Name: Abhinav Reddy Boddu

Roll Number: 2021101034

Few README points:

- For Q5 , run the following before running `./q5` :

```
chmod +x ./q5
```

Q3

OS:

- `OS Name:` Ubuntu 20.04.3 LTS(64 bit) (`Release Date:` August 2021)
- `Desktop Environment:` GNOME 3.36.8
- `Shell:` bash 5.0.17
- `Kernel:` Linux Kernel (`Version:` 5.13.0-44-generic)

Kernel Modules:

`Note:` There are about 160 kernel modules , here are some of the most important once:

1. `snd_soc_skl` : Intel Skylake ASoC HDA driver
2. `snd_soc_hdac_hda` : ASoC Extensions for legacy HDA Drivers
3. `snd_hda_ext_core` : HDA extended core
4. `snd_soc_sst_dsp` : Intel SST Core
5. `snd_soc_acpi_intel_match` : Intel Common ACPI MatQ1'21ch module
6. `iwlmvm` : The new Intel(R) wireless AGN driver for Linux
7. `mac80211` : IEEE 802.11 subsystem
8. `i915` : Intel Graphics

File Systems:

- '`boot`' Partition uses FAT (32 bit) Format
- '`/`' and '`/home`' uses Ext4 (Version 1.0)

Processor:

- `Manufacturer:` Intel Corporation
- `Model:` Core i5
- `Generation:` 8th-generation (Kaby Lake)
- `Processor Number:` i5-8250U
- `Base Frequency:` 1.6 GHz (`Max Turbo Frequency:` 3.4 GHz)
- `Cache:` 6 MB Intel® Smart Cache
- `Lithograpy/Fabrication:` 14nm Fabrication
- `Cores:` 4 Core (`Threads:` 8 Threads)
- `Graphics:` Intel UHD Graphics 620 (integrated)

Memory:

- Total of 4 RAM slots (2 - empty , 2 - Used) (`Maximum Capacity:` 8 GB x 4 = 32 GB)
- Configration of each RAM slot:

```
Form Factor: SODIMM
Data Width: 64 bits
Size: 4096 MB (supports upto 8192 MB)
Configured Memory Speed: 2400 MT/s
Configured Voltage: 1.2 V
```

PCI Devices:

- `Host bridge:` Intel Corporation Xeon E3-1200 v6/7th Gen Core Processor Host Bridge/DRAM Registers (rev 08)
- `Signal processing controller:` Intel Corporation Xeon E3-1200 v5/E3-1500 v5/6th Gen Core Processor Thermal Subsystem (rev 08) `x 3`
- `USB controller:` Intel Corporation Sunrise Point-LP USB 3.0 xHCI Controller (rev 21)
- `Communication controller:` Intel Corporation Sunrise Point-LP CSME HECI #1 (rev 21)

- SATA controller: Intel Corporation Sunrise Point-LP SATA Controller [AHCI mode] (rev 21)
- PCI bridge: Intel Corporation Sunrise Point-LP PCI Express Root Port #1 (rev f1) x 2
- SD Host controller: Intel Corporation Sunrise Point-LP Secure Digital IO Controller (rev 21)
- ISA bridge: Intel Corporation Sunrise Point LPC Controller/eSPI Controller (rev 21)
- Memory controller: Intel Corporation Sunrise Point-LP PMC (rev 21)
- Audio device: Intel Corporation Sunrise Point-LP HD Audio (rev 21)
- SMBus: Intel Corporation Sunrise Point-LP SMBus (rev 21)
- Network controller: Intel Corporation Wireless 8265 / 8275 (rev 78)

USB Devices:

- Linux Foundation 3.0 Root Hub (USB 3.0 x 1)
- Linux Foundation 2.0 Root Hub (USB 2.0 x 2)
- Chicony Electronics Co., Ltd USB2.0 VGA UVC WebCam (Webcam)

Battery:

- Technology: Lithium-ion
- Vendor: ASUSTeK
- energy-full-design: 33.156 Wh

Sensors:

- Cooling Fan RPM Sensor: asus-isa-0000
- CPU Core Temperature Sensors: coretemp-isa-0000 x 4
- HDD temperature: acpitz-acpi-0
- Battery Voltage: BAT0-acpi-0

Storage:

- Capacity: 1TB
- Technology: Hard disk drive (HDD)
- Partitioning Scheme: GUID Partition Table

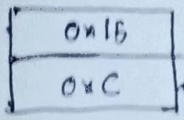
DMI:

- Product:
  - Name: ViviBook 15_ASUS Laptop X540UAR
  - Vendor: ASUSTek COMPUTER INC.
- BIOS:
  - Vendor: American Megatrends inc. (AMI)
  - Version: X540UAR.306
- Board:
  - Vendor: ASUSTek COMPUTER INC.
- Chassis:
  - Vendor: ASUSTek COMPUTER INC.

Benchmarking Scores:

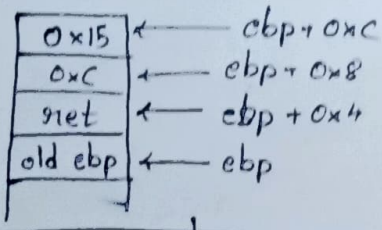
- CPU Blowfish: 1.33
- CPU cryptohash: 782.84
- CPU Zlib: 0.59
- FPU FFT: 0.88
- FPU Raytracing: 1.41
- GPU Drawing: 5471.91

Q4) before calling

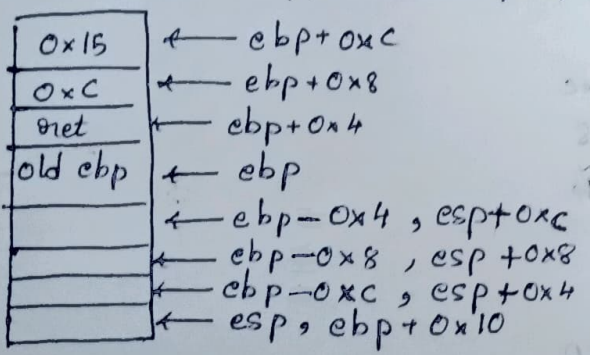


<+10> push ebp
↳ Pushing ebp to function stack

<+1> mov ebp, esp
making esp point to ebp



<+3> sub esp, 0x10 # esp=esp-0x10

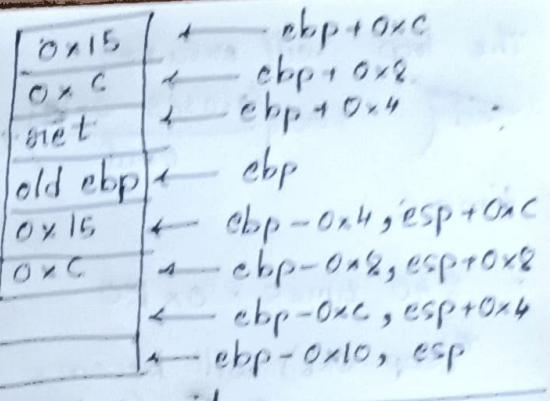


<+6> mov eax, DWORD PTR [ebp+0xc]
eax = 0x15

<+9> mov DWORD PTR [ebp-0x4], eax
*(ebp-0x4) = eax = 0x15

<+12> mov eax, DWORD PTR [ebp+0x8]
eax = *(ebp+0x8) = 0xc

<+15> mov DWORD PTR [ebp-0x8], eax
*(ebp-0x8) = eax = 0xc



<+18> jmp 0x50c <assemblycode +31>
jump to instruction at address 0x50c i.e assembly code +31

<+20> add DWORD PTR [ebp-0x4], 0x1
*(ebp-0x4) += 1

<+24> add DWORD PTR [ebp-0x8], 0xaf
*(ebp-0x8) += 175

<+31> cmp DWORD PTR [ebp-0x8], 0xa3d3

<+38> jle 0x501 <assemblycode +20>
if *(ebp-0x8) <= 41939 go to instruction on address assembly code +20

The above 5 lines are similar to:

```
while (*(ebp-0x8)<=41939){
    *(ebp-0x4) += 1;
    *(ebp-0x8) += 175;
}
```

The loop will execute

$$\text{floor}\left(\frac{0xa3d3 - 0xC}{0xaf}\right) + 1$$

times.

= 240 times = 0xF0

∴ *(ebp-0x8) will become

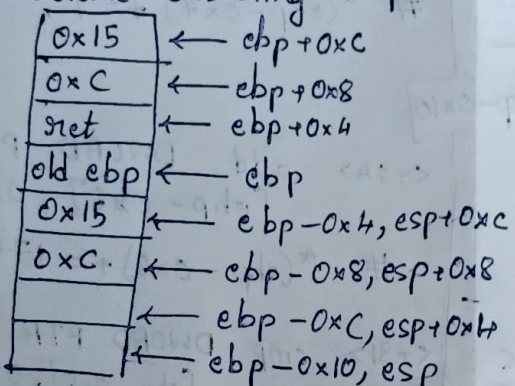
$$0xC + (0xF0 \cdot 0xaf) = 0xA41C$$

and *(ebp-0x4) will become

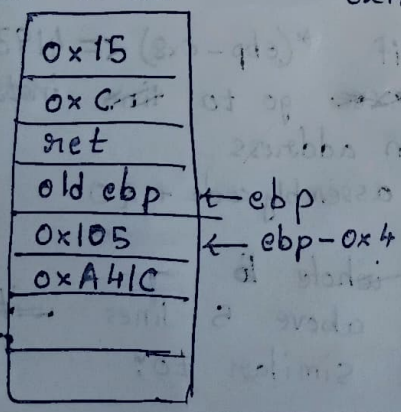
$$0x15 + (0xF0 \cdot 0x1)$$

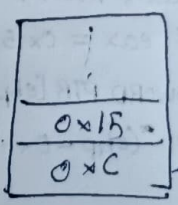
$$= 0x105$$

Stack before entering loop:



Stack after exiting loop.





Stack of Parent function

```
<+40>  mov  eax, DWORD PTR [ebp-0x4]
    # eax= *(ebp-0x4) = 0x105
<+43>  leave
    # make esp and ebp
    # as they were before
    # executing <+1>
<+44>  ret  #  Return.
```

5 (a)

- the given executable "q5.out" shows up in the directory and also on running the command "ls" in terminal.
- But on trying to execute it by running "./q5.out" bash throws the error "No such file or directory"

- The problem here is the given executable is a DYN (shared object file), but the interpreter was not correct one.

(b)

- the type of the ELF file DYN (shared object file)

- Machine - Advanced Micro Devices (x86-64)
- Data : 2's complement, Little endian