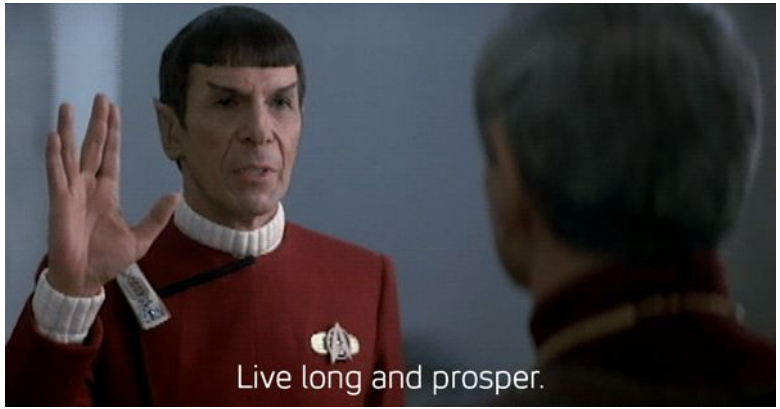
File Edit Format Run Options Window Help

```
olympicCountries = ["Canada", "Malaysia", "Brit
print(olympicCountries[0])
print(olympicCountries[1])
print(olympicCountries[2])
print(olympicCountries[3])
print(olympicCountries[4])
print(olympicCountries[5])


##print(olympicCountries[6])
##
##
##print(len(olympicCountries))
##
##for x in olympicCountries:
##  print(x)
##
##
##length = len(olympicCountries)
```



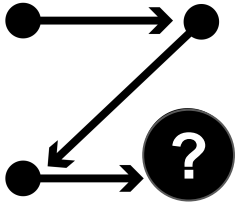
Semantic (Logic) Errors

Like writing the wrong answer. It makes sense but it isn't answering the question.



Programs are only as good as the humans who code them. They will do EXACTLY what you tell them to do.

The problem is, we often tell them to do the wrong thing!



Common Semantic Errors

Each program has its own challenges and each person writes their code differently. There are millions of different possible logical errors that might happen.

But Some Common General Things to Look Out For:

- Indentation in Python is incorrect
- Parts of the code being skipped (wrong conditions checked)
- Variables not changing values at the right times
- Functions that you forget to return a value
- Infinite Loops

But finding these errors can be very tricky!

Solutions

“Tracing” check the values of variables at different points in your program.

Simply add print statements into your program at different points. You can delete these statements later after the problems are fixed.

Scenarios

1. You've programmed a toy car to drive around a map, but when it reaches a house the car continues to drive through it! Does your program have a syntax error or a logical error?

1. You've set up a math program. It seems to run OK but when the teacher types in a letter instead of a number, the program crashes. What kind of error is this?