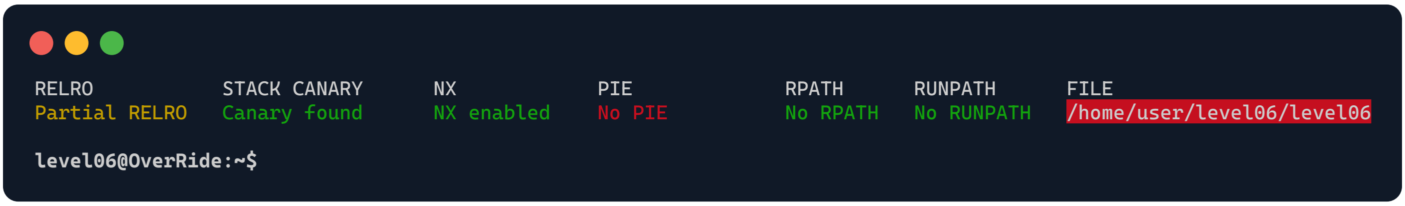
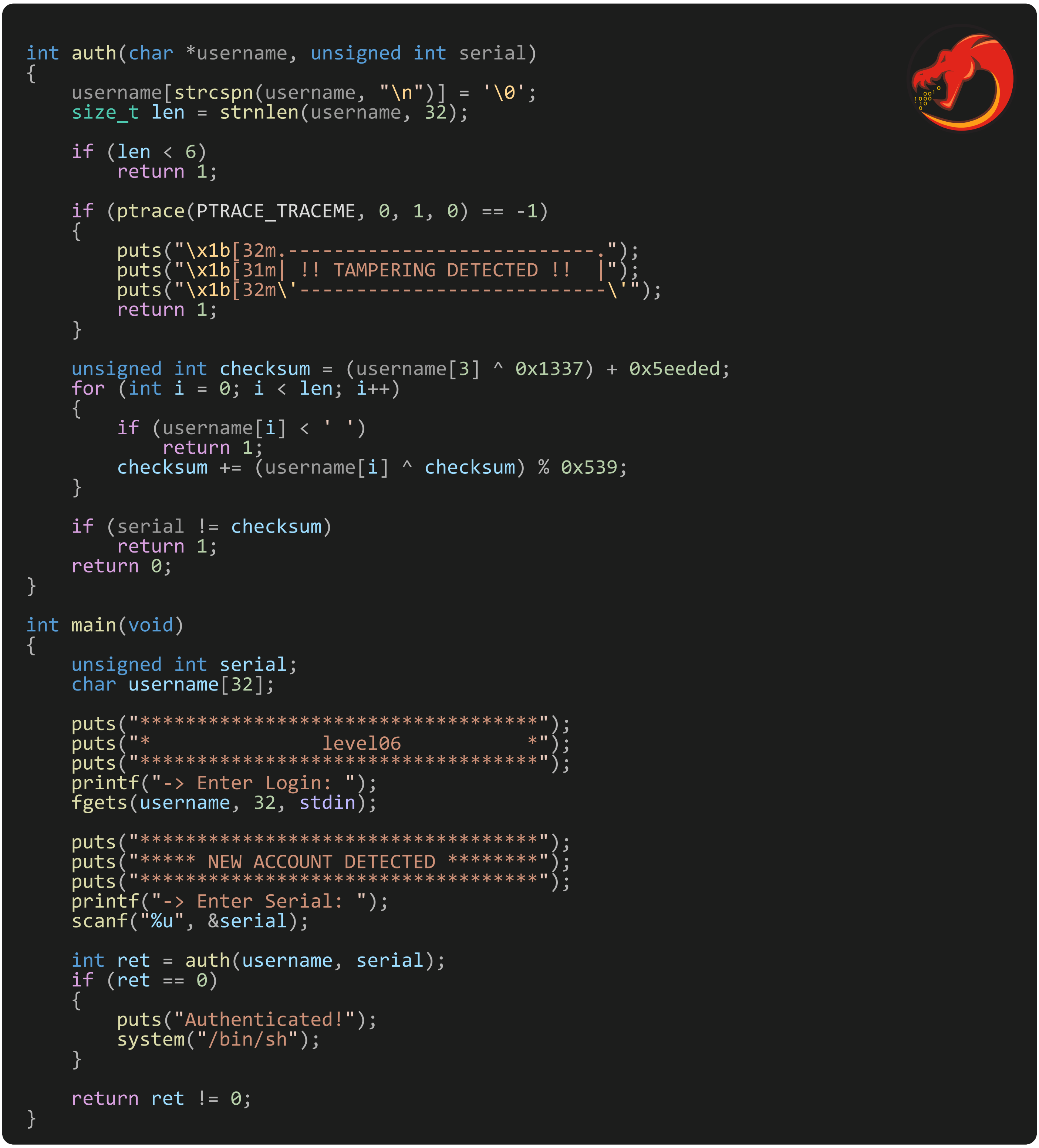
./level06



```
RELRO           STACK CANARY     NX            PIE             RPATH      RUNPATH      FILE
Partial RELRO   Canary found     NX enabled    No PIE          No RPATH   No RUNPATH   /home/user/level06/level06

level06@OverRide:~$
```

Decompiled file with ***Ghidra***:



```c
int auth(char *username, unsigned int serial)
{
    username[strcspn(username, "\n")] = '\0';
    size_t len = strnlen(username, 32);

    if (len < 6)
        return 1;

    if (ptrace(PTRACE_TRACEME, 0, 1, 0) == -1)
    {
        puts("\x1b[32m.---------------------------.");
        puts("\x1b[31m| !! TAMPERING DETECTED !!  |");
        puts("\x1b[32m\'---------------------------\'");
        return 1;
    }

    unsigned int checksum = (username[3] ^ 0x1337) + 0x5eeded;
    for (int i = 0; i < len; i++)
    {
        if (username[i] < ' ')
            return 1;
        checksum += (username[i] ^ checksum) % 0x539;
    }

    if (serial != checksum)
        return 1;
    return 0;
}

int main(void)
{
    unsigned int serial;
    char username[32];

    puts("***********************************");
    puts("*               level06           *");
    puts("***********************************");
    printf("-> Enter Login: ");
    fgets(username, 32, stdin);

    puts("***********************************");
    puts("***** NEW ACCOUNT DETECTED ********");
    puts("***********************************");
    printf("-> Enter Serial: ");
    scanf("%u", &serial);

    int ret = auth(username, serial);
    if (ret == 0)
    {
        puts("Authenticated!");
        system("/bin/sh");
    }

    return ret != 0;
}
```

./level06^{2}

This **program** is designed as a simple authentication system that uses a **username** and a **serial number** to validate a user and then attempts to authenticate them based on certain criteria:

Firstly, the program removes any newline character from the end of the **username** and checks that it is at least six characters long. If the **username** is too short, the **authentication** fails.

Next, the program uses the **ptrace** system call with the PTRACE_TRACEME flag. This is a common way to detect if a program is being debugged; if it is, the program prints a tampering detection message and fails the authentication.

For the actual authentication, the program calculates a **checksum** from the **username**.
The program initializes a checksum by **XOR**-ing the third character of the username with 0x1337 and adding 0x5eeded to it. It then iterates over each character in the **username**, confirming it's printable, and for each character, it **XOR**s it with the **checksum**, takes the result modulo 0x539, and adds it to the checksum.

The **authentication** is successful if the final **checksum** matches the **serial number** provided by the user, at which point the program acknowledges the successful login and grants **shell** access.

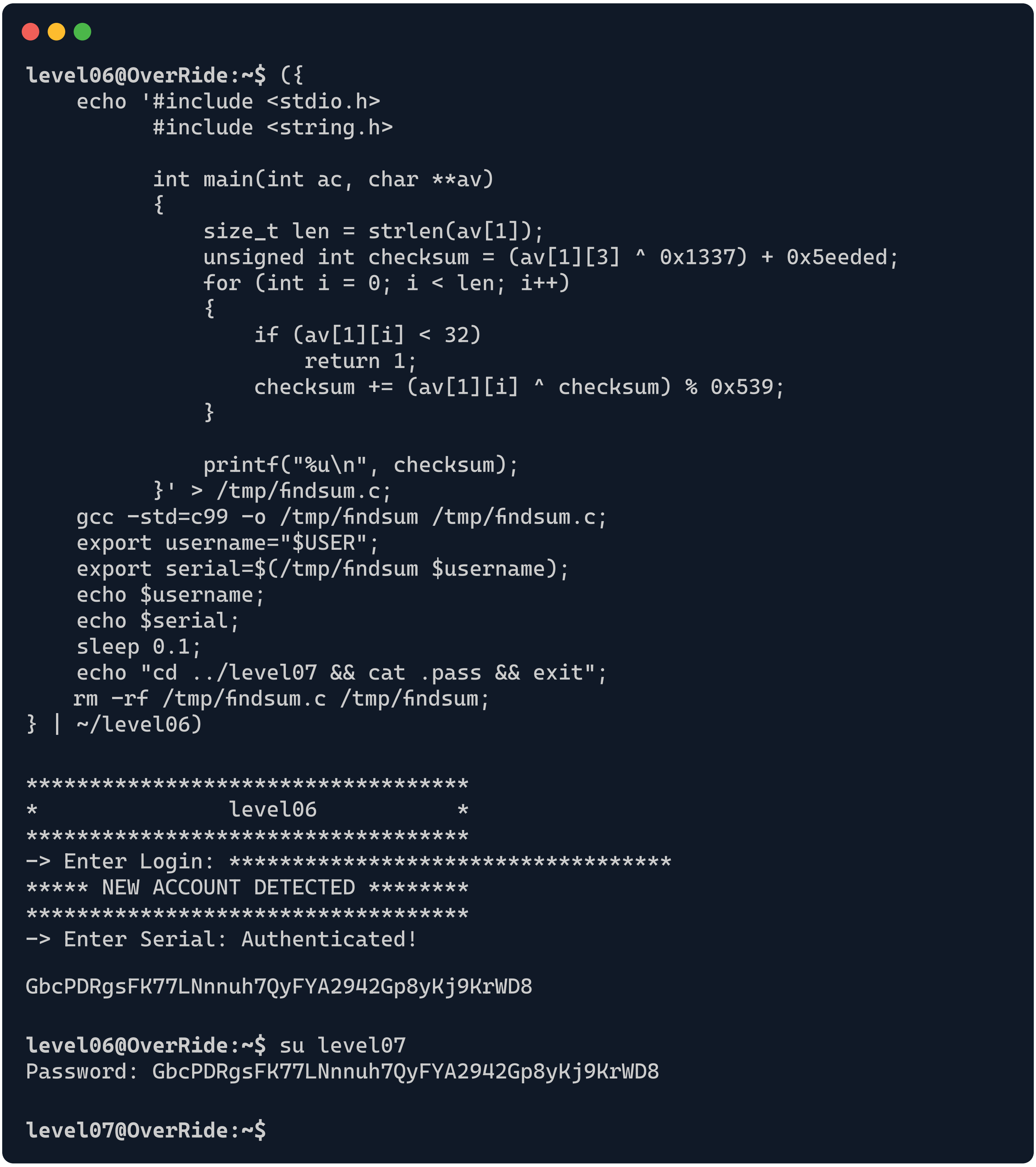
To crack this program, we simply need to **replicate** the checksum calculation using a chosen **username** to generate a matching **serial number** for **authentication**:

```c
#include <stdio.h>
#include <string.h>

int main(int ac, char **av)
{
    size_t len = strlen(av[1]);
    unsigned int checksum = (av[1][3] ^ 0x1337) + 0x5eeded;
    for (int i = 0; i < len; i++)
    {
        if (av[1][i] < ' ')
            return 1;
        checksum += (av[1][i] ^ checksum) % 0x539;
    }

    printf("%u\n", checksum);
}
```

./level06[3]



```
level06@OverRide:~$ ({
    echo '#include <stdio.h>
          #include <string.h>

          int main(int ac, char **av)
          {
              size_t len = strlen(av[1]);
              unsigned int checksum = (av[1][3] ^ 0x1337) + 0x5eeded;
              for (int i = 0; i < len; i++)
              {
                  if (av[1][i] < 32)
                      return 1;
                  checksum += (av[1][i] ^ checksum) % 0x539;
              }

              printf("%u\n", checksum);
          }' > /tmp/findsum.c;
    gcc -std=c99 -o /tmp/findsum /tmp/findsum.c;
    export username="$USER";
    export serial=$(/tmp/findsum $username);
    echo $username;
    echo $serial;
    sleep 0.1;
    echo "cd ../level07 && cat .pass && exit";
    rm -rf /tmp/findsum.c /tmp/findsum;
} | ~/level06)

***********************************
*                level06          *
***********************************
-> Enter Login: ***********************************
***** NEW ACCOUNT DETECTED ********
***********************************
-> Enter Serial: Authenticated!

GbcPDRgsFK77LNnnuh7QyFYA2942Gp8yKj9KrWD8

level06@OverRide:~$ su level07
Password: GbcPDRgsFK77LNnnuh7QyFYA2942Gp8yKj9KrWD8

level07@OverRide:~$
```