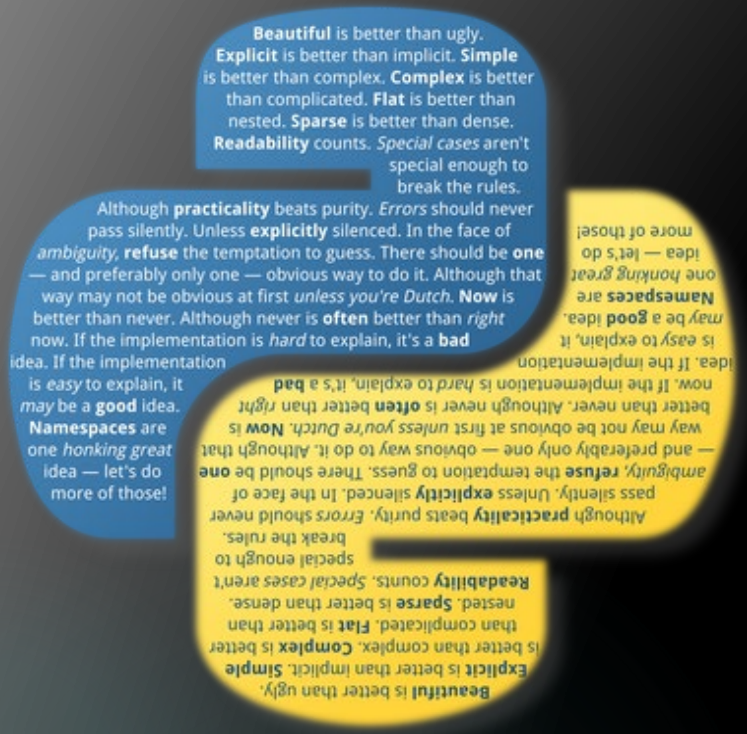
IS612 Introduction To Coding
Spring 2022

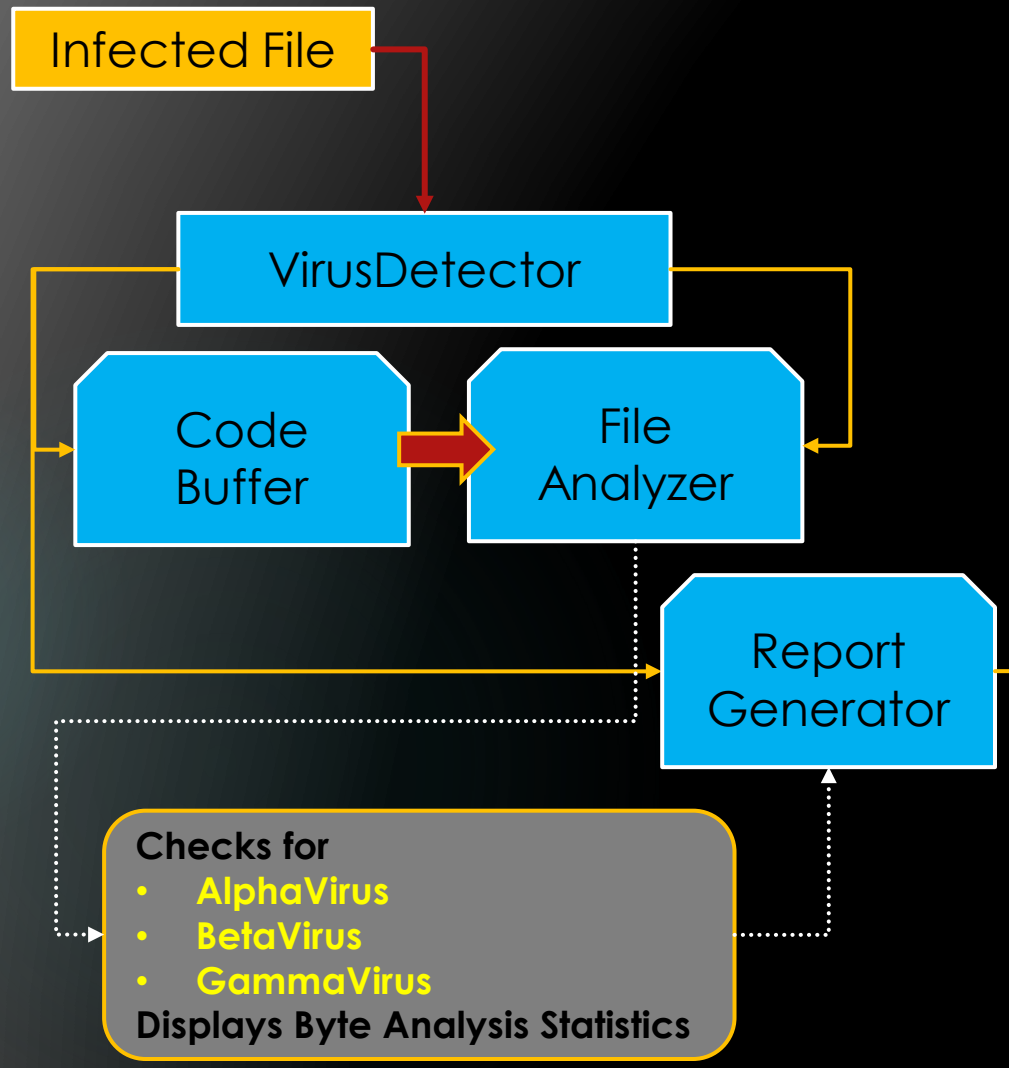
OOP



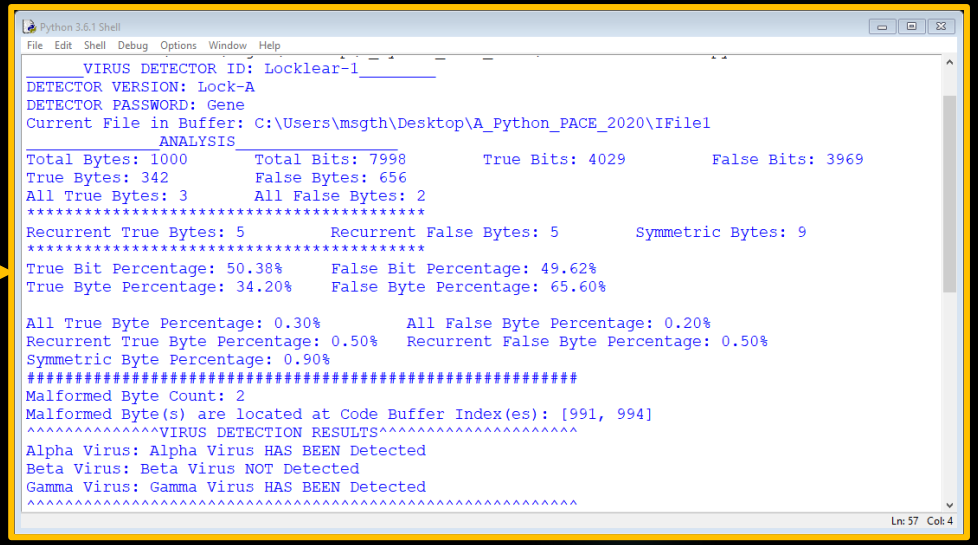
CEX 5

OOP AND FILE IO

General



- Our task is to create a VirusDetector object that can read binary files and determine if they contain a specified type(s) of computer virus.
- The VirusDetector object reads the binary file and transfers the file to the Code Buffer of the VirusDetector object.
- Once the file is in the Code Buffer, the VirusDetector object analyzes the binary code.
- The analysis creates a report about the binary code and whether the specified viruses have been detected.



General

- The **bit** is a basic unit of information in computing.
  - A bit is either a '1' or a '0'
  - A '1' bit is considered True and a '0' bit is considered False.
- The **byte** is a unit of digital information which consists of eight bits and is the smallest addressable unit of memory in computer architectures.
- A **malformed byte** is any byte that contains less than 8 bits…it is not considered to be a True or a False byte.
- A byte can be:
  - **All True Byte**: a byte in which all bits are True bits…11111111
  - **All False Byte**: a byte in which all bits are False bits … 00000000
  - **True Byte**: any byte in which there are more True bits than False bits…10111010
  - **False Byte**: any byte in which there are the same number or more False bits than True bits… 00101100
  - **Recurrent True Byte**: any byte containing an alternating sequence of True then False bits …10101010
  - **Recurrent False Byte**: any byte containing an alternating sequence of False then True bits…01010101
  - **Symetric Byte**: any byte containing 4 all True bits and 4 all False bits in consecutive order… 11110000 or 00001111
- Bits and bytes are not numbers and therefore are represented as strings in programming …'10101010'

Virus Identification

AlphaVirus

- A binary file contains the **Alpha Virus** if any of the following conditions are true:
  - C1: The are more than 6 Recurrent True Bytes in the file.
  - C2: There are no '0' bits in any single byte in the file.
  - C3: There are more than 4 All True Bytes in the file.
  - C4: The total number of bits in the file is evenly divisible by 6
- A binary file does not contain the **Alpha Virus** if it has no malformed bytes.

BetaVirus

- A binary file contains the **Beta Virus** if any of the following conditions are true:
  - C1: The are no Recurrent True Bytes in the file.
  - C2: There are no '1' bits in any single byte in the file.
  - C3: There are more than 4 Symmetric Bytes in the file.
  - C4: The total number of bits in the file is evenly divisible by 3.
- A binary file does not contain the **Beta Virus** if has less than 6 malformed bytes.

GammaVirus

- A binary file contains the **Gamma Virus** if any of the following conditions are true:
  - C1: The are exactly 8 Recurrent False Bytes in the file.
  - C2: There is a Malformed Byte in the file.
  - C3: There are no Recurrent True or Symmetric Bytes in the file.
  - C4: The number or True bytes is more than 8% greater than the number of False Bytes

VirusDetector	
-detectorID: String -detectorVersion: String -detectorPassword: String -analyzedFile: String -codeBuffer: List(String) +static detectorCount: int	
+displayDetectorInfo() +readFileToCodeBuffer() +flushCodeBuffer() +analyzeCodeBuffer() +countTotalBytes() +countTotalBits() +countFalseBits() +countTrueBytes() +countFalseBytes() +countAllTrueBytes() +countAllFalseBytes() +countRecurrentTrueBytes() +countRecurrentFalseBytes()	+countSymmetricBytes() +checkForMalformedByte() +checkBit (String b) +detectAlphaVirus() +detectBetaVirus() +detectGammaVirus() + static displayDetectorCodeBuffer (VirusDetector vd)

The **constructor** for the **VirusDetector** class **must have** the following signature:

```
def __init__(self,detectorID,detectorVersion,detectorPassword):
```

The constructor increments **detectorCount** by 1 after each object is created

Instance Method Specifications

Method	Method Type	Input	Processing	Output
displayDetectorInfo	Instance	None	prints the version and password of this VirusDetector object formatted as shown on slide 10	void…formatted output
readFileToCodeBuffer	Instance	None	reads a binary file into the codeBuffer of this VirusDetector object and sets the analyzedFile attribute to the filepath of the binary file	void
flushCodeBuffer	Instance	None	deletes the contents of the codeBuffer of this VirusDetector object	void
analyzeCodeBuffer	Instance	None	reads the codeBuffer of this VirusDetector object and displays the information as shown on slide 12	void…formatted output
countTotalBytes	Instance	None	counts the total number of bytes in the codeBuffer of this VirusDetector object	int…byte count
countTotalBits	Instance	None	counts the total number of bits in the codeBuffer of this VirusDetector object	int…bit count
countTrueBits	Instance	None	counts the total number of True bits in the codeBuffer of this VirusDetector object	int…True bit count
countFalseBits	Instance	None	counts the total number of False bits in the codeBuffer of this VirusDetector object	int…False bit count
countTrueBytes	Instance	None	counts the total number of True bytes in the codeBuffer of this VirusDetector object	int…True byte count
countFalseBytes	Instance	None	counts the total number of False bytes in the codeBuffer of this VirusDetector object	int…False byte count
countAllTrueBytes	Instance	None	counts the total number of All True bytes in the codeBuffer of this VirusDetector object	int…All True byte count
countAllFalseBytes	Instance	None	counts the total number of All False bytes in the codeBuffer of this VirusDetector object	int…All False byte count

Instance Method Specifications

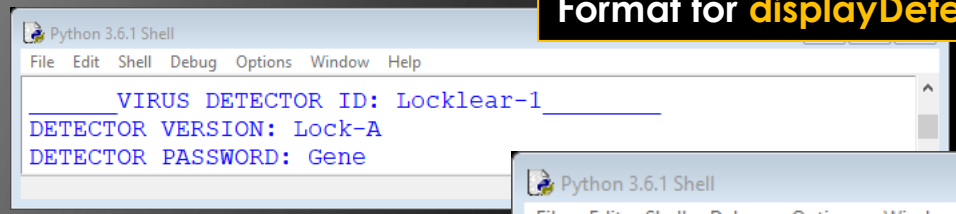
Method	Method Type	Input	Processing	Output
countRecurrentTrueBytes	Instance	None	counts the total number of Recurrent True bytes in the codeBuffer of this VirusDetector object	int…Recurrent True byte count
countRecurrentFalseBytes	Instance	None	counts the total number of Recurrent False bytes in the codeBuffer of this VirusDetector object	int…Recurrent False byte count
countSymmetricBytes	Instance	None	counts the total number of Symmetric bytes in the codeBuffer of this VirusDetector object	int…Symmetric byte count
checkForMalformedByte	Instance	None	determines the number (count) of malformed bytes as well as the index in the codeBuffer of each malformed byte	tuple of length 2 0 Index contains the number of malformed bytes and the 1 index contains a list of the indexes of each malformed byte
checkTrueBit	Instance	Bit	determines if a bit is true	boolean…True if a bit is a '1' and False otherwise
detectAlphaVirus	Instance	None	determines if the file in the codeBuffer of this VirusDetector object contains the Alpha Virus (see slide 5)	boolean…True if the virus is present and False otherwise
detectBetaVirus	Instance	None	determines if the file in the codeBuffer of this VirusDetector object contains the Beta Virus (see slide 5)	boolean…True if the virus is present and False otherwise
detectGammaVirus	Instance	None	determines if the file in the codeBuffer of this VirusDetector object contains the Gamma Virus (see slide 5)	boolean…True if the virus is present and False otherwise

Static Method Specifications

Method	Method Type	Input	Processing	Output
displayDetectorCodeBuffer	Static	VirusDetector object	prints the contents of the codeBuffer of the specified VirusDetector object	void…codeBuffer contents

Formatted Output

Format for displayDetectorInfo



Virus Detector Info

Filepath of infected file

Bytes and Bit Counts

Bytes Percentages

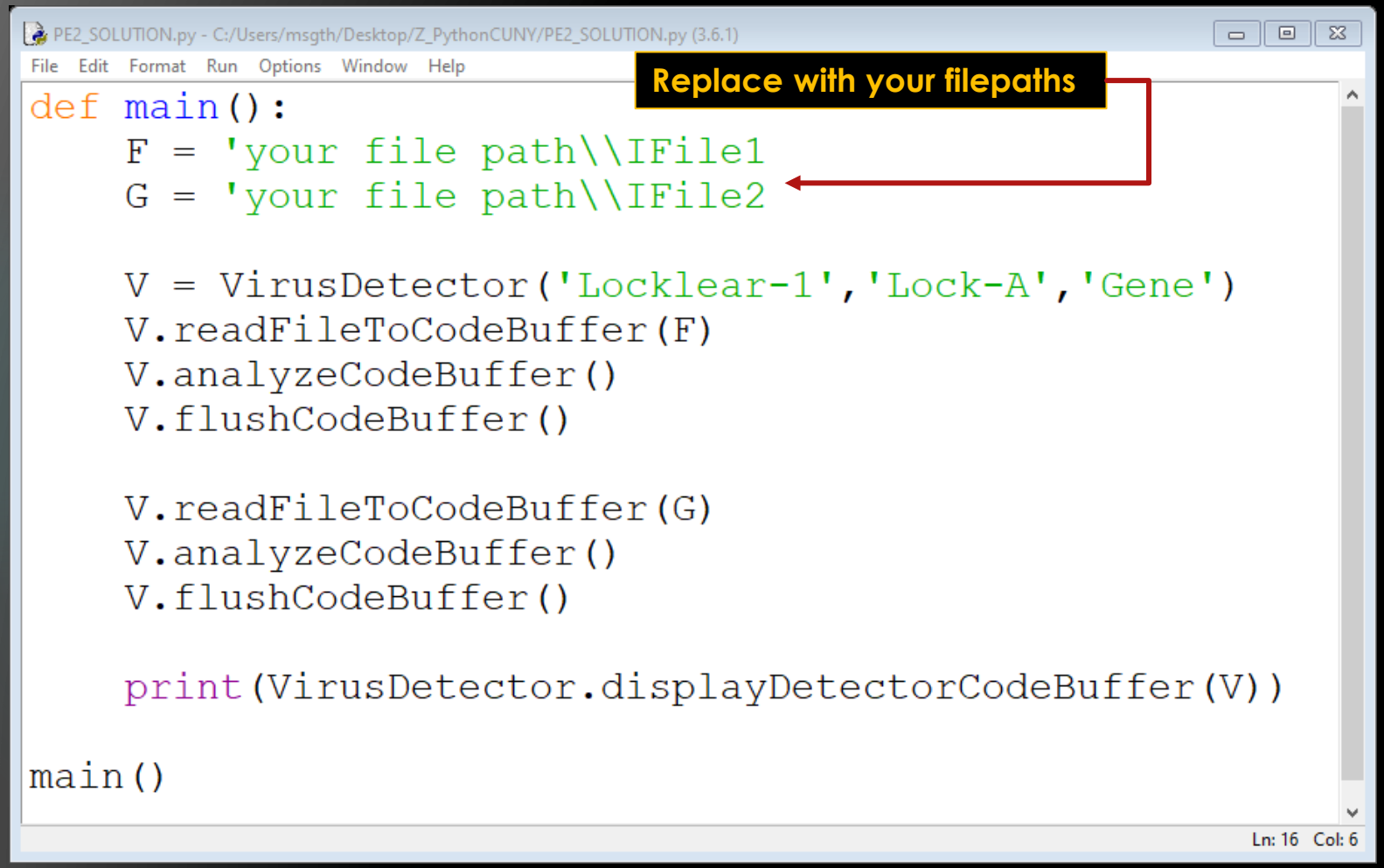
Malformed Byte count and indexes

Virus Detection Results

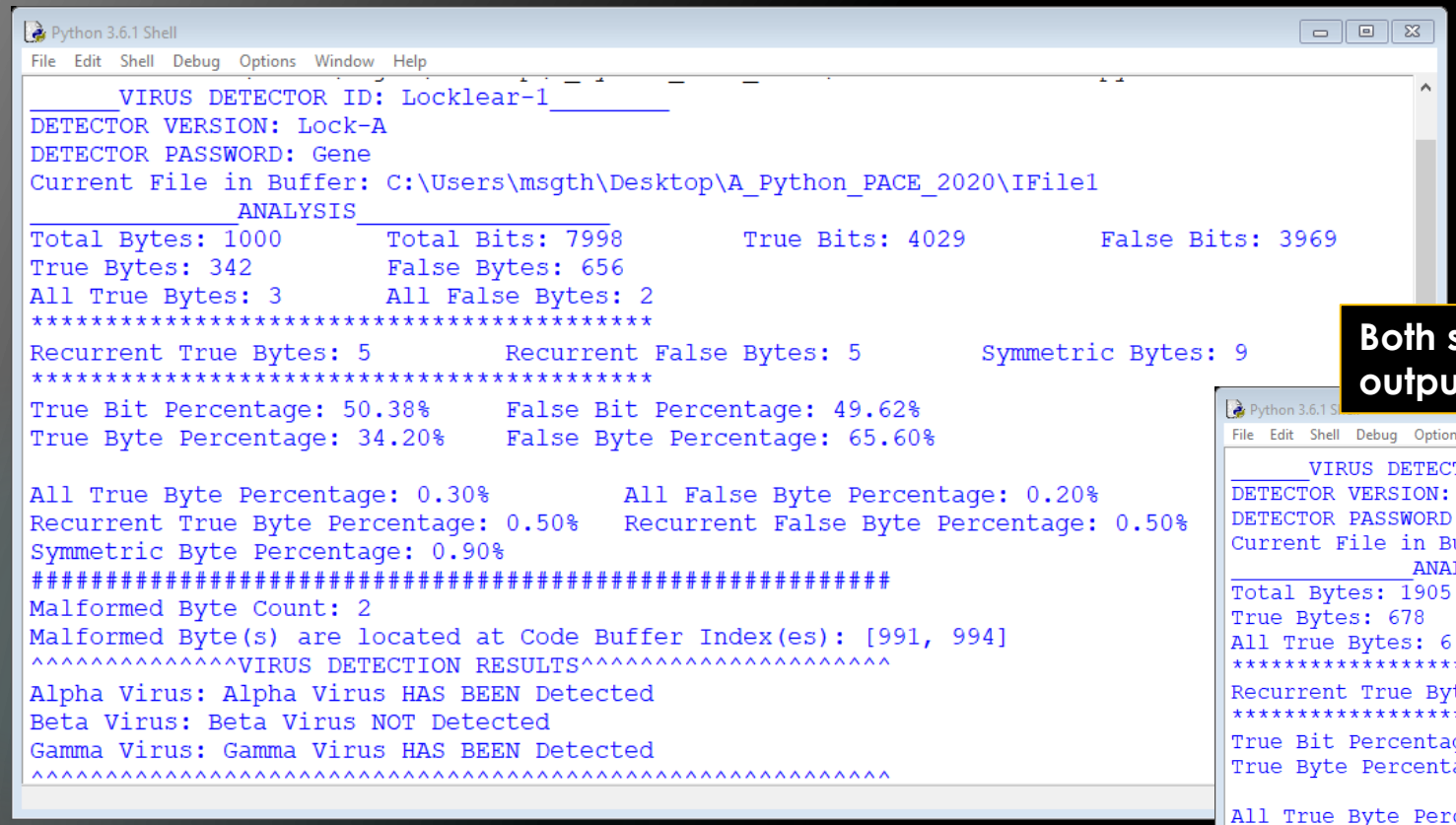
```
Python 3.6.1 Shell
File Edit Shell Debug Options Window Help
_____VIRUS DETECTOR ID: Locklear-1_____
DETECTOR VERSION: Lock-A
DETECTOR PASSWORD: Gene
Current File in Buffer: C:\Users\msgth\Desktop\A_Python_PACE_2020\IFile1
_____________ANALYSIS_____________________
Total Bytes: 1000       Total Bits: 7998        True Bits: 4029         False Bits: 3969
True Bytes: 342         False Bytes: 656
All True Bytes: 3       All False Bytes: 2
*****************************************
Recurrent True Bytes: 5         Recurrent False Bytes: 5        Symmetric Bytes: 9
*****************************************
True Bit Percentage: 50.38%     False Bit Percentage: 49.62%
True Byte Percentage: 34.20%    False Byte Percentage: 65.60%

All True Byte Percentage: 0.30%         All False Byte Percentage: 0.20%
Recurrent True Byte Percentage: 0.50%   Recurrent False Byte Percentage: 0.50%
Symmetric Byte Percentage: 0.90%
#########################################################
Malformed Byte Count: 2
Malformed Byte(s) are located at Code Buffer Index(es): [991, 994]
^^^^^^^^^^^^^^^VIRUS DETECTION RESULTS^^^^^^^^^^^^^^^^^^^^^
Alpha Virus: Alpha Virus HAS BEEN Detected
Beta Virus: Beta Virus NOT Detected
Gamma Virus: Gamma Virus HAS BEEN Detected
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
                                                    Ln: 57  Col: 4
```

Testing and Expected Output

- Define a main method in your script and include the code exactly as shown below.



Testing and Expected Output Format



Both screenshots show the combined formatted output of running the script