

Burak Yesil

I pledge my honor that I have abided by the Stevens Honor System.

```
arr: .quad 1, 6, 7, 88, 200, 250, 1000
```

The Query is in some position in the array:

```
user@box: ~/shared/CS382/lab4
File Actions Edit View Help
user@box: ~/shared/CS382/lab4
user@box:~$ cd shared/CS382/lab4
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 1234 a.out
bind: Address already in use
qemu: could not open gdbserver on port 1234
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 12345 a.out
Input Target Value:
88
```

```
user@box: ~/shared/CS382/lab4
File Actions Edit View Help
user@box: ~/shared/CS382/lab4
Register group: general
x0      0x411070      4264048
x1      0x3          3
x2      0xe4da6991ea95a700 -1956135012712208640
x3      0xffffffff0    4294967248
x4      0x58         88
x5      0x40007ffb32   274886294322
x6      0x21a        538
x7      0x58         88
x8      0x7          7
x9      0x3          3

B+> 0x400378 <Exit>      bl      0x4002e0 <printf@plt>
0x40037c <Exit+4>      mov     x0, #0x0          // #0
0x400380 <Exit+8>      mov     w8, #0x5d          // #93
0x400384 <Exit+12>     svc     #0x0
0x400388 <Exit+16>     .inst  0x00411058 ; undefined
0x40038c <Exit+20>     .inst  0x00000000 ; undefined
0x400390 <Exit+24>     .inst  0x0041106d ; undefined
0x400394 <Exit+28>     .inst  0x00000000 ; undefined
0x400398 <Exit+32>     .inst  0x00411050 ; undefined
0x40039c <Exit+36>     .inst  0x00000000 ; undefined

remote Thread 1.1692 In: Exit L57 PC: 0x400378
Breakpoint 1, _start () at binarysearch.s:11
=> 0x0000000004002f0 <_start+0>: c0 04 00 58 ldr x0, 0x400388 <Exit+16>
(gdb) b Exit
Breakpoint 2 at 0x400378: file binarysearch.s, line 57.
(gdb) c
Continuing.

Breakpoint 2, Exit () at binarysearch.s:57
=> 0x000000000400378 <Exit+0>: da ff ff 97 bl 0x4002e0 <printf@plt>
(gdb)
```

As you can see the X1 register has the value 3 which is the index of 88. Since it changed from 0 to 3 it shows that 88 was found

The Query is the last element in the array:

```
user@box: ~/shared/CS382/lab4
File Actions Edit View Help

Register group: general
x0      0x411070      4264048
x1      0x6           6
x2      0x2fa3090a49a17f00 3432597280776093440
x3      0xffffffffd0 4294967248
x4      0x3e8         1000
x5      0x40007ffb34 274886294324
x6      0x21a         538
x7      0x3e8         1000
x8      0x7           7
x9      0x6           6

B+>0x400378 <Exit>      bl      0x4002e0 <printf@plt>
0x40037c <Exit+4>      mov     x0, #0x0           // #0
0x400380 <Exit+8>      mov     w8, #0x5d           // #93
0x400384 <Exit+12>     svc     #0x0
0x400388 <Exit+16>     .inst  0x00411058 ; undefined
0x40038c <Exit+20>     .inst  0x00000000 ; undefined
0x400390 <Exit+24>     .inst  0x0041106d ; undefined
0x400394 <Exit+28>     .inst  0x00000000 ; undefined
0x400398 <Exit+32>     .inst  0x00411050 ; undefined
0x40039c <Exit+36>     .inst  0x00000000 ; undefined

remote Thread 1.1672 In: Exit      L57  PC: 0x400378
Breakpoint 1, _start () at binarysearch.s:11
=> 0x00000000004002f0 <_start+0>:      c0 04 00 58      ldr     x0, 0x400388 <Exit+16>
(gdb) b Exit
Breakpoint 2 at 0x400378: file binarysearch.s, line 57.
(gdb) c
Continuing.

Breakpoint 2, Exit () at binarysearch.s:57
=> 0x0000000000400378 <Exit+0>: da ff ff 97      bl      0x4002e0 <printf@plt>
(gdb) 
```

```
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 1234 a.out
Input Target Value:
1000

```

As you can see the X1 register has the value 6 which is the index of 1000, the last element. Since X1 changed from 0 to 6, it shows 1000 was found

The Query is not in the array:

```
user@box: ~/shared/CS382/lab4
File Actions Edit View Help
user@box: ~/shared/CS382/lab4
Register group: general
x0      0x411070      4264048
x1      0x0          0
x2      0x8a074facddb6db00 -8500738168034239744
x3      0xffffffff0 4294967248
x4      0x1          1
x5      0x40007ffb31 274886294321
x6      0x21a        538
x7      0x1          1
x8      0x7          7
x9      0x0          0

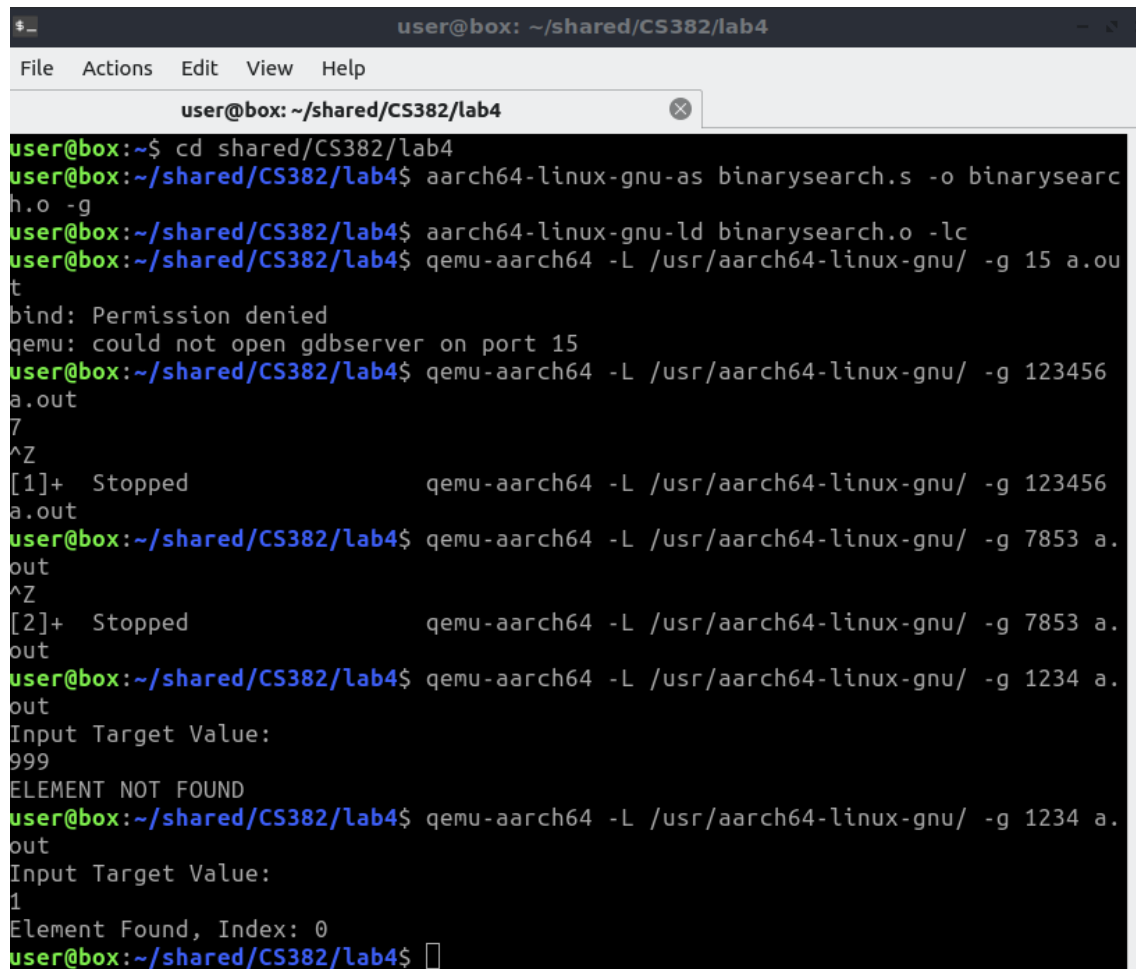
B+ 0x4002f0 <_start>    ldr    x0, 0x400388 <Exit+16>
    0x4002f4 <_start+4>  bl     0x4002e0 <printf@plt>
    0x4002f8 <_start+8>  ldr    x0, 0x400390 <Exit+24>
    0x4002fc <_start+12> ldr    x1, 0x400398 <Exit+32>
    0x400300 <_start+16> bl     0x4002d0 <scanf@plt>
    0x400304 <_start+20> adr    x11, 0x411010
    0x400308 <_start+24> ldr    x8, 0x4003a0 <Exit+40>
    0x40030c <_start+28> ldr    x8, [x8]
    0x400310 <_start+32> sub    x10, x8, #0x1
    0x400314 <_start+36> bl     0x400318 <BS>

exec No process In: L?? PC: ??
(gdb) b Exit
Breakpoint 2 at 0x400378: file binarysearch.s, line 57.
(gdb) c
Continuing.

Breakpoint 2, Exit () at binarysearch.s:57
=> 0x0000000000400378 <Exit+0>: da ff ff 97      bl     0x4002e0 <printf@plt>
(gdb) c
Continuing.
[Inferior 1 (process 1) exited normally]
(gdb) █
```

As you can see the value of register x1 did not change meaning it's not in the array.

The Query is the First element of the array:



```
user@box: ~$ cd shared/CS382/lab4
user@box:~/shared/CS382/lab4$ aarch64-linux-gnu-as binarysearch.s -o binarysearch.o -g
user@box:~/shared/CS382/lab4$ aarch64-linux-gnu-ld binarysearch.o -lc
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 15 a.out
bind: Permission denied
qemu: could not open gdbserver on port 15
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 123456 a.out
7
^Z
[1]+  Stopped                  qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 123456 a.out
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 7853 a.out
^Z
[2]+  Stopped                  qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 7853 a.out
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 1234 a.out
Input Target Value:
999
ELEMENT NOT FOUND
user@box:~/shared/CS382/lab4$ qemu-aarch64 -L /usr/aarch64-linux-gnu/ -g 1234 a.out
Input Target Value:
1
Element Found, Index: 0
user@box:~/shared/CS382/lab4$
```

```
user@box: ~/shared/CS382/lab4
File Actions Edit View Help
user@box: ~/shared/CS382/lab4
Register group: general
x0      0x411070      4264048
x1      0x0          0
x2      0x2400a7f4ad39f600 2594258054685521408
x3      0xffffffff0    4294967248
x4      0x1          1
x5      0x40007ffb31   274886294321
x6      0x21a        538
x7      0x1          1
x8      0x7          7
x9      0x0          0

B->0x400378 <Exit>      bl      0x4002e0 <printf@plt>
0x40037c <Exit+4>      mov      x0, #0x0          // #0
0x400380 <Exit+8>      mov      w8, #0x5d          // #93
0x400384 <Exit+12>     svc      #0x0
0x400388 <Exit+16>     .inst   0x00411058 ; undefined
0x40038c <Exit+20>     .inst   0x00000000 ; undefined
0x400390 <Exit+24>     .inst   0x0041106d ; undefined
0x400394 <Exit+28>     .inst   0x00000000 ; undefined
0x400398 <Exit+32>     .inst   0x00411050 ; undefined
0x40039c <Exit+36>     .inst   0x00000000 ; undefined

remote Thread 1.1714 In: Exit      L57  PC: 0x400378
Breakpoint 1, _start () at binarysearch.s:11
=> 0x00000000004002f0 <_start+0>:  c0 04 00 58      ldr      x0, 0x400388 <Exit+16>
(gdb) b Exit
Breakpoint 2 at 0x400378: file binarysearch.s, line 57.
(gdb) c
Continuing.

Breakpoint 2, Exit () at binarysearch.s:57
=> 0x0000000000400378 <Exit+0>:  da ff ff 97      bl      0x4002e0 <printf@plt>
(gdb) □
```

Since 1 is the first element in the array X1 stayed as 0.