PSP0201
Week 5
Writeup

Group Name: Undecided

Members

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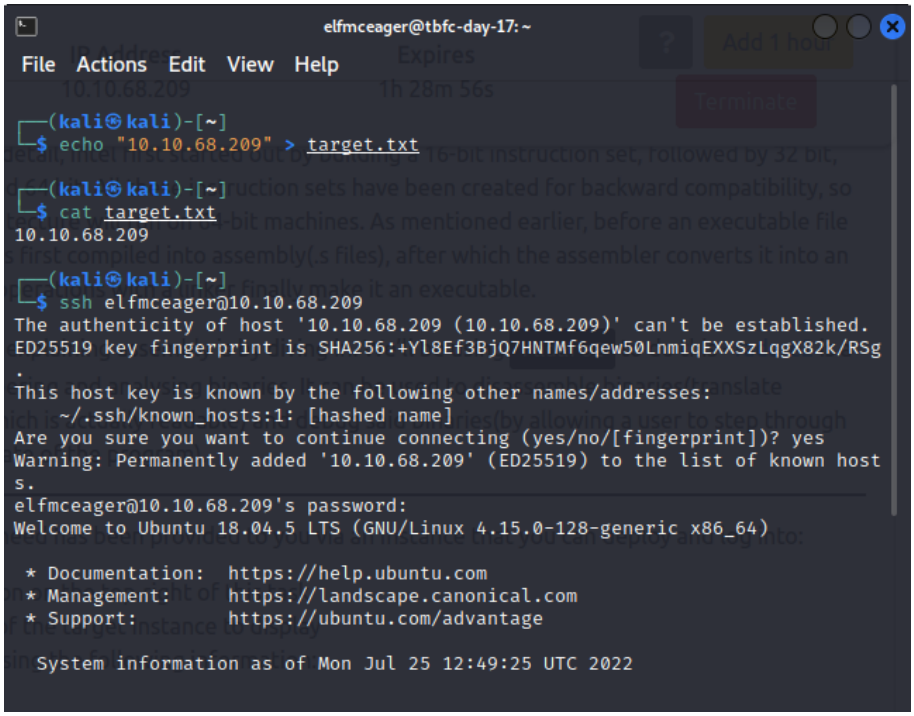
Day 17: Reverse Engineering – ReverseELFneering

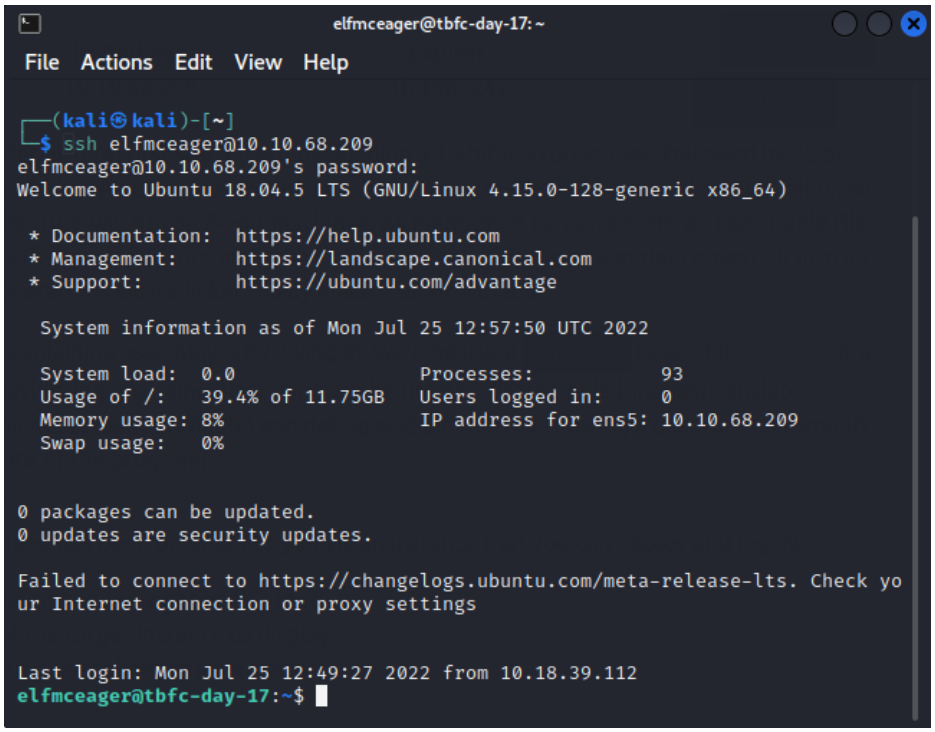
Tools used: Attackbox, Firefox, Virtualbox

Solution/walkthrough:

Question 1

View the pdf@main and print the code that is in the sim.main





```
[0×00400a30]> pdf@main
            ;-- main:
/ (fcn) sym.main 68
|   sym.main ();
|           ; var int local_ch @ rbp-0×c
|           ; var int local_8h @ rbp-0×8
|           ; var int local_4h @ rbp-0×4
|              ; DATA XREF from 0×00400a4d (entry0)
|           0×00400b4d      55              push rbp
|           0×00400b4e      4889e5          mov rbp, rsp
|           0×00400b51      4883ec10        sub rsp, 0×10
|           0×00400b55      c745f4040000.   mov dword [local_ch], 4
|           0×00400b5c      c745f8050000.   mov dword [local_8h], 5
|           0×00400b63      8b55f4          mov edx, dword [local_ch]
|           0×00400b66      8b45f8          mov eax, dword [local_8h]
|           0×00400b69      01d0            add eax, edx
|           0×00400b6b      8945fc          mov dword [local_4h], eax
|           0×00400b6e      8b4dfc          mov ecx, dword [local_4h]
|           0×00400b71      8b55f8          mov edx, dword [local_8h]
|           0×00400b74      8b45f4          mov eax, dword [local_ch]
|           0×00400b77      89c6            mov esi, eax
|           0×00400b79      488d3d881409.   lea rdi, qword str.the_value_of_a_
is__d__the_value_of_b_is__d_and_the_value_of_c_is__d ; 0×492008 ; "the value
of a is %d, the value of b is %d and the value of c is %d"
|           0×00400b80      b800000000      mov eax, 0
|           0×00400b85      e8f6ea0000      call sym.__printf
|           0×00400b8a      b800000000      mov eax, 0
|           0×00400b8f      c9              leave
\           0×00400b90      c3              ret
[0×00400a30]>
```

```
1 2 3 4   98% 01:29 PM
elfmceager@tbfc-day-17: ~
File Actions Edit View Help
0 updates are security updates.

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check yo
ur Internet connection or proxy settings


Last login: Mon Jul 25 12:49:27 2022 from 10.18.39.112
elfmceager@tbfc-day-17:~$ challenge1 file1
challenge1: command not found
elfmceager@tbfc-day-17:~$ r2 -d ./file1
Process with PID 1730 started...
= attach 1730 1730
bin.baddr 0×00400000
Using 0×400000
Warning: Cannot initialize dynamic strings
asm.bits 64
[0×00400a30]> aa
[ ] Analyze all flags starting with sym. and entry0 (aa)
 WARNING : block size exceeding max block size at 0×006ba220
[+] Try changing it with e anal.bb.maxsize
 WARNING : block size exceeding max block size at 0×006bc860
[+] Try changing it with e anal.bb.maxsize
r2 -d /file1


[x] Analyze all flags starting with sym. and entry0 (aa)
Could not execvp: No such file or directory
[w] Cannot open 'dbg:///file1' for writing.
[0×00400a30]> pdf@main
            ;-- main:
/ (fcn) sym.main 68
|   sym.main ();
|           ; var int local_ch @ rbp-0×c
|           ; var int local_8h @ rbp-0×8
|           ; var int local_4h @ rbp-0×4
|              ; DATA XREF from 0×00400a4d (entry0)
|           0×00400b4d      55              push rbp
|           0×00400b4e      4889e5          mov rbp, rsp
|           0×00400b51      4883ec10        sub rsp, 0×10
```

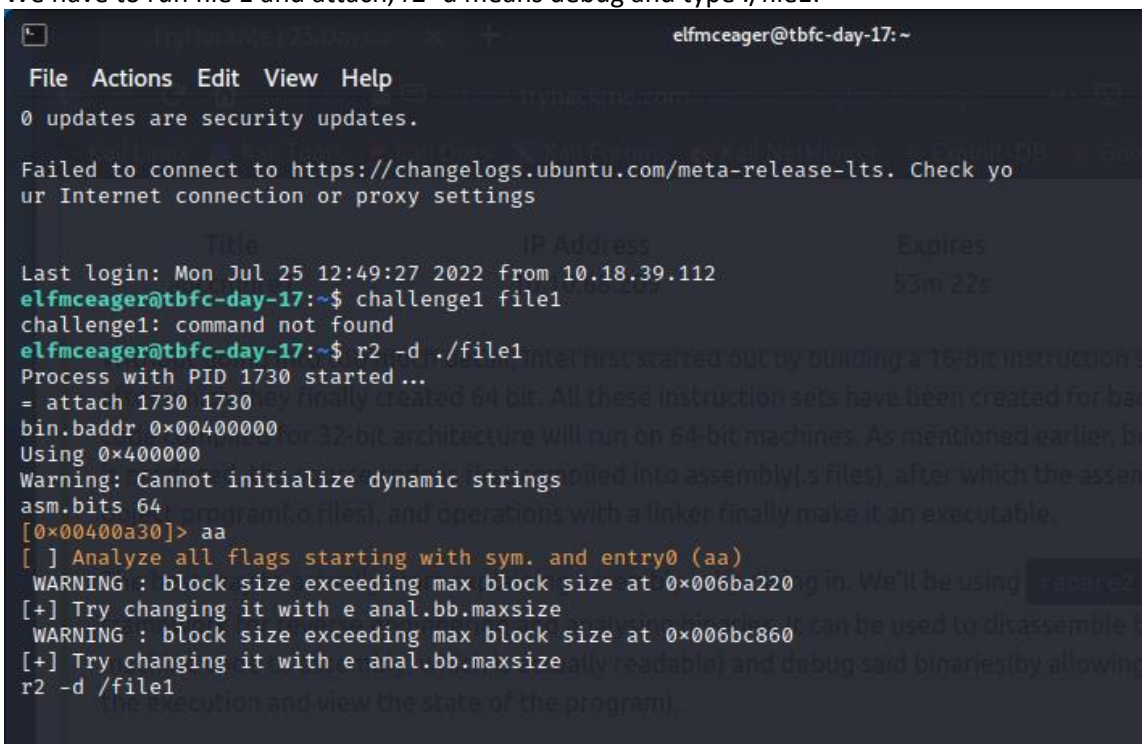
A register is a workbench where we can work on task one at a time where we can restore its value. We will have a register that will hold the value of local ch and another folder that hold the local 8h.

We have to perform mathematical functions on the two registers and it will overwrite the source register with the result.

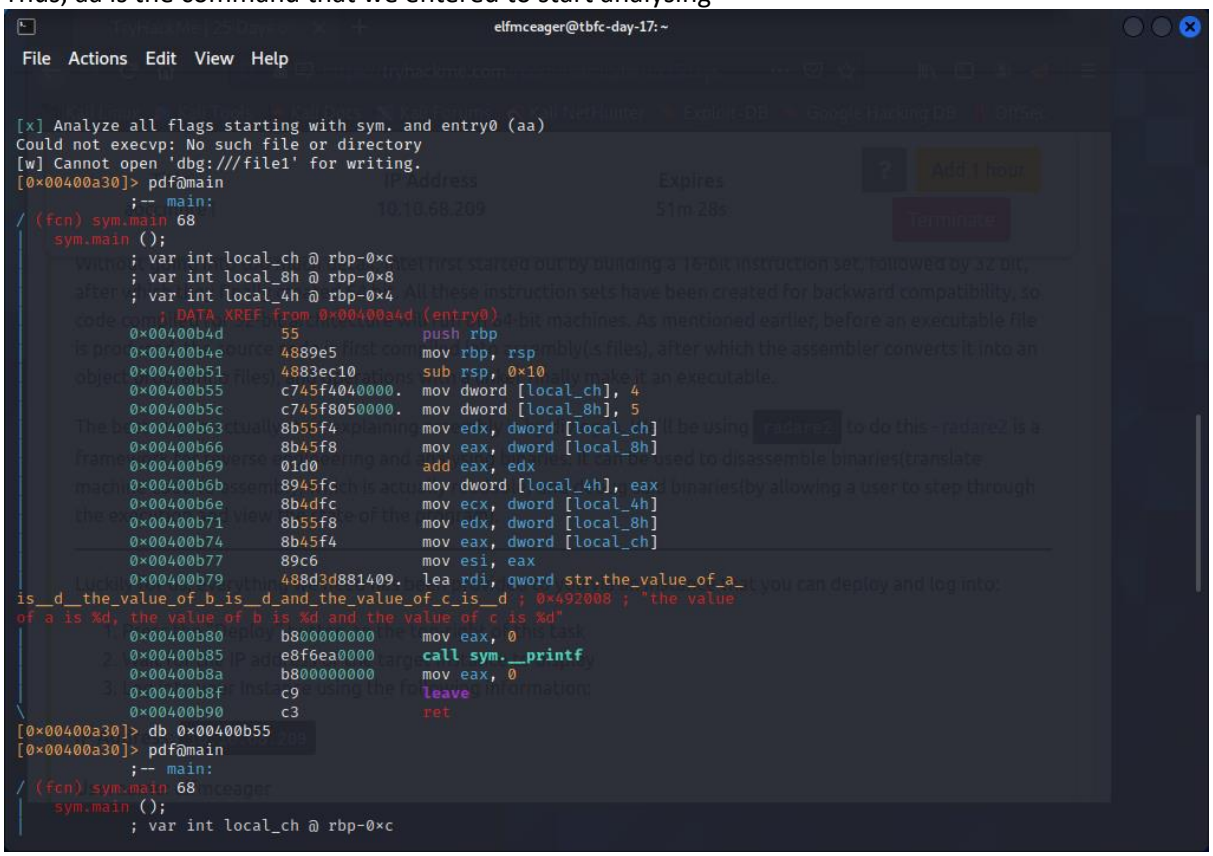
Therefore, the data type that were matched with the size in bytes is byte = 1, Word = 2, Double Word = 4, Quad = 8, Single Precision = 4, Double Precision = 8

Question 2

We have to run file 1 and attach, r2 -d means debug and type ./file1.

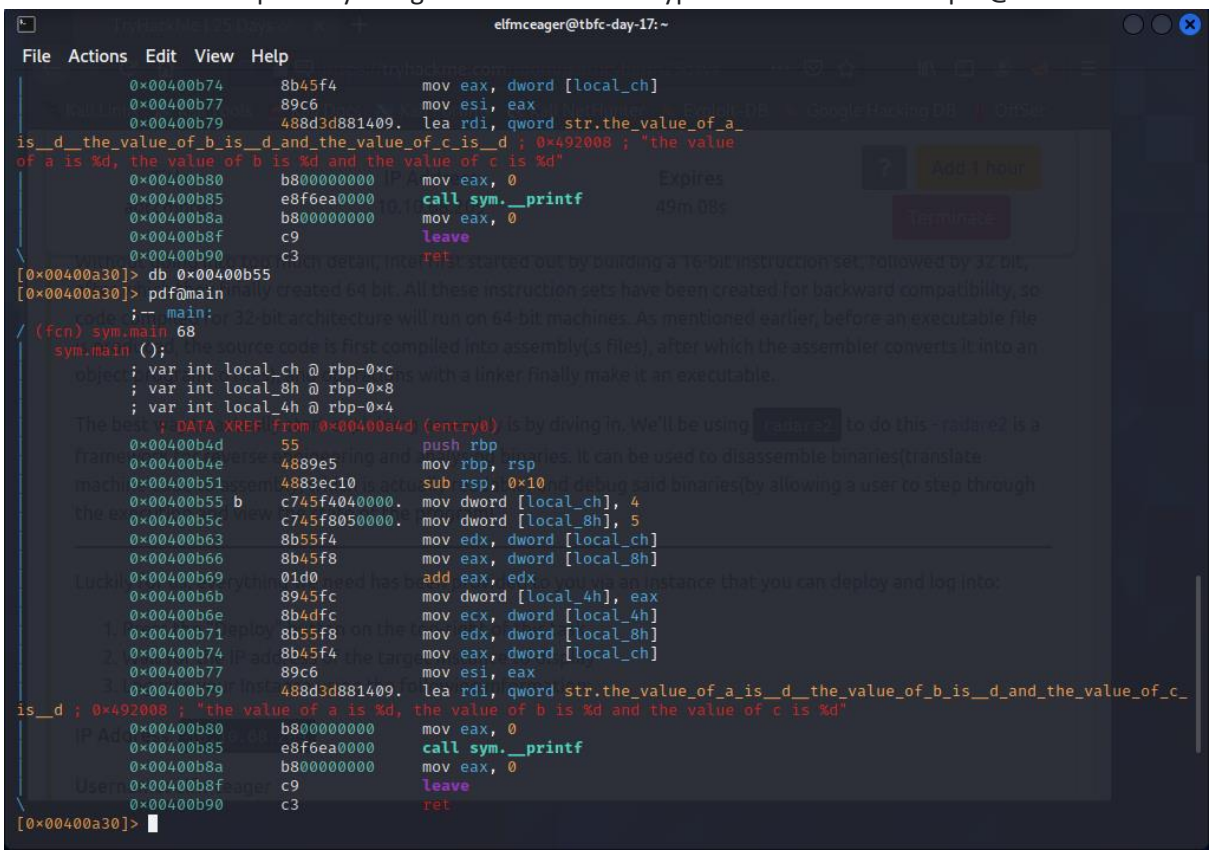


Thus, aa is the command that we entered to start analysing



Question 3

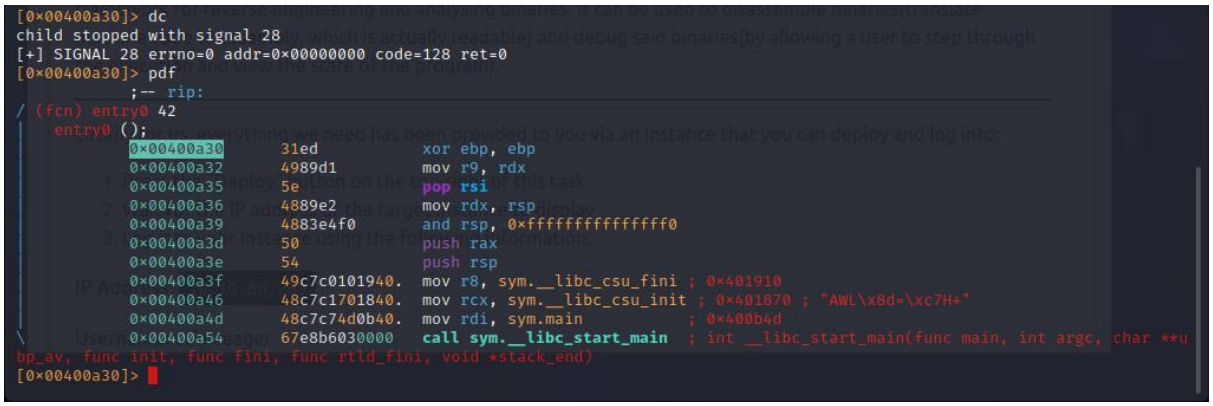
We can set the breakpoint by using the db command. Type db0x00400b55 and pdf@main.

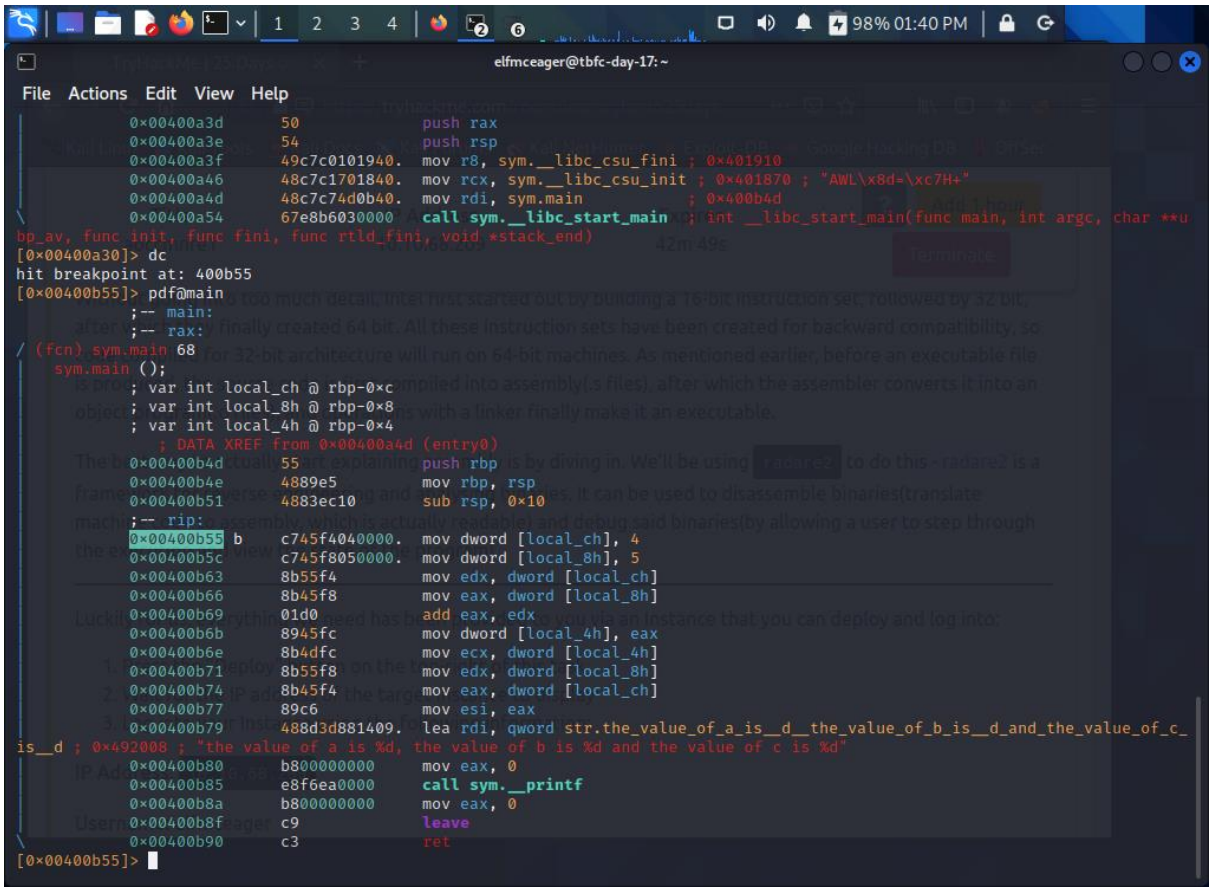


We will see a lowercase b next to it which is telling us that we have a breakpoint.

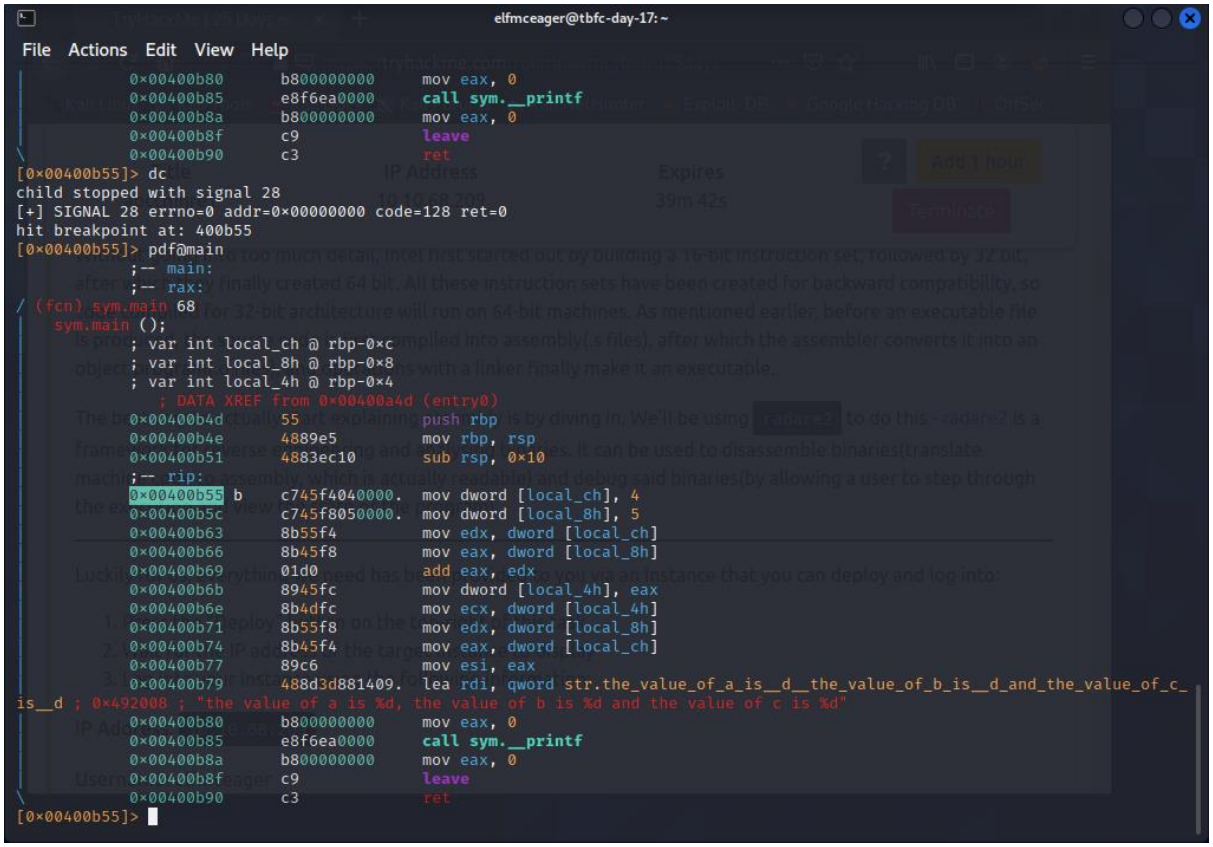
Question 4

We can type in dc which starts sunning the code and it will run up the first breakpoint.



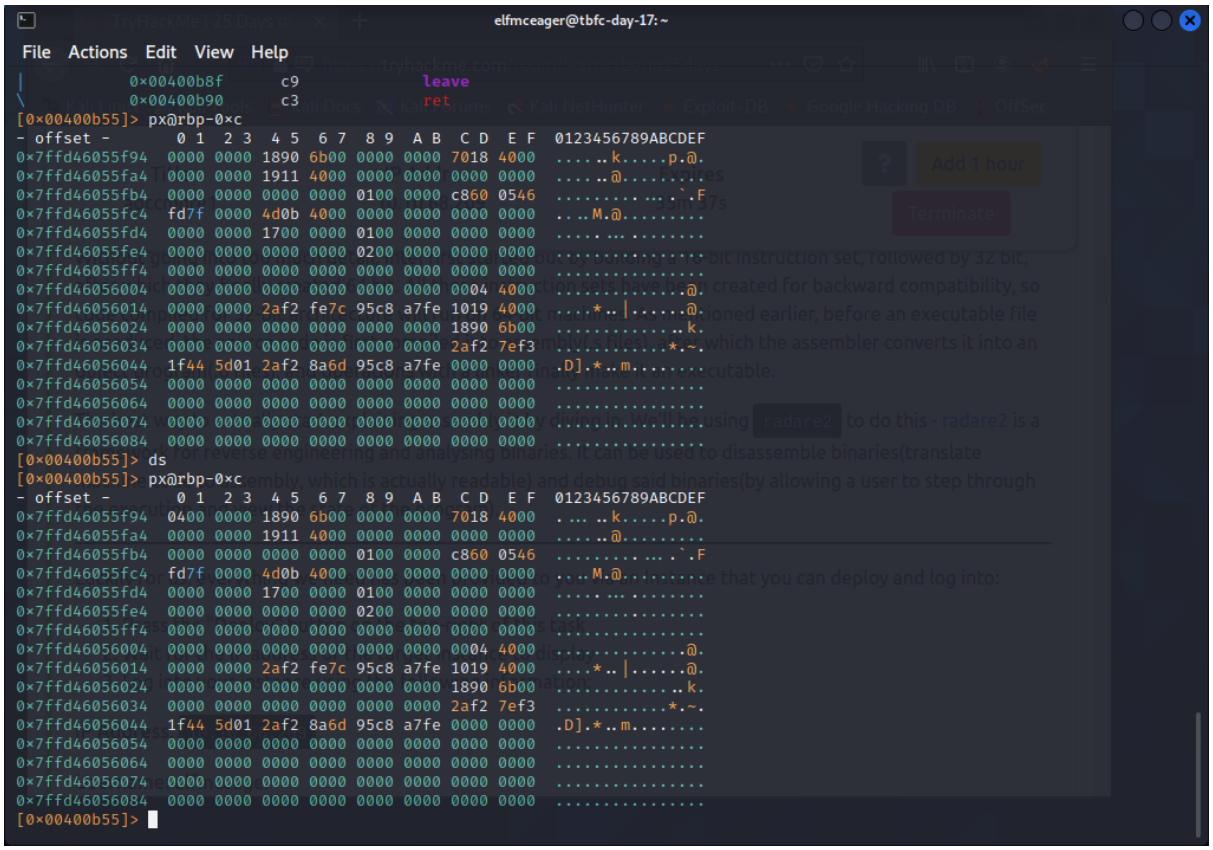


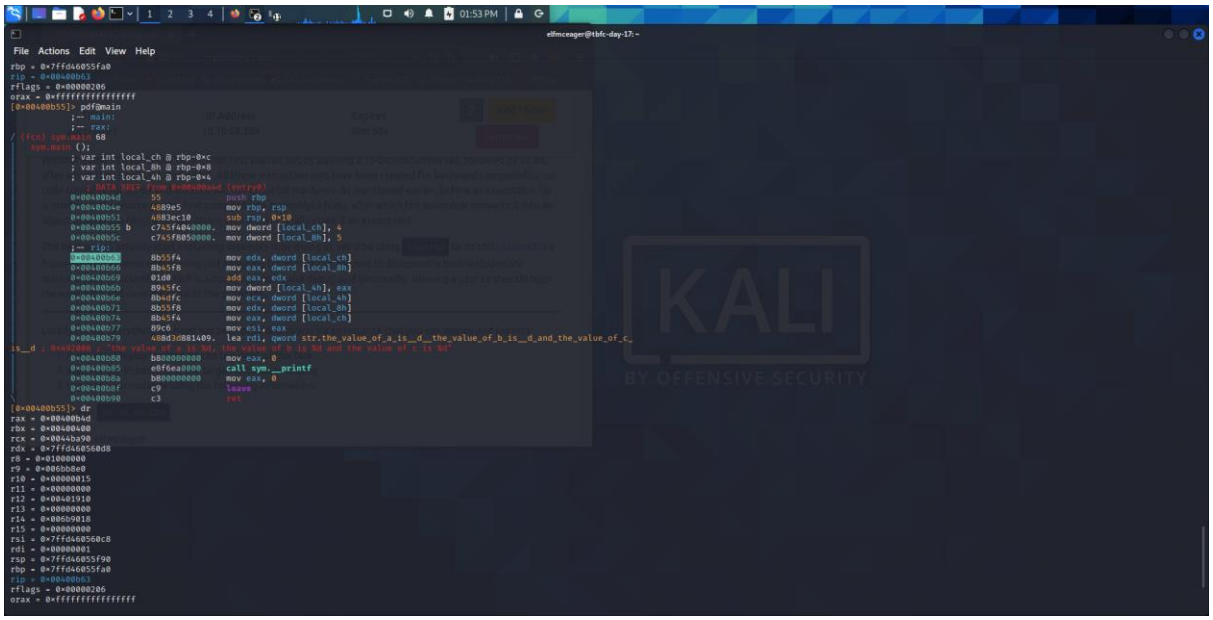
We have set a memory location 400b55 and that is where it stopped. When we do a pdf@main again, we will see it is highlighted and there is a rip comment where we are currently sitting.

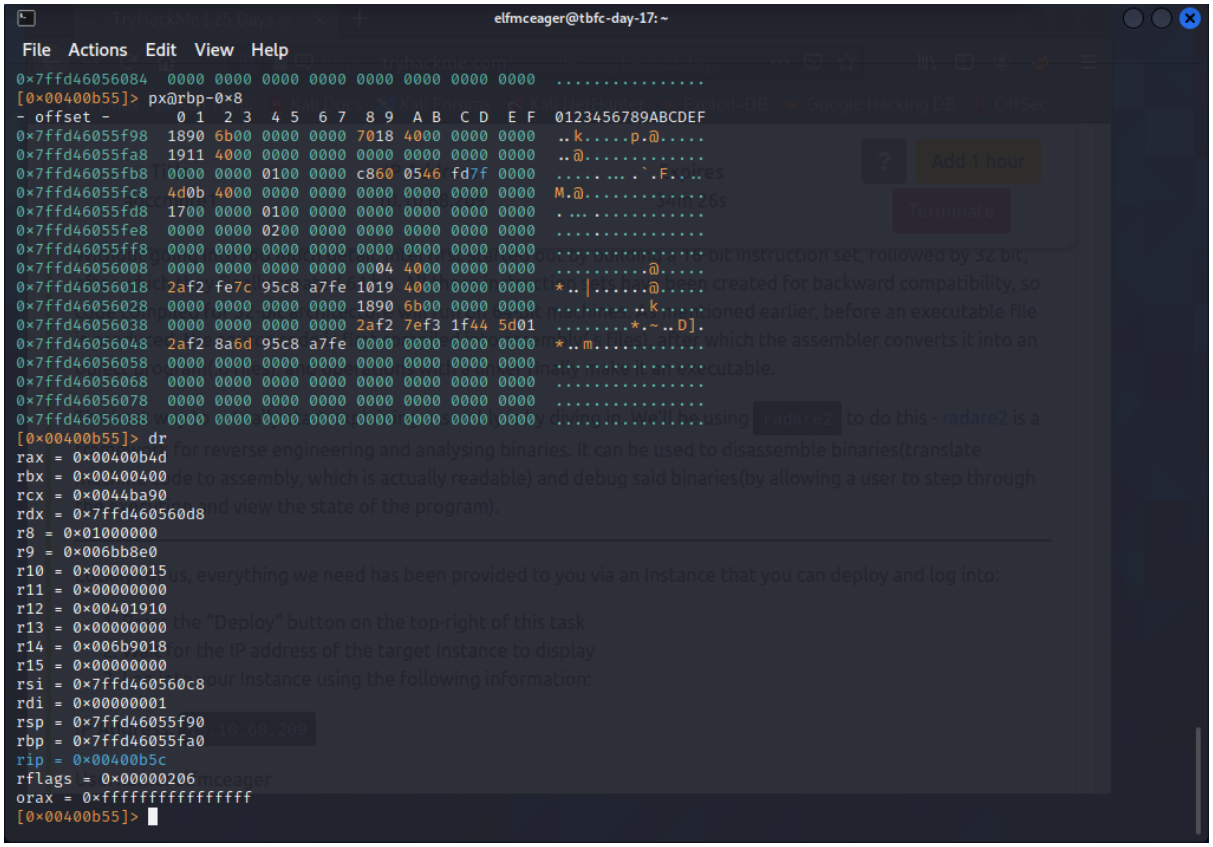

elfmceager@tbfc-day-17: ~
File Actions Edit View Help
0×00400b80 b800000000 mov eax, 0
0×00400b85 e8f6ea0000 call sym.__printf
0×00400b8a b800000000 mov eax, 0
0×00400b8f c9 leave
0×00400b90 c3 ret
[0×00400b55]> dc
child stopped with signal 28
[+] SIGNAL 28 errno=0 addr=0×00000000 code=128 ret=0
hit breakpoint at: 400b55
[0×00400b55]> pdf@main
;-- main:
;-- rax:
/ (fcn) sym.main 68
sym.main ();
; var int local_ch @ rbp-0×c
; var int local_8h @ rbp-0×8
; var int local_4h @ rbp-0×4
; DATA XREF from 0×00400a4d (entry0)
0×00400b4d 55 push rbp
0×00400b4e 4889e5 mov rbp, rsp
0×00400b51 4883ec10 sub rsp, 0×10
;-- rip:
0×00400b55 b c745f4040000. mov dword [local_ch], 4
0×00400b5c c745f8050000. mov dword [local_8h], 5
0×00400b63 8b55f4 mov edx, dword [local_ch]
0×00400b66 8b45f8 mov eax, dword [local_8h]
0×00400b69 01d0 add eax, edx
0×00400b6b 8945fc mov dword [local_4h], eax
0×00400b6e 8b4dfc mov ecx, dword [local_4h]
0×00400b71 8b55f8 mov edx, dword [local_8h]
0×00400b74 8b45f4 mov eax, dword [local_ch]
0×00400b77 89c6 mov esi, eax
0×00400b79 488d3d881409. lea rdi, qword str.the_value_of_a_is__d__the_value_of_b_is__d_and_the_value_of_c_is__d ; 0×492008 ; "the value of a is %d, the value of b is %d and the value of c is %d"
0×00400b80 b800000000 mov eax, 0
0×00400b85 e8f6ea0000 call sym.__printf
0×00400b8a b800000000 mov eax, 0
0×00400b8f c9 leave
0×00400b90 c3 ret
[0×00400b55]>

Question 5,6 & 7

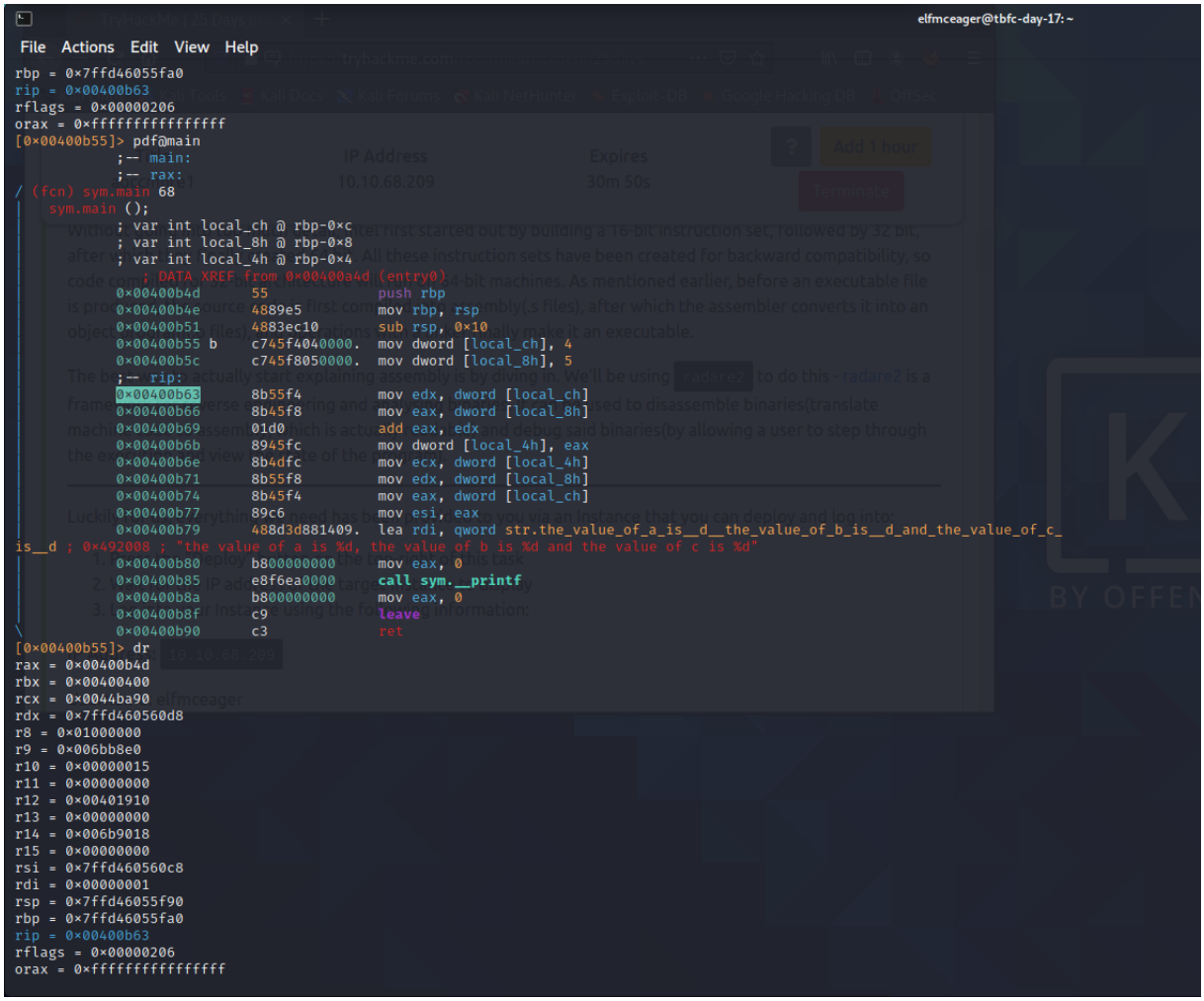
When we look at the code again, we will see that we are right at the line where we do the addition of eax + edx







We have to look at the registers, rax = 5, rdx = 4, when we step, we will perform the addition and one of our registers will be modified.



Thus, 1 is the value of local_ch when its corresponding movl instruction is called, 6 is the value of eax when the imull instruction is called, and 6 is the value of local_4h before eax is set to 0.

Thought Process/Methodology:

Print the code found in sim.main and view the pdf@main. A register serves as a work surface where we can do tasks one at a time in order to recover their value. The local ch value will be kept in a register, while the local 8h value will be kept in another folder. The two registers must be subjected to mathematical operations, and the results will be written over the source register. As a result, byte = 1, word = 2, double word = 4, quad = 8, single precision = 4, double precision = 8, and the data type were matched with the size in bytes. To execute file 1 and attach, type./file1. Type r2 -d to debug. Thus, we entered the command aa to begin our analysis. Using the db command, we can set the breakpoint. Enter pdf@main and db0x00400b55. The fact that there is a lowercase b next to it indicates that we have reached a breakpoint. We may start the code by typing dc, and it will run up the first breakpoint. It halted at a memory location that we placed at 400b55. It will be underlined and have a rip comment where we are sitting if we run a pdf@main once more. Rereading the code will reveal that we are currently on the line where the addition of eax and edx is performed. When we step, we will conduct the addition, and one of our registers will be changed. The registers are: rax = 5, rdx = 4, etc. Thus, 1 represents the value of local ch when the movl instruction corresponding to it is called, 6 represents the value of eax when the imull instruction is executed, and 6 represents the value of local 4h prior to eax being set to 0.