

CS 342: Operating Systems  
Project 3 Report  
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Section 1

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# Introduction

I added the complete codes and the long outputs in the appendix section to make the report more readable.

## Step 1

Step 1 Initiated

```
Address of main is 4007e7
Address of initialized data 1 (128B) is: 6020a0
Address of unutilized data 1 (16KB) is: 602180
Address of initialized data 2 (64B) is: 602120
Address of unutilized data 2 (8KB) is: 606180
Address of nextStep function is: 400d4c
Address of factorial function is: 400ccf
Address of printf function is: 7ff658708e80
Process PID: 27801
```

## Step 1 pmap Output

```
$pmap 6061
27801:  ./app
0000000000400000      8K r-x-- app
0000000000601000      4K r---- app
0000000000602000      4K rw--- app
0000000000603000     24K rw--- [ anon ]
00000000006d4000    132K rw--- [ anon ]
00007ff6586a4000   1948K r-x-- libc-2.27.so
00007ff65888b000   2048K ----- libc-2.27.so
00007ff658a8b000     16K r---- libc-2.27.so
00007ff658a8f000      8K rw--- libc-2.27.so
00007ff658a91000     16K rw--- [ anon ]
00007ff658a95000    156K r-x-- ld-2.27.so
00007ff658c9d000      8K rw--- [ anon ]
00007ff658cbc000      4K r---- ld-2.27.so
00007ff658cbd000      4K rw--- ld-2.27.so
00007ff658cbe000      4K rw--- [ anon ]
00007ffd76dcf000   132K rw--- [ stack ]
00007ffd76df9000     12K r---- [ anon ]
00007ffd76dfc000      4K r-x-- [ anon ]
```

```

fffffffffff600000    4K --x--  [ anon ]
total              4536K

```

## Comparison

Main function's address is 4007e7 and this is on the page starting with 400000. Other functions that I declared are also in this page and the size of the page is 8KB. Therefore, the text section is 2 pages long. Global variables are in pages between 601000 and 608000. Total size of these pages are 32KB. Data section is bigger than the text section in size.

## Objdumps

Objdump of app is in the appendix below. The addresses of global variables are the same with the addresses in the program output. It is normal that the addresses are the same here because these are virtual addresses.

Objdump of module1 is also in the appendix. All global variables and functions are extern to module1 and address seems to show 0 for these. Linker knows that the addresses will be in another file.

Objdump of module2 is below.

```

module2.o:      file format elf64-x86-64
module2.o
architecture: i386:x86-64, flags 0x00000011:
HAS_RELOC, HAS_SYMS
start address 0x0000000000000000

```

Sections:

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	0000007d	0000000000000000	0000000000000000	0000000000000000	00000040 2**0
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000080	0000000000000000	0000000000000000	0000000000000000	000000c0 2**5
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	0000000000000000	0000000000000000	0000000000000000	00000140 2**0
	ALLOC					
3	.rodata	00000023	0000000000000000	0000000000000000	0000000000000000	00000140 2**0
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
4	.comment	0000002a	0000000000000000	0000000000000000	0000000000000000	00000163 2**0
	CONTENTS, READONLY					
5	.note.GNU-stack	00000000	0000000000000000	0000000000000000	0000000000000000	0000018d 2**0
	CONTENTS, READONLY					
6	.eh_frame	00000038	0000000000000000	0000000000000000	0000000000000000	00000190 2**3
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, DATA					

SYMBOL TABLE:

```

0000000000000000 1      df *ABS*      0000000000000000 module2.c

```

```

0000000000000000 1 d .text 0000000000000000 .text
0000000000000000 1 d .data 0000000000000000 .data
0000000000000000 1 d .bss 0000000000000000 .bss
0000000000000000 1 d .rodata 0000000000000000 .rodata
0000000000000000 1 d .note.GNU-stack 0000000000000000 .note.GNU-stack
0000000000000000 1 d .eh_frame 0000000000000000 .eh_frame
0000000000000000 1 d .comment 0000000000000000 .comment
0000000000000000 g O .data 0000000000000080 initData1
0000000000000400 O *COM* 0000000000000020 unutilized1
0000000000000000 g F .text 000000000000007d factorial
0000000000000000 *UND* 0000000000000000 _GLOBAL_OFFSET_TABLE_
0000000000000000 *UND* 0000000000000000 printf
0000000000000000 *UND* 0000000000000000 __stack_chk_fail

```

Disassembly of section .text:

```

0000000000000000 <factorial>:
 0: 55                                push    %rbp
 1: 48 89 e5                          mov     %rsp,%rbp
 4: 48 83 ec 20                        sub     $0x20,%rsp
 8: 89 7d ec                          mov     %edi,-0x14(%rbp)
b: 64 48 8b 04 25 28 00             mov     %fs:0x28,%rax
12: 00 00
14: 48 89 45 f8                      mov     %rax,-0x8(%rbp)
18: 31 c0                             xor     %eax,%eax
1a: 83 7d ec 00                      cmpl    $0x0,-0x14(%rbp)
1e: 75 07                             jne     27 <factorial+0x27>
20: b8 01 00 00 00                  mov     $0x1,%eax
25: eb 40                             jmp     67 <factorial+0x67>
27: 83 7d ec 0f                      cmpl    $0xf,-0x14(%rbp)
2b: 7f 1f                             jg      4c <factorial+0x4c>
2d: 48 8d 45 f0                      lea     -0x10(%rbp),%rax
31: 48 89 c2                          mov     %rax,%rdx
34: 48 8d 35 00 00 00 00             lea     0x0(%rip),%rsi        # 3b <factorial+0x3b>
                               37: R_X86_64_PC32 .rodata-0x4
3b: 48 8d 3d 00 00 00 00             lea     0x0(%rip),%rdi        # 42 <factorial+0x42>
                               3e: R_X86_64_PC32 .rodata+0x18
42: b8 00 00 00 00                  mov     $0x0,%eax
47: e8 00 00 00 00                  callq   4c <factorial+0x4c>
                               48: R_X86_64_PLT32 printf-0x4
4c: 8b 45 ec                          mov     -0x14(%rbp),%eax
4f: 83 e8 01                          sub     $0x1,%eax
52: 89 c7                             mov     %eax,%edi
54: e8 00 00 00 00                  callq   59 <factorial+0x59>
                               55: R_X86_64_PC32 factorial-0x4
59: 89 c2                             mov     %eax,%edx
5b: 8b 45 ec                          mov     -0x14(%rbp),%eax
5e: 0f af c2                          imul    %edx,%eax
61: 89 45 f4                          mov     %eax,-0xc(%rbp)
64: 8b 45 f4                          mov     -0xc(%rbp),%eax
67: 48 8b 4d f8                      mov     -0x8(%rbp),%rcx
6b: 64 48 33 0c 25 28 00             xor     %fs:0x28,%rcx
72: 00 00
74: 74 05                             je      7b <factorial+0x7b>
76: e8 00 00 00 00                  callq   7b <factorial+0x7b>

```

```

77: R_X86_64_PLT32    __stack_chk_fail-0x4
7b: c9                  leaveq
7c: c3                  retq

```

Addresses are starting from zero in module2. These addresses are not real virtual addresses but offsets. The linker determines the virtual address by using these offsets. Module1 and module2 are called relocatable because their addresses are 'relocated'. App, on the other hand is executable because it uses virtual addresses that the OS can use.

Here are some references in app.

### Printf

```

4008f5: 48 8b 05 ec 16 20 00    mov     0x2016ec(%rip),%rax    # 601fe8
<printf@GLIBC_2.2.5>
400912: e8 d9 fd ff ff         callq   4006f0 <printf@plt>

```

### Globals

```

400829: 48 8d 05 70 18 20 00    lea     0x201870(%rip),%rax    # 6020a0 <initData1>
40088f: 48 8d 05 ea 58 20 00    lea     0x2058ea(%rip),%rax    # 606180
<unutilized2>

```

### Functions

```

40093b: e8 0c 04 00 00         callq   400d4c <nextStep>
00cf4: eb 40                  jmp     400d36 <factorial+0x67>
400cfa: 7f 1f                  jg      400d1b <factorial+0x4c>
400d23: e8 a7 ff ff ff         callq   400ccf <factorial>

```

Here are some references in module1, module2

```

54: e8 00 00 00 00         callq   59 <factorial+0x59>
55: R_X86_64_PC32         factorial-0x4
1ba: R_X86_64_PC32        .rodata+0x26

```

A call to printf function.

```

400868: e8 83 fe ff ff         callq   4006f0 <printf@plt>

```

Files in proc/pid

arch_status	environ	mountinfo	personality	statm
attr	exe	mounts	projid_map	status
autogroup	fd	mountstats	root	syscall
auxv	fdinfo	net	sched	task
cgroup	gid_map	ns	schedstat	timers
clear_refs	io	numa_maps	sessionid	timerslack_ns
cmdline	limits	oom_adj	setgroups	uid_map

comm	loginuid	oom_score	smaps	wchan
coredump_filter	map_files	oom_score_adj	smaps_rollup	
cpuset	maps	pagemap	stack	
cwd	mem	patch_state	stat	

Mem and stack seems to be related to memory management but I get a permission denied error when trying to access.

```
$cat maps
00400000-00402000 r-xp 00000000 103:05 402526
/home/yusuf/CS/CS342/OSProjects/Project3/src/app
00601000-00602000 r--p 00001000 103:05 402526
/home/yusuf/CS/CS342/OSProjects/Project3/src/app
00602000-00603000 rw-p 00002000 103:05 402526
/home/yusuf/CS/CS342/OSProjects/Project3/src/app
00603000-00609000 rw-p 00000000 00:00 0
0113f000-01160000 rw-p 00000000 00:00 0
7f91f6b55000-7f91f6d3c000 r-xp 00000000 103:05 268207
/lib/x86_64-linux-gnu/libc-2.27.so
7f91f6d3c000-7f91f6f3c000 ---p 001e7000 103:05 268207
/lib/x86_64-linux-gnu/libc-2.27.so
7f91f6f3c000-7f91f6f40000 r--p 001e7000 103:05 268207
/lib/x86_64-linux-gnu/libc-2.27.so
7f91f6f40000-7f91f6f42000 rw-p 001eb000 103:05 268207
/lib/x86_64-linux-gnu/libc-2.27.so
7f91f6f42000-7f91f6f46000 rw-p 00000000 00:00 0
7f91f6f46000-7f91f6f6d000 r-xp 00000000 103:05 268179
/lib/x86_64-linux-gnu/ld-2.27.so
7f91f714e000-7f91f7150000 rw-p 00000000 00:00 0
7f91f716d000-7f91f716e000 r--p 00027000 103:05 268179
/lib/x86_64-linux-gnu/ld-2.27.so
7f91f716e000-7f91f716f000 rw-p 00028000 103:05 268179
/lib/x86_64-linux-gnu/ld-2.27.so
7f91f716f000-7f91f7170000 rw-p 00000000 00:00 0
7ffc09a8000-7ffc09c9000 rw-p 00000000 00:00 0
7ffc09d1000-7ffc09d4000 r--p 00000000 00:00 0
7ffc09d4000-7ffc09d5000 r-xp 00000000 00:00 0
ffffffff600000-ffffffff601000 --xp 00000000 00:00 0
```

[heap]

[stack]

[vvar]

[vdso]

[vsyscall]

## Step 2

Step 2 Initiated

```
Address of heap data1: 7ff658c1c010
Address of heap data2: 7ff658bdb010
Address of heap data3: 7ff658b9a010
Address of heap data4: 7ff6585a3010
```

Heap addresses are in a very different place compared to the global variables.

## Pmap of Step 2

```
27801:    ./app
0000000000400000      8K r-x-- app
0000000000601000      4K r---- app
0000000000602000      4K rw--- app
0000000000603000     24K rw--- [ anon ]
00000000006d4000    132K rw--- [ anon ]
00007ff6585a3000   1028K rw--- [ anon ]
00007ff6586a4000   1948K r-x-- libc-2.27.so
00007ff65888b000   2048K ----- libc-2.27.so
00007ff658a8b000     16K r---- libc-2.27.so
00007ff658a8f000      8K rw--- libc-2.27.so
00007ff658a91000     16K rw--- [ anon ]
00007ff658a95000    156K r-x-- ld-2.27.so
00007ff658b9a000  1044K rw--- [ anon ]
00007ff658cbc000      4K r---- ld-2.27.so
00007ff658cbd000      4K rw--- ld-2.27.so
00007ff658cbe000      4K rw--- [ anon ]
00007ffd76dcf000   132K rw--- [ stack ]
00007ffd76df9000     12K r---- [ anon ]
00007ffd76dfc000      4K r-x-- [ anon ]
fffffffffff60000      4K --x-- [ anon ]
total                6600K
```

These lines are new and their size are approximately 2MB in total. They are the heap.

```
00007ff6585a3000 1028K rw--- [ anon ]
00007ff658b9a000 1044K rw--- [ anon ]
```

Below line is from ps aux

```
yusuf 27801 0.0 0.0 6596 724 pts/0 S+ 04:57 0:00 ./app
```

Virtual memory usage: 6596KB, Physical memory usage: 724KB

## Step 3

### Step 3 Initiated

```
Address of local variable: 7ffd76c6e200
Address of local variable: 7ffd76c6e1d0
Address of local variable: 7ffd76c6e1a0
Address of local variable: 7ffd76c6e170
Address of local variable: 7ffd76c6e140
Address of local variable: 7ffd76c6e110
Address of local variable: 7ffd76c6e0e0
Address of local variable: 7ffd76c6e0b0
Address of local variable: 7ffd76c6e080
Address of local variable: 7ffd76c6e050
Address of local variable: 7ffd76c6e020
Address of local variable: 7ffd76c6dff0
Address of local variable: 7ffd76c6dfc0
Address of local variable: 7ffd76c6df90
Address of local variable: 7ffd76c6df60
Fact: 0
```

### Pmap of step 3

```
27801:    ./app
0000000000400000      8K r-x-- app
0000000000601000      4K r---- app
0000000000602000      4K rw--- app
0000000000603000     24K rw--- [ anon ]
00000000006d4000    132K rw--- [ anon ]
00007ff6585a3000   1028K rw--- [ anon ]
00007ff6586a4000   1948K r-x-- libc-2.27.so
00007ff65888b000   2048K ----- libc-2.27.so
00007ff658a8b000     16K r---- libc-2.27.so
00007ff658a8f000      8K rw--- libc-2.27.so
00007ff658a91000     16K rw--- [ anon ]
00007ff658a95000    156K r-x-- ld-2.27.so
00007ff658b9a000   1044K rw--- [ anon ]
00007ff658cbc000      4K r---- ld-2.27.so
00007ff658cbd000      4K rw--- ld-2.27.so
00007ff658cbe000      4K rw--- [ anon ]
00007ffd76c6d000   1548K rw--- [ stack ]
00007ffd76df9000     12K r---- [ anon ]
00007ffd76dfc000      4K r-x-- [ anon ]
```



```
ffffffffffff600000      4K --x--  [ anon ]
total      8016K
```

```
      7ffd76c6d000 rw-p 00000000 00:00      0 1548 1548 1548    1548 1548
0          0          0          0      0      0      0      0 [stack]
```

Size of stack becomes 1548KB. Printed pointer values are starting with 7ffd76c6. Pmap and this match.

## Step 4

Step 4 Initiated

Creating File!

Created file with name: project\_file

Wrote 1MB data to project\_file

Address of memory map: 7ff6584a3000

## Pmap of step 4

```
27801:  ./app
0000000000400000      8K r-x--  app
0000000000601000      4K r----  app
0000000000602000      4K rw---  app
0000000000603000     24K rw---  [ anon ]
00000000006d4000    132K rw---  [ anon ]
00007ff6584a3000   1024K rw---  project_file
00007ff6585a3000   1028K rw---  [ anon ]
00007ff6586a4000   1948K r-x--  libc-2.27.so
00007ff65888b000   2048K -----  libc-2.27.so
00007ff658a8b000     16K r----  libc-2.27.so
00007ff658a8f000      8K rw---  libc-2.27.so
00007ff658a91000     16K rw---  [ anon ]
00007ff658a95000    156K r-x--  ld-2.27.so
00007ff658b9a000   1044K rw---  [ anon ]
00007ff658cbc000      4K r----  ld-2.27.so
00007ff658cbd000      4K rw---  ld-2.27.so
00007ff658cbe000      4K rw---  [ anon ]
00007ffd76c6d000   1548K rw---  [ stack ]
00007ffd76df9000     12K r----  [ anon ]
00007ffd76dfc000      4K r-x--  [ anon ]
```

```
ffffffffffff600000      4K --x--  [ anon ]
total                9040K
```

The mmap is allocated on the virtual address space.

```
yusuf 27801 0.0 0.0 9036 3012 pts/0 S+ 04:57 0:00 ./app
```

Vmem usage is 9036KB and physical memory usage is 3012KB.

## Step 5

Step 5 Initiated

```
Reading some values from the start of the mmap
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg
Reading some values from the end of the mmap
abcdefghijklmnopqrstuvwxyz12345
abcdefghijklmnopqrstuvwxyz12345
```

```
yusuf 27801 0.0 0.0 9036 3540 pts/0 S+ 04:57 0:00 ./app
```

Vmem usage is 9036KB and physical memory usage is 3540KB.

Virtual memory usage didn't increase. However, physical memory usage increased. This happened because the OS put some of the pages in the virtual memory to the physical memory to be able to read/write to mmap.

## Pmap of step 5

```
$ pmap 5501
5501:    ./app
0000000000400000      8K r-x-- app
0000000000601000      4K r---- app
0000000000602000      4K rw--- app
0000000000603000     24K rw--- [ anon ]
00000000012ad000    132K rw--- [ anon ]
00007f26d8f04000   1024K rw--- project_file
00007f26d9004000   1028K rw--- [ anon ]
00007f26d9105000   1948K r-x-- libc-2.27.so
00007f26d92ec000   2048K ----- libc-2.27.so
00007f26d94ec000     16K r---- libc-2.27.so
```

```

00007f26d94f0000      8K rw--- libc-2.27.so
00007f26d94f2000     16K rw---  [ anon ]
00007f26d94f6000    156K r-x-- ld-2.27.so
00007f26d95fb000   1044K rw---  [ anon ]
00007f26d971d000      4K r---- ld-2.27.so
00007f26d971e000      4K rw--- ld-2.27.so
00007f26d971f000      4K rw---  [ anon ]
00007fff1b287000   1548K rw---  [ stack ]
00007fff1b5e4000     12K r----  [ anon ]
00007fff1b5e7000      4K r-x--  [ anon ]
ffffffffffff600000      4K --x--  [ anon ]
total                9040K

```

This is text section, 2 Pages

```
0000000000400000      8K r-x-- app
```

These are global from data, 8 pages

```
0000000000601000      4K r---- app
```

```
0000000000602000      4K rw--- app
```

```
0000000000603000     24K rw---  [ anon ]
```

I am not sure about this one. 33 Pages

```
00000000012ad000    132K rw---  [ anon ]
```

Memory map. 256 Pages

```
00007f26d8f04000   1024K rw--- project_file
```

Heap. 257 Pages

```
00007f26d9004000   1028K rw---  [ anon ]
```

From dynamic linked libraries. 1005 Pages in total

```
00007f26d9105000   1948K r-x-- libc-2.27.so
```

```
00007f26d92ec000   2048K ----- libc-2.27.so
```

```
00007f26d94ec000     16K r---- libc-2.27.so
```

```
00007f26d94f0000      8K rw--- libc-2.27.so
```

Presumably heap, 4 Pages

```
00007f26d94f2000     16K rw---  [ anon ]
```

Linked library. 39 Pages

```
00007f26d94f6000    156K r-x-- ld-2.27.so
```

Heap, 261 Pages

```
00007f26d95fb000   1044K rw---  [ anon ]
```

Linked library, 2 Pages

```
00007f26d971d000      4K r---- ld-2.27.so
```

```
00007f26d971e000      4K rw--- ld-2.27.so
```

Heap, 1 Page

```
00007f26d971f000      4K rw---  [ anon ]
```

Stack, 387 Pages

```
00007fff1b287000   1548K rw---  [ stack ]
```

Heap (Presumably), 5 Pages  
00007fff1b5e4000 12K r---- [ anon ]  
00007fff1b5e7000 4K r-x-- [ anon ]  
fffffffffff600000 4K --x-- [ anon ]

Total page number:  
 $9040K / 4K = 2260$

Data section size:  
0000000000601000 4K r---- app  
0000000000602000 4K rw--- app  
0000000000603000 24K rw--- [ anon ]  
00000000012ad000 132K rw--- [ anon ]  
00007f26d9004000 1028K rw--- [ anon ]  
 $(4K + 4K + 24k + 132K + 1028K + 1044K) / 4K = 559$  Pages long.

Text section size:  
0000000000400000 8K r-x-- app  
 $8K / 4K = 2$  Pages long.

## Step 6

Full output is in the appendix. Here is a part of the output.

...  
Address: 4007e0  
Data : 55  
Address: 4007e1  
Data : 48  
Address: 4007e2  
Data : 89  
Address: 4007e3  
Data : e5  
Address: 4007e4  
Data : 5d  
Address: 4007e5  
Data : eb  
Address: 4007e6  
Data : 89  
Address: 4007e7  
Data : 55

```
Address: 4007e8
Data    : 48
Address: 4007e9
Data    : 89
Address: 4007ea
Data    : e5
...
```

The addresses are the same with the objdump addresses.

The program size is 13.4KB normally.

When linked statically, file size becomes 849.4KB. Output of objdumd is 8.2MB in size.

Therefore, it is too large to print here. It has standard library functions in it as well because all funtions used are put into the executable instead of dynamically linking.

## Appendix

### Objdump of App

```
objdump -dx app
```

```
app:      file format elf64-x86-64
app
architecture: i386:x86-64, flags 0x00000112:
EXEC_P, HAS_SYMS, D_PAGED
start address 0x000000000400700

Program Header:
  PHDR off           0x0000000000000040 vaddr 0x000000000400040 paddr 0x000000000400040
align 2**3
  filesz 0x00000000000001f8 memsz 0x00000000000001f8 flags r--
  INTERP off 0x0000000000000238 vaddr 0x000000000400238 paddr 0x000000000400238 align 2**0
  filesz 0x000000000000001c memsz 0x000000000000001c flags r--
  LOAD off           0x0000000000000000 vaddr 0x000000000400000 paddr 0x000000000400000
align 2**21
  filesz 0x0000000000001330 memsz 0x0000000000001330 flags r-x
  LOAD off           0x0000000000001e08 vaddr 0x000000000601e08 paddr 0x000000000601e08
align 2**21
  filesz 0x0000000000000358 memsz 0x00000000000006378 flags rw-
  DYNAMIC off 0x0000000000001e18 vaddr 0x000000000601e18 paddr 0x000000000601e18 align 2**3
  filesz 0x00000000000001d0 memsz 0x00000000000001d0 flags rw-
  NOTE off           0x0000000000000254 vaddr 0x000000000400254 paddr 0x000000000400254
align 2**2
  filesz 0x0000000000000044 memsz 0x0000000000000044 flags r--
EH_FRAME off 0x0000000000001184 vaddr 0x000000000401184 paddr 0x000000000401184 align 2**2
  filesz 0x0000000000000054 memsz 0x0000000000000054 flags r--
  STACK off 0x0000000000000000 vaddr 0x0000000000000000 paddr 0x0000000000000000 align 2**4
  filesz 0x0000000000000000 memsz 0x0000000000000000 flags rw-
  RELRO off 0x0000000000001e08 vaddr 0x000000000601e08 paddr 0x000000000601e08 align 2**0
```

filesz 0x00000000000001f8 memsz 0x00000000000001f8 flags r--

Dynamic Section:

NEEDED	libc.so.6
INIT	0x000000000400628
FINI	0x000000000400de4
INIT_ARRAY	0x000000000601e08
INIT_ARRAYSZ	0x000000000000008
FINI_ARRAY	0x000000000601e10
FINI_ARRAYSZ	0x000000000000008
GNU_HASH	0x000000000400298
STRTAB	0x000000000400410
SYMTAB	0x0000000004002c0
STRSZ	0x000000000000093
SYMENT	0x000000000000018
DEBUG	0x000000000000000
PLTGOT	0x000000000602000
PLTRELSZ	0x0000000000000f0
PLTREL	0x000000000000007
JMPREL	0x000000000400538
RELA	0x0000000004004f0
RELASZ	0x000000000000048
RELAENT	0x000000000000018
VERNEED	0x0000000004004c0
VERNEEDNUM	0x000000000000001
VERSYM	0x0000000004004a4

Version References:

required from libc.so.6:  
0x0d696914 0x00 03 GLIBC\_2.4  
0x09691a75 0x00 02 GLIBC\_2.2.5

Sections:

Idx	Name	Size	VMA	LMA	File off	Algn
0	.interp	0000001c	000000000400238	000000000400238	00000238	2**0
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
1	.note.ABI-tag	00000020	000000000400254	000000000400254	00000254	2**2
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
2	.note.gnu.build-id	00000024	000000000400274	000000000400274	00000274	2**2
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
3	.gnu.hash	00000024	000000000400298	000000000400298	00000298	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
4	.dynsym	00000150	0000000004002c0	0000000004002c0	000002c0	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
5	.dynstr	00000093	000000000400410	000000000400410	00000410	2**0
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
6	.gnu.version	0000001c	0000000004004a4	0000000004004a4	000004a4	2**1
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
7	.gnu.version_r	00000030	0000000004004c0	0000000004004c0	000004c0	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
8	.rela.dyn	00000048	0000000004004f0	0000000004004f0	000004f0	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
9	.rela.plt	000000f0	000000000400538	000000000400538	00000538	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
10	.init	00000017	000000000400628	000000000400628	00000628	2**2
	CONTENTS, ALLOC, LOAD, READONLY, CODE					
11	.plt	000000b0	000000000400640	000000000400640	00000640	2**4

```

CONTENTS, ALLOC, LOAD, READONLY, CODE
12 .plt.got 00000008 00000000004006f0 00000000004006f0 000006f0 2**3
CONTENTS, ALLOC, LOAD, READONLY, CODE
13 .text 000006e2 0000000000400700 0000000000400700 00000700 2**4
CONTENTS, ALLOC, LOAD, READONLY, CODE
14 .fini 00000009 0000000000400de4 0000000000400de4 00000de4 2**2
CONTENTS, ALLOC, LOAD, READONLY, CODE
15 .rodata 00000392 0000000000400df0 0000000000400df0 00000df0 2**3
CONTENTS, ALLOC, LOAD, READONLY, DATA
16 .eh_frame_hdr 00000054 0000000000401184 0000000000401184 00001184 2**2
CONTENTS, ALLOC, LOAD, READONLY, DATA
17 .eh_frame 00000158 00000000004011d8 00000000004011d8 000011d8 2**3
CONTENTS, ALLOC, LOAD, READONLY, DATA
18 .init_array 00000008 0000000000601e08 0000000000601e08 00001e08 2**3
CONTENTS, ALLOC, LOAD, DATA
19 .fini_array 00000008 0000000000601e10 0000000000601e10 00001e10 2**3
CONTENTS, ALLOC, LOAD, DATA
20 .dynamic 000001d0 0000000000601e18 0000000000601e18 00001e18 2**3
CONTENTS, ALLOC, LOAD, DATA
21 .got 00000018 0000000000601fe8 0000000000601fe8 00001fe8 2**3
CONTENTS, ALLOC, LOAD, DATA
22 .got.plt 00000068 0000000000602000 0000000000602000 00002000 2**3
CONTENTS, ALLOC, LOAD, DATA
23 .data 000000e0 0000000000602080 0000000000602080 00002080 2**5
CONTENTS, ALLOC, LOAD, DATA
24 .bss 00006020 0000000000602160 0000000000602160 00002160 2**5
ALLOC
25 .comment 00000029 0000000000000000 0000000000000000 00002160 2**0
CONTENTS, READONLY

```

# SYMBOL TABLE:

```

0000000000400238 1 d .interp 0000000000000000 .interp
0000000000400254 1 d .note.ABI-tag 0000000000000000 .note.ABI-tag
0000000000400274 1 d .note.gnu.build-id 0000000000000000
.note.gnu.build-id
0000000000400298 1 d .gnu.hash 0000000000000000 .gnu.hash
00000000004002c0 1 d .dynsym 0000000000000000 .dynsym
0000000000400410 1 d .dynstr 0000000000000000 .dynstr
00000000004004a4 1 d .gnu.version 0000000000000000 .gnu.version
00000000004004c0 1 d .gnu.version_r 0000000000000000 .gnu.version_r
00000000004004f0 1 d .rela.dyn 0000000000000000 .rela.dyn
0000000000400538 1 d .rela.plt 0000000000000000 .rela.plt
0000000000400628 1 d .init 0000000000000000 .init
0000000000400640 1 d .plt 0000000000000000 .plt
00000000004006f0 1 d .plt.got 0000000000000000 .plt.got
0000000000400700 1 d .text 0000000000000000 .text
0000000000400de4 1 d .fini 0000000000000000 .fini
0000000000400df0 1 d .rodata 0000000000000000 .rodata
0000000000401184 1 d .eh_frame_hdr 0000000000000000 .eh_frame_hdr
00000000004011d8 1 d .eh_frame 0000000000000000 .eh_frame
0000000000601e08 1 d .init_array 0000000000000000 .init_array
0000000000601e10 1 d .fini_array 0000000000000000 .fini_array
0000000000601e18 1 d .dynamic 0000000000000000 .dynamic
0000000000601fe8 1 d .got 0000000000000000 .got
0000000000602000 1 d .got.plt 0000000000000000 .got.plt
0000000000602080 1 d .data 0000000000000000 .data
0000000000602160 1 d .bss 0000000000000000 .bss
0000000000000000 1 d .comment 0000000000000000 .comment

```

0000000000000000	1	df *ABS*	0000000000000000	crtstuff.c
0000000000400740	1	F .text	0000000000000000	deregister_tm_clones
0000000000400770	1	F .text	0000000000000000	register_tm_clones
00000000004007b0	1	F .text	0000000000000000	__do_global_ctors_aux
0000000000602160	1	O .bss	0000000000000001	completed.7698
0000000000601e10	1	O .fini_array	0000000000000000	
__do_global_ctors_aux_fini_array_entry				
00000000004007e0	1	F .text	0000000000000000	frame_dummy
0000000000601e08	1	O .init_array	0000000000000000	
__frame_dummy_init_array_entry				
0000000000000000	1	df *ABS*	0000000000000000	module1.c
0000000000000000	1	df *ABS*	0000000000000000	module2.c
0000000000000000	1	df *ABS*	0000000000000000	module3.c
0000000000000000	1	df *ABS*	0000000000000000	crtstuff.c
000000000040132c	1	O .eh_frame	0000000000000000	__FRAME_END__
0000000000000000	1	df *ABS*	0000000000000000	
0000000000601e10	1	.init_array	0000000000000000	__init_array_end
0000000000601e18	1	O .dynamic	0000000000000000	__DYNAMIC
0000000000601e08	1	.init_array	0000000000000000	__init_array_start
0000000000401184	1	.eh_frame_hdr	0000000000000000	__GNU_EH_FRAME_HDR
0000000000602000	1	O .got.plt	0000000000000000	__GLOBAL_OFFSET_TABLE__
0000000000400de0	g	F .text	0000000000000002	__libc_csu_fini
0000000000000000		F *UND*	0000000000000000	putchar@@GLIBC_2.2.5
0000000000602080	w	.data	0000000000000000	data_start
0000000000000000		F *UND*	0000000000000000	puts@@GLIBC_2.2.5
0000000000400ccf	g	F .text	000000000000007d	factorial
0000000000000000		F *UND*	0000000000000000	write@@GLIBC_2.2.5
0000000000000000		F *UND*	0000000000000000	getpid@@GLIBC_2.2.5
0000000000602160	g	.data	0000000000000000	__edata
0000000000400de4	g	F .fini	0000000000000000	__fini
0000000000000000		F *UND*	0000000000000000	__stack_chk_fail@@GLIBC_2.4
0000000000000000		F *UND*	0000000000000000	mmap@@GLIBC_2.2.5
0000000000000000		F *UND*	0000000000000000	printf@@GLIBC_2.2.5
0000000000606180	g	O .bss	0000000000002000	unutilized2
0000000000000000		F *UND*	0000000000000000	close@@GLIBC_2.2.5
0000000000000000		F *UND*	0000000000000000	
__libc_start_main@@GLIBC_2.2.5				
0000000000400d4c	g	F .text	000000000000001f	nextStep
00000000006020a0	g	O .data	0000000000000080	initData1
0000000000602080	g	.data	0000000000000000	__data_start
0000000000000000		F *UND*	0000000000000000	getchar@@GLIBC_2.2.5
0000000000000000	w	*UND*	0000000000000000	__gmon_start__
0000000000602088	g	O .data	0000000000000000	.hidden __dso_handle
0000000000400df0	g	O .rodata	0000000000000004	__IO_stdin_used
0000000000400d70	g	F .text	0000000000000065	__libc_csu_init
0000000000000000		F *UND*	0000000000000000	malloc@@GLIBC_2.2.5
0000000000608180	g	.bss	0000000000000000	__end
0000000000400730	g	F .text	0000000000000002	.hidden
__dl_relocate_static_pie				
0000000000400700	g	F .text	000000000000002b	__start
0000000000602160	g	.bss	0000000000000000	__bss_start
00000000004007e7	g	F .text	00000000000004e8	main
0000000000000000		F *UND*	0000000000000000	open@@GLIBC_2.2.5
0000000000602180	g	O .bss	0000000000004000	unutilized1
0000000000602160	g	O .data	0000000000000000	.hidden __TMC_END__
0000000000602120	g	O .data	0000000000000040	initData2
0000000000400628	g	F .init	0000000000000000	__init



# Disassembly of section .init:

```

0000000000400628 <_init>:
    400628:  48 83 ec 08      sub    $0x8,%rsp
    40062c:  48 8b 05 c5 19 20 00  mov    0x2019c5(%rip),%rax      # 601ff8
<__gmon_start__>
    400633:  48 85 c0          test   %rax,%rax
    400636:  74 02            je     40063a <_init+0x12>
    400638:  ff d0            callq  *%rax
    40063a:  48 83 c4 08      add    $0x8,%rsp
    40063e:  c3              retq

```

# Disassembly of section .plt:

```

0000000000400640 <.plt>:
    400640:  ff 35 c2 19 20 00  pushq  0x2019c2(%rip)      # 602008
<_GLOBAL_OFFSET_TABLE_+0x8>
    400646:  ff 25 c4 19 20 00  jmpq   *0x2019c4(%rip)    # 602010
<_GLOBAL_OFFSET_TABLE_+0x10>
    40064c:  0f 1f 40 00       nopl   0x0(%rax)

0000000000400650 <putchar@plt>:
    400650:  ff 25 c2 19 20 00  jmpq   *0x2019c2(%rip)    # 602018
<putchar@GLIBC_2.2.5>
    400656:  68 00 00 00 00    pushq  $0x0
    40065b:  e9 e0 ff ff ff    jmpq   400640 <.plt>

0000000000400660 <puts@plt>:
    400660:  ff 25 ba 19 20 00  jmpq   *0x2019ba(%rip)    # 602020 <puts@GLIBC_2.2.5>
    400666:  68 01 00 00 00    pushq  $0x1
    40066b:  e9 d0 ff ff ff    jmpq   400640 <.plt>

0000000000400670 <write@plt>:
    400670:  ff 25 b2 19 20 00  jmpq   *0x2019b2(%rip)    # 602028 <write@GLIBC_2.2.5>
    400676:  68 02 00 00 00    pushq  $0x2
    40067b:  e9 c0 ff ff ff    jmpq   400640 <.plt>

0000000000400680 <getpid@plt>:
    400680:  ff 25 aa 19 20 00  jmpq   *0x2019aa(%rip)    # 602030 <getpid@GLIBC_2.2.5>
    400686:  68 03 00 00 00    pushq  $0x3
    40068b:  e9 b0 ff ff ff    jmpq   400640 <.plt>

0000000000400690 <__stack_chk_fail@plt>:
    400690:  ff 25 a2 19 20 00  jmpq   *0x2019a2(%rip)    # 602038
<__stack_chk_fail@GLIBC_2.4>
    400696:  68 04 00 00 00    pushq  $0x4
    40069b:  e9 a0 ff ff ff    jmpq   400640 <.plt>

00000000004006a0 <mmap@plt>:
    4006a0:  ff 25 9a 19 20 00  jmpq   *0x20199a(%rip)    # 602040 <mmap@GLIBC_2.2.5>
    4006a6:  68 05 00 00 00    pushq  $0x5
    4006ab:  e9 90 ff ff ff    jmpq   400640 <.plt>

00000000004006b0 <close@plt>:

```

```

4006b0: ff 25 92 19 20 00    jmpq    *0x201992(%rip)    # 602048 <close@GLIBC_2.2.5>
4006b6: 68 06 00 00 00      pushq   $0x6
4006bb: e9 80 ff ff ff      jmpq    400640 <.plt>

00000000004006c0 <getchar@plt>:
4006c0: ff 25 8a 19 20 00    jmpq    *0x20198a(%rip)    # 602050
<getchar@GLIBC_2.2.5>
4006c6: 68 07 00 00 00      pushq   $0x7
4006cb: e9 70 ff ff ff      jmpq    400640 <.plt>

00000000004006d0 <malloc@plt>:
4006d0: ff 25 82 19 20 00    jmpq    *0x201982(%rip)    # 602058 <malloc@GLIBC_2.2.5>
4006d6: 68 08 00 00 00      pushq   $0x8
4006db: e9 60 ff ff ff      jmpq    400640 <.plt>

00000000004006e0 <open@plt>:
4006e0: ff 25 7a 19 20 00    jmpq    *0x20197a(%rip)    # 602060 <open@GLIBC_2.2.5>
4006e6: 68 09 00 00 00      pushq   $0x9
4006eb: e9 50 ff ff ff      jmpq    400640 <.plt>

Disassembly of section .plt.got:

00000000004006f0 <printf@plt>:
4006f0: ff 25 f2 18 20 00    jmpq    *0x2018f2(%rip)    # 601fe8 <printf@GLIBC_2.2.5>
4006f6: 66 90               xchg    %ax,%ax

Disassembly of section .text:

0000000000400700 <_start>:
400700: 31 ed               xor     %ebp,%ebp
400702: 49 89 d1            mov     %rdx,%r9
400705: 5e                 pop     %rsi
400706: 48 89 e2            mov     %rsp,%rdx
400709: 48 83 e4 f0         and     $0xfffffffffffffff0,%rsp
40070d: 50                 push    %rax
40070e: 54                 push    %rsp
40070f: 49 c7 c0 e0 0d 40 00 mov     $0x400de0,%r8
400716: 48 c7 c1 70 0d 40 00 mov     $0x400d70,%rcx
40071d: 48 c7 c7 e7 07 40 00 mov     $0x4007e7,%rdi
400724: ff 15 c6 18 20 00    callq   *0x2018c6(%rip)    # 601ff0
<__libc_start_main@GLIBC_2.2.5>
40072a: f4                 hlt
40072b: 0f 1f 44 00 00      nopl    0x0(%rax,%rax,1)

0000000000400730 <_dl_relocate_static_pie>:
400730: f3 c3              repz retq
400732: 66 2e 0f 1f 84 00 00 nopw    %cs:0x0(%rax,%rax,1)
400739: 00 00 00
40073c: 0f 1f 40 00         nopl    0x0(%rax)

0000000000400740 <deregister_tm_clones>:
400740: 55                 push    %rbp
400741: b8 60 21 60 00      mov     $0x602160,%eax
400746: 48 3d 60 21 60 00    cmp     $0x602160,%rax
40074c: 48 89 e5            mov     %rsp,%rbp
40074f: 74 17              je      400768 <deregister_tm_clones+0x28>
400751: b8 00 00 00 00      mov     $0x0,%eax

```

```

400756: 48 85 c0          test    %rax,%rax
400759: 74 0d             je      400768 <deregister_tm_clones+0x28>
40075b: 5d               pop     %rbp
40075c: bf 60 21 60 00   mov     $0x602160,%edi
400761: ff e0            jmpq    *%rax
400763: 0f 1f 44 00 00   nopl    0x0(%rax,%rax,1)
400768: 5d               pop     %rbp
400769: c3               retq
40076a: 66 0f 1f 44 00 00 nopw     0x0(%rax,%rax,1)

0000000000400770 <register_tm_clones>:
400770: be 60 21 60 00   mov     $0x602160,%esi
400775: 55               push    %rbp
400776: 48 81 ee 60 21 60 00 sub     $0x602160,%rsi
40077d: 48 89 e5         mov     %rsp,%rbp
400780: 48 c1 fe 03      sar     $0x3,%rsi
400784: 48 89 f0         mov     %rsi,%rax
400787: 48 c1 e8 3f      shr     $0x3f,%rax
40078b: 48 01 c6         add     %rax,%rsi
40078e: 48 d1 fe         sar     %rsi
400791: 74 15            je      4007a8 <register_tm_clones+0x38>
400793: b8 00 00 00 00   mov     $0x0,%eax
400798: 48 85 c0          test    %rax,%rax
40079b: 74 0b            je      4007a8 <register_tm_clones+0x38>
40079d: 5d               pop     %rbp
40079e: bf 60 21 60 00   mov     $0x602160,%edi
4007a3: ff e0            jmpq    *%rax
4007a5: 0f 1f 00          nopl    (%rax)
4007a8: 5d               pop     %rbp
4007a9: c3               retq
4007aa: 66 0f 1f 44 00 00 nopw     0x0(%rax,%rax,1)

00000000004007b0 <__do_global_dtors_aux>:
4007b0: 80 3d a9 19 20 00 00 cmpb     $0x0,0x2019a9(%rip)          # 602160
<__TMC_END__>
4007b7: 75 17            jne     4007d0 <__do_global_dtors_aux+0x20>
4007b9: 55               push    %rbp
4007ba: 48 89 e5         mov     %rsp,%rbp
4007bd: e8 7e ff ff ff   callq   400740 <deregister_tm_clones>
4007c2: c6 05 97 19 20 00 01 movb     $0x1,0x201997(%rip)          # 602160
<__TMC_END__>
4007c9: 5d               pop     %rbp
4007ca: c3               retq
4007cb: 0f 1f 44 00 00   nopl    0x0(%rax,%rax,1)
4007d0: f3 c3            repz    retq
4007d2: 0f 1f 40 00      nopl    0x0(%rax)
4007d6: 66 2e 0f 1f 84 00 00 nopw     %cs:0x0(%rax,%rax,1)
4007dd: 00 00 00

00000000004007e0 <frame_dummy>:
4007e0: 55               push    %rbp
4007e1: 48 89 e5         mov     %rsp,%rbp
4007e4: 5d               pop     %rbp
4007e5: eb 89            jmp     400770 <register_tm_clones>

00000000004007e7 <main>:
4007e7: 55               push    %rbp

```

```

4007e8: 48 89 e5          mov    %rsp,%rbp
4007eb: 48 83 ec 50       sub    $0x50,%rsp
4007ef: 48 8d 35 02 06 00 00 lea    0x602(%rip),%rsi    # 400df8 <_IO_stdin_used+0x8>
4007f6: 48 8d 3d 0c 06 00 00 lea    0x60c(%rip),%rdi    # 400e09
<_IO_stdin_used+0x19>
4007fd: b8 00 00 00 00    mov    $0x0,%eax
400802: e8 e9 fe ff ff    callq 4006f0 <printf@plt>
400807: 48 8d 05 d9 ff ff ff lea    -0x27(%rip),%rax    # 4007e7 <main>
40080e: 48 89 c2          mov    %rax,%rdx
400811: 48 8d 35 f6 05 00 00 lea    0x5f6(%rip),%rsi    # 400e0e
<_IO_stdin_used+0x1e>
400818: 48 8d 3d 03 06 00 00 lea    0x603(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
40081f: b8 00 00 00 00    mov    $0x0,%eax
400824: e8 c7 fe ff ff    callq 4006f0 <printf@plt>
400829: 48 8d 05 70 18 20 00 lea    0x201870(%rip),%rax    # 6020a0 <initData1>
400830: 48 89 c2          mov    %rax,%rdx
400833: 48 8d 35 f6 05 00 00 lea    0x5f6(%rip),%rsi    # 400e30
<_IO_stdin_used+0x40>
40083a: 48 8d 3d e1 05 00 00 lea    0x5e1(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
400841: b8 00 00 00 00    mov    $0x0,%eax
400846: e8 a5 fe ff ff    callq 4006f0 <printf@plt>
40084b: 48 8d 05 2e 19 20 00 lea    0x20192e(%rip),%rax    # 602180
<unutilized1>
400852: 48 89 c2          mov    %rax,%rdx
400855: 48 8d 35 04 06 00 00 lea    0x604(%rip),%rsi    # 400e60
<_IO_stdin_used+0x70>
40085c: 48 8d 3d bf 05 00 00 lea    0x5bf(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
400863: b8 00 00 00 00    mov    $0x0,%eax
400868: e8 83 fe ff ff    callq 4006f0 <printf@plt>
40086d: 48 8d 05 ac 18 20 00 lea    0x2018ac(%rip),%rax    # 602120 <initData2>
400874: 48 89 c2          mov    %rax,%rdx
400877: 48 8d 35 12 06 00 00 lea    0x612(%rip),%rsi    # 400e90
<_IO_stdin_used+0xa0>
40087e: 48 8d 3d 9d 05 00 00 lea    0x59d(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
400885: b8 00 00 00 00    mov    $0x0,%eax
40088a: e8 61 fe ff ff    callq 4006f0 <printf@plt>
40088f: 48 8d 05 ea 58 20 00 lea    0x2058ea(%rip),%rax    # 606180
<unutilized2>
400896: 48 89 c2          mov    %rax,%rdx
400899: 48 8d 35 20 06 00 00 lea    0x620(%rip),%rsi    # 400ec0
<_IO_stdin_used+0xd0>
4008a0: 48 8d 3d 7b 05 00 00 lea    0x57b(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
4008a7: b8 00 00 00 00    mov    $0x0,%eax
4008ac: e8 3f fe ff ff    callq 4006f0 <printf@plt>
4008b1: 48 c7 c0 4c 0d 40 00 mov    $0x400d4c,%rax
4008b8: 48 89 c2          mov    %rax,%rdx
4008bb: 48 8d 35 26 06 00 00 lea    0x626(%rip),%rsi    # 400ee8
<_IO_stdin_used+0xf8>
4008c2: 48 8d 3d 59 05 00 00 lea    0x559(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
4008c9: b8 00 00 00 00    mov    $0x0,%eax
4008ce: e8 1d fe ff ff    callq 4006f0 <printf@plt>

```

```

4008d3: 48 c7 c0 cf 0c 40 00    mov     $0x400ccf,%rax
4008da: 48 89 c2                mov     %rax,%rdx
4008dd: 48 8d 35 2c 06 00 00    lea     0x62c(%rip),%rsi        # 400f10
<_IO_stdin_used+0x120>
4008e4: 48 8d 3d 37 05 00 00    lea     0x537(%rip),%rdi        # 400e22
<_IO_stdin_used+0x32>
4008eb: b8 00 00 00 00          mov     $0x0,%eax
4008f0: e8 fb fd ff ff          callq   4006f0 <printf@plt>
4008f5: 48 8b 05 ec 16 20 00    mov     0x2016ec(%rip),%rax      # 601fe8
<printf@GLIBC_2.2.5>
4008fc: 48 89 c2                mov     %rax,%rdx
4008ff: 48 8d 35 32 06 00 00    lea     0x632(%rip),%rsi        # 400f38
<_IO_stdin_used+0x148>
400906: 48 8d 3d 15 05 00 00    lea     0x515(%rip),%rdi        # 400e22
<_IO_stdin_used+0x32>
40090d: b8 00 00 00 00          mov     $0x0,%eax
400912: e8 d9 fd ff ff          callq   4006f0 <printf@plt>
400917: e8 64 fd ff ff          callq   400680 <getpid@plt>
40091c: 89 c2                    mov     %eax,%edx
40091e: 48 8d 35 33 06 00 00    lea     0x633(%rip),%rsi        # 400f58
<_IO_stdin_used+0x168>
400925: 48 8d 3d 3a 06 00 00    lea     0x63a(%rip),%rdi        # 400f66
<_IO_stdin_used+0x176>
40092c: b8 00 00 00 00          mov     $0x0,%eax
400931: e8 ba fd ff ff          callq   4006f0 <printf@plt>
400936: b8 00 00 00 00          mov     $0x0,%eax
40093b: e8 0c 04 00 00          callq   400d4c <nextStep>
400940: 48 8d 35 25 06 00 00    lea     0x625(%rip),%rsi        # 400f6c
<_IO_stdin_used+0x17c>
400947: 48 8d 3d bb 04 00 00    lea     0x4bb(%rip),%rdi        # 400e09
<_IO_stdin_used+0x19>
40094e: b8 00 00 00 00          mov     $0x0,%eax
400953: e8 98 fd ff ff          callq   4006f0 <printf@plt>
400958: bf 00 00 08 00          mov     $0x80000,%edi
40095d: e8 6e fd ff ff          callq   4006d0 <malloc@plt>
400962: 48 89 45 d0              mov     %rax,-0x30(%rbp)
400966: bf 00 00 04 00          mov     $0x40000,%edi
40096b: e8 60 fd ff ff          callq   4006d0 <malloc@plt>
400970: 48 89 45 d8              mov     %rax,-0x28(%rbp)
400974: bf 00 00 04 00          mov     $0x40000,%edi
400979: e8 52 fd ff ff          callq   4006d0 <malloc@plt>
40097e: 48 89 45 e0              mov     %rax,-0x20(%rbp)
400982: bf 00 00 10 00          mov     $0x100000,%edi
400987: e8 44 fd ff ff          callq   4006d0 <malloc@plt>
40098c: 48 89 45 e8              mov     %rax,-0x18(%rbp)
400990: 48 8b 45 d0              mov     -0x30(%rbp),%rax
400994: 48 89 c2                mov     %rax,%rdx
400997: 48 8d 35 df 05 00 00    lea     0x5df(%rip),%rsi        # 400f7d
<_IO_stdin_used+0x18d>
40099e: 48 8d 3d 7d 04 00 00    lea     0x47d(%rip),%rdi        # 400e22
<_IO_stdin_used+0x32>
4009a5: b8 00 00 00 00          mov     $0x0,%eax
4009aa: e8 41 fd ff ff          callq   4006f0 <printf@plt>
4009af: 48 8b 45 d8              mov     -0x28(%rbp),%rax
4009b3: 48 89 c2                mov     %rax,%rdx
4009b6: 48 8d 35 d8 05 00 00    lea     0x5d8(%rip),%rsi        # 400f95
<_IO_stdin_used+0x1a5>

```

```

    4009bd:    48 8d 3d 5e 04 00 00    lea    0x45e(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
    4009c4:    b8 00 00 00 00 00      mov     $0x0,%eax
    4009c9:    e8 22 fd ff ff        callq   4006f0 <printf@plt>
    4009ce:    48 8b 45 e0          mov     -0x20(%rbp),%rax
    4009d2:    48 89 c2            mov     %rax,%rdx
    4009d5:    48 8d 35 d1 05 00 00    lea     0x5d1(%rip),%rsi    # 400fad
<_IO_stdin_used+0x1bd>
    4009dc:    48 8d 3d 3f 04 00 00    lea     0x43f(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
    4009e3:    b8 00 00 00 00 00      mov     $0x0,%eax
    4009e8:    e8 03 fd ff ff        callq   4006f0 <printf@plt>
    4009ed:    48 8b 45 e8          mov     -0x18(%rbp),%rax
    4009f1:    48 89 c2            mov     %rax,%rdx
    4009f4:    48 8d 35 ca 05 00 00    lea     0x5ca(%rip),%rsi    # 400fc5
<_IO_stdin_used+0x1d5>
    4009fb:    48 8d 3d 20 04 00 00    lea     0x420(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
    400a02:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a07:    e8 e4 fc ff ff        callq   4006f0 <printf@plt>
    400a0c:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a11:    e8 36 03 00 00        callq   400d4c <nextStep>
    400a16:    48 8d 35 c0 05 00 00    lea     0x5c0(%rip),%rsi    # 400fdd
<_IO_stdin_used+0x1ed>
    400a1d:    48 8d 3d e5 03 00 00    lea     0x3e5(%rip),%rdi    # 400e09
<_IO_stdin_used+0x19>
    400a24:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a29:    e8 c2 fc ff ff        callq   4006f0 <printf@plt>
    400a2e:    bf 00 80 00 00 00      mov     $0x8000,%edi
    400a33:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a38:    e8 92 02 00 00        callq   400ccf <factorial>
    400a3d:    89 c2            mov     %eax,%edx
    400a3f:    48 8d 35 a8 05 00 00    lea     0x5a8(%rip),%rsi    # 400fee
<_IO_stdin_used+0x1fe>
    400a46:    48 8d 3d 19 05 00 00    lea     0x519(%rip),%rdi    # 400f66
<_IO_stdin_used+0x176>
    400a4d:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a52:    e8 99 fc ff ff        callq   4006f0 <printf@plt>
    400a57:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a5c:    e8 eb 02 00 00        callq   400d4c <nextStep>
    400a61:    48 8d 35 8d 05 00 00    lea     0x58d(%rip),%rsi    # 400ff5
<_IO_stdin_used+0x205>
    400a68:    48 8d 3d 9a 03 00 00    lea     0x39a(%rip),%rdi    # 400e09
<_IO_stdin_used+0x19>
    400a6f:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a74:    e8 77 fc ff ff        callq   4006f0 <printf@plt>
    400a79:    48 8d 3d 86 05 00 00    lea     0x586(%rip),%rdi    # 401006
<_IO_stdin_used+0x216>
    400a80:    e8 db fb ff ff        callq   400660 <puts@plt>
    400a85:    ba 80 01 00 00      mov     $0x180,%edx
    400a8a:    be 42 00 00 00      mov     $0x42,%esi
    400a8f:    48 8d 3d 7f 05 00 00    lea     0x57f(%rip),%rdi    # 401015
<_IO_stdin_used+0x225>
    400a96:    b8 00 00 00 00 00      mov     $0x0,%eax
    400a9b:    e8 40 fc ff ff        callq   4006e0 <open@plt>
    400aa0:    89 45 cc            mov     %eax,-0x34(%rbp)

```

```

400aa3: 48 8d 3d 7e 05 00 00    lea    0x57e(%rip),%rdi    # 401028
<_IO_stdin_used+0x238>
400aaa: e8 b1 fb ff ff          callq  400660 <puts@plt>
400aaf: c7 45 b8 00 00 00 00    movl   $0x0,-0x48(%rbp)
400ab6: eb 1a                    jmp     400ad2 <main+0x2eb>
400ab8: 8b 45 cc                  mov     -0x34(%rbp),%eax
400abb: ba 20 00 00 00          mov     $0x20,%edx
400ac0: 48 8d 35 89 05 00 00    lea     0x589(%rip),%rsi    # 401050
<_IO_stdin_used+0x260>
400ac7: 89 c7                    mov     %eax,%edi
400ac9: e8 a2 fb ff ff          callq  400670 <write@plt>
400ace: 83 45 b8 01              addl    $0x1,-0x48(%rbp)
400ad2: 81 7d b8 ff 7f 00 00    cmpl    $0x7fff,-0x48(%rbp)
400ad9: 7e dd                    jle     400ab8 <main+0x2d1>
400adb: 48 8d 3d 96 05 00 00    lea     0x596(%rip),%rdi    # 401078
<_IO_stdin_used+0x288>
400ae2: e8 79 fb ff ff          callq  400660 <puts@plt>
400ae7: 8b 45 cc                  mov     -0x34(%rbp),%eax
400aea: 41 b9 00 00 00 00 00    mov     $0x0,%r9d
400af0: 41 89 c0                  mov     %eax,%r8d
400af3: b9 02 00 00 00 00      mov     $0x2,%ecx
400af8: ba 03 00 00 00 00      mov     $0x3,%edx
400afd: be 00 00 10 00          mov     $0x100000,%esi
400b02: bf 00 00 00 00          mov     $0x0,%edi
400b07: e8 94 fb ff ff          callq  4006a0 <mmap@plt>
400b0c: 48 89 45 f0              mov     %rax,-0x10(%rbp)
400b10: 48 8b 45 f0              mov     -0x10(%rbp),%rax
400b14: 48 89 c2                  mov     %rax,%rdx
400b17: 48 8d 35 79 05 00 00    lea     0x579(%rip),%rsi    # 401097
<_IO_stdin_used+0x2a7>
400b1e: 48 8d 3d fd 02 00 00    lea     0x2fd(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
400b25: b8 00 00 00 00 00      mov     $0x0,%eax
400b2a: e8 c1 fb ff ff          callq  4006f0 <printf@plt>
400b2f: b8 00 00 00 00 00      mov     $0x0,%eax
400b34: e8 13 02 00 00          callq  400d4c <nextStep>
400b39: 48 8d 35 6f 05 00 00    lea     0x56f(%rip),%rsi    # 4010af
<_IO_stdin_used+0x2bf>
400b40: 48 8d 3d c2 02 00 00    lea     0x2c2(%rip),%rdi    # 400e09
<_IO_stdin_used+0x19>
400b47: b8 00 00 00 00 00      mov     $0x0,%eax
400b4c: e8 9f fb ff ff          callq  4006f0 <printf@plt>
400b51: c7 45 bc 00 00 00 00    movl    $0x0,-0x44(%rbp)
400b58: eb 26                    jmp     400b80 <main+0x399>
400b5a: 8b 45 bc                  mov     -0x44(%rbp),%eax
400b5d: 99                        cld
400b5e: c1 ea 19                  shr     $0x19,%edx
400b61: 01 d0                    add     %edx,%eax
400b63: 83 e0 7f                  and     $0x7f,%eax
400b66: 29 d0                    sub     %edx,%eax
400b68: 8d 48 28                  lea     0x28(%rax),%ecx
400b6b: 8b 45 bc                  mov     -0x44(%rbp),%eax
400b6e: 48 63 d0                  movslq  %eax,%rdx
400b71: 48 8b 45 f0              mov     -0x10(%rbp),%rax
400b75: 48 01 d0                  add     %rdx,%rax
400b78: 89 ca                    mov     %ecx,%edx
400b7a: 88 10                    mov     %dl,(%rax)

```

```

400b7c: 83 45 bc 01      addl    $0x1,-0x44(%rbp)
400b80: 81 7d bc ff ff 07 00    cmpl    $0x7ffff,-0x44(%rbp)
400b87: 7e d1            jle     400b5a <main+0x373>
400b89: 48 8d 3d 30 05 00 00    lea     0x530(%rip),%rdi        # 4010c0
<_IO_stdin_used+0x2d0>
400b90: e8 cb fa ff ff      callq   400660 <puts@plt>
400b95: c7 45 c0 00 00 00 00    movl    $0x0,-0x40(%rbp)
400b9c: eb 1e            jmp     400bbc <main+0x3d5>
400b9e: 8b 45 c0          mov     -0x40(%rbp),%eax
400ba1: 48 63 d0          movslq  %eax,%rdx
400ba4: 48 8b 45 f0       mov     -0x10(%rbp),%rax
400ba8: 48 01 d0          add     %rdx,%rax
400bab: 0f b6 00          movzbl  (%rax),%eax
400bae: 0f be c0          movsbl  %al,%eax
400bb1: 89 c7            mov     %eax,%edi
400bb3: e8 98 fa ff ff      callq   400650 <putchar@plt>
400bb8: 83 45 c0 01       addl    $0x1,-0x40(%rbp)
400bbc: 83 7d c0 3f       cmpl    $0x3f,-0x40(%rbp)
400bc0: 7e dc            jle     400b9e <main+0x3b7>
400bc2: 48 8d 35 27 05 00 00    lea     0x527(%rip),%rsi        # 4010f0
<_IO_stdin_used+0x300>
400bc9: 48 8d 3d 4d 05 00 00    lea     0x54d(%rip),%rdi        # 40111d
<_IO_stdin_used+0x32d>
400bd0: b8 00 00 00 00      mov     $0x0,%eax
400bd5: e8 16 fb ff ff      callq   4006f0 <printf@plt>
400bda: c7 45 c4 c0 ff 0f 00    movl    $0xffffc0,-0x3c(%rbp)
400bel: eb 1e            jmp     400c01 <main+0x41a>
400be3: 8b 45 c4          mov     -0x3c(%rbp),%eax
400be6: 48 63 d0          movslq  %eax,%rdx
400be9: 48 8b 45 f0       mov     -0x10(%rbp),%rax
400bed: 48 01 d0          add     %rdx,%rax
400bf0: 0f b6 00          movzbl  (%rax),%eax
400bf3: 0f be c0          movsbl  %al,%eax
400bf6: 89 c7            mov     %eax,%edi
400bf8: e8 53 fa ff ff      callq   400650 <putchar@plt>
400bfd: 83 45 c4 01       addl    $0x1,-0x3c(%rbp)
400c01: 81 7d c4 ff ff 0f 00    cmpl    $0xfffff,-0x3c(%rbp)
400c08: 7e d9            jle     400be3 <main+0x3fc>
400c0a: 8b 45 cc          mov     -0x34(%rbp),%eax
400c0d: 89 c7            mov     %eax,%edi
400c0f: e8 9c fa ff ff      callq   4006b0 <close@plt>
400c14: b8 00 00 00 00      mov     $0x0,%eax
400c19: e8 2e 01 00 00      callq   400d4c <nextStep>
400cle: 48 8d 35 fd 04 00 00    lea     0x4fd(%rip),%rsi        # 401122
<_IO_stdin_used+0x332>
400c25: 48 8d 3d dd 01 00 00    lea     0x1dd(%rip),%rdi        # 400e09
<_IO_stdin_used+0x19>
400c2c: b8 00 00 00 00      mov     $0x0,%eax
400c31: e8 ba fa ff ff      callq   4006f0 <printf@plt>
400c36: 48 8d 05 aa fb ff ff    lea     -0x456(%rip),%rax        # 4007e7 <main>
400c3d: 48 25 00 f0 ff ff      and     $0xffffffffffffffff000,%rax
400c43: 48 89 45 f8       mov     %rax,-0x8(%rbp)
400c47: c7 45 c8 00 00 00 00    movl    $0x0,-0x38(%rbp)
400c4e: eb 59            jmp     400ca9 <main+0x4c2>
400c50: 8b 45 c8          mov     -0x38(%rbp),%eax
400c53: 48 63 d0          movslq  %eax,%rdx
400c56: 48 8b 45 f8       mov     -0x8(%rbp),%rax

```



```

400c5a: 48 01 d0          add    %rdx,%rax
400c5d: 48 89 c2          mov    %rax,%rdx
400c60: 48 8d 35 cc 04 00 00 lea    0x4cc(%rip),%rsi    # 401133
<_IO_stdin_used+0x343>
400c67: 48 8d 3d b4 01 00 00 lea    0x1b4(%rip),%rdi    # 400e22
<_IO_stdin_used+0x32>
400c6e: b8 00 00 00 00    mov    $0x0,%eax
400c73: e8 78 fa ff ff    callq 4006f0 <printf@plt>
400c78: 8b 45 c8          mov    -0x38(%rbp),%eax
400c7b: 48 63 d0          movslq %eax,%rdx
400c7e: 48 8b 45 f8       mov    -0x8(%rbp),%rax
400c82: 48 01 d0          add    %rdx,%rax
400c85: 0f b6 00          movzbl (%rax),%eax
400c88: 0f b6 c0          movzbl %al,%eax
400c8b: 89 c2            mov    %eax,%edx
400c8d: 48 8d 35 a9 04 00 00 lea    0x4a9(%rip),%rsi    # 40113d
<_IO_stdin_used+0x34d>
400c94: 48 8d 3d ac 04 00 00 lea    0x4ac(%rip),%rdi    # 401147
<_IO_stdin_used+0x357>
400c9b: b8 00 00 00 00    mov    $0x0,%eax
400ca0: e8 4b fa ff ff    callq 4006f0 <printf@plt>
400ca5: 83 45 c8 01       addl   $0x1,-0x38(%rbp)
400ca9: 81 7d c8 ff 0f 00 00 cmpl   $0xffff,-0x38(%rbp)
400cb0: 7e 9e            jle    400c50 <main+0x469>
400cb2: 48 8d 3d 96 04 00 00 lea    0x496(%rip),%rdi    # 40114f
<_IO_stdin_used+0x35f>
400cb9: e8 a2 f9 ff ff    callq 400660 <puts@plt>
400cbe: b8 00 00 00 00    mov    $0x0,%eax
400cc3: e8 84 00 00 00    callq 400d4c <nextStep>
400cc8: b8 00 00 00 00    mov    $0x0,%eax
400ccd: c9              leaveq
400cce: c3              retq

0000000000400ccf <factorial>:
400ccf: 55              push   %rbp
400cd0: 48 89 e5        mov    %rsp,%rbp
400cd3: 48 83 ec 20     sub    $0x20,%rsp
400cd7: 89 7d ec        mov    %edi,-0x14(%rbp)
400cda: 64 48 8b 04 25 28 00 mov    %fs:0x28,%rax
400ce1: 00 00
400ce3: 48 89 45 f8     mov    %rax,-0x8(%rbp)
400ce7: 31 c0           xor    %eax,%eax
400ce9: 83 7d ec 00     cmpl   $0x0,-0x14(%rbp)
400ced: 75 07           jne    400cf6 <factorial+0x27>
400cef: b8 01 00 00 00    mov    $0x1,%eax
400cf4: eb 40           jmp    400d36 <factorial+0x67>
400cf6: 83 7d ec 0f     cmpl   $0xf,-0x14(%rbp)
400cfa: 7f 1f           jg     400d1b <factorial+0x4c>
400cfc: 48 8d 45 f0     lea    -0x10(%rbp),%rax
400d00: 48 89 c2        mov    %rax,%rdx
400d03: 48 8d 35 55 04 00 00 lea    0x455(%rip),%rsi    # 40115f
<_IO_stdin_used+0x36f>
400d0a: 48 8d 3d 6a 04 00 00 lea    0x46a(%rip),%rdi    # 40117b
<_IO_stdin_used+0x38b>
400d11: b8 00 00 00 00    mov    $0x0,%eax
400d16: e8 d5 f9 ff ff    callq 4006f0 <printf@plt>
400d1b: 8b 45 ec        mov    -0x14(%rbp),%eax

```

```

400d1e: 83 e8 01          sub    $0x1,%eax
400d21: 89 c7             mov    %eax,%edi
400d23: e8 a7 ff ff ff   callq 400ccf <factorial>
400d28: 89 c2             mov    %eax,%edx
400d2a: 8b 45 ec          mov    -0x14(%rbp),%eax
400d2d: 0f af c2          imul   %edx,%eax
400d30: 89 45 f4          mov    %eax,-0xc(%rbp)
400d33: 8b 45 f4          mov    -0xc(%rbp),%eax
400d36: 48 8b 4d f8       mov    -0x8(%rbp),%rcx
400d3a: 64 48 33 0c 25 28 00 xor    %fs:0x28,%rcx
400d41: 00 00
400d43: 74 05             je     400d4a <factorial+0x7b>
400d45: e8 46 f9 ff ff   callq 400690 <__stack_chk_fail@plt>
400d4a: c9               leaveq
400d4b: c3               retq

0000000000400d4c <nextStep>:
400d4c: 55               push   %rbp
400d4d: 48 89 e5          mov    %rsp,%rbp
400d50: 48 83 ec 10       sub    $0x10,%rsp
400d54: c6 45 ff 20       movb   $0x20,-0x1(%rbp)
400d58: eb 08             jmp    400d62 <nextStep+0x16>
400d5a: e8 61 f9 ff ff   callq 4006c0 <getchar@plt>
400d5f: 88 45 ff          mov    %al,-0x1(%rbp)
400d62: 80 7d ff 6e       cmpb   $0x6e,-0x1(%rbp)
400d66: 75 f2             jne    400d5a <nextStep+0xe>
400d68: 90               nop
400d69: c9               leaveq
400d6a: c3               retq
400d6b: 0f 1f 44 00 00   nopl   0x0(%rax,%rax,1)

0000000000400d70 <__libc_csu_init>:
400d70: 41 57             push   %r15
400d72: 41 56             push   %r14
400d74: 49 89 d7          mov    %rdx,%r15
400d77: 41 55             push   %r13
400d79: 41 54             push   %r12
400d7b: 4c 8d 25 86 10 20 00 lea     0x201086(%rip),%r12          # 601e08
<__frame_dummy_init_array_entry>
400d82: 55               push   %rbp
400d83: 48 8d 2d 86 10 20 00 lea     0x201086(%rip),%rbp          # 601e10
<__init_array_end>
400d8a: 53               push   %rbx
400d8b: 41 89 fd          mov    %edi,%r13d
400d8e: 49 89 f6          mov    %rsi,%r14
400d91: 4c 29 e5          sub    %r12,%rbp
400d94: 48 83 ec 08       sub    $0x8,%rsp
400d98: 48 c1 fd 03       sar    $0x3,%rbp
400d9c: e8 87 f8 ff ff   callq 400628 <_init>
400da1: 48 85 ed          test   %rbp,%rbp
400da4: 74 20             je     400dc6 <__libc_csu_init+0x56>
400da6: 31 db             xor    %ebx,%ebx
400da8: 0f 1f 84 00 00 00 00 nopl   0x0(%rax,%rax,1)
400daf: 00
400db0: 4c 89 fa          mov    %r15,%rdx
400db3: 4c 89 f6          mov    %r14,%rsi
400db6: 44 89 ef          mov    %r13d,%edi

```

```

400db9:  41 ff 14 dc      callq  *(%r12,%rbx,8)
400dbd:  48 83 c3 01      add    $0x1,%rbx
400dc1:  48 39 dd         cmp    %rbx,%rbp
400dc4:  75 ea           jne    400db0 <__libc_csu_init+0x40>
400dc6:  48 83 c4 08      add    $0x8,%rsp
400dca:  5b             pop    %rbx
400dcb:  5d             pop    %rbp
400dcc:  41 5c           pop    %r12
400dce:  41 5d           pop    %r13
400dd0:  41 5e           pop    %r14
400dd2:  41 5f           pop    %r15
400dd4:  c3             retq
400dd5:  90             nop
400dd6:  66 2e 0f 1f 84 00 00      nopw   %cs:0x0(%rax,%rax,1)
400ddd:  00 00 00

```

0000000000400de0 <\_\_libc\_csu\_fini>:

```

400de0:  f3 c3          repz retq

```

Disassembly of section .fini:

```

0000000000400de4 <_fini>:
400de4:  48 83 ec 08      sub    $0x8,%rsp
400de8:  48 83 c4 08      add    $0x8,%rsp
400dec:  c3             retq

```

## Objdump of Module1

```

module1.o:      file format elf64-x86-64
module1.o
architecture: i386:x86-64, flags 0x00000011:
HAS_RELOC, HAS_SYMS
start address 0x0000000000000000

```

Sections:

Idx	Name	Size	VMA	LMA	File off	Algn
0	.text	000004e8	0000000000000000	0000000000000000	00000040	2**0
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE					
1	.data	00000000	0000000000000000	0000000000000000	00000528	2**0
	CONTENTS, ALLOC, LOAD, DATA					
2	.bss	00000000	0000000000000000	0000000000000000	00000528	2**0
	ALLOC					
3	.rodata	00000367	0000000000000000	0000000000000000	00000528	2**3
	CONTENTS, ALLOC, LOAD, READONLY, DATA					
4	.comment	0000002a	0000000000000000	0000000000000000	0000088f	2**0
	CONTENTS, READONLY					
5	.note.GNU-stack	00000000	0000000000000000	0000000000000000	000008b9	2**0
	CONTENTS, READONLY					
6	.eh_frame	00000038	0000000000000000	0000000000000000	000008c0	2**3
	CONTENTS, ALLOC, LOAD, RELOC, READONLY, DATA					

SYMBOL TABLE:

```

0000000000000000 1      df *ABS*      0000000000000000 module1.c
0000000000000000 1      d  .text      0000000000000000 .text
0000000000000000 1      d  .data      0000000000000000 .data

```

```

0000000000000000 1 d .bss 0000000000000000 .bss
0000000000000000 1 d .rodata 0000000000000000 .rodata
0000000000000000 1 d .note.GNU-stack 0000000000000000 .note.GNU-stack
0000000000000000 1 d .eh_frame 0000000000000000 .eh_frame
0000000000000000 1 d .comment 0000000000000000 .comment
0000000000000000 g F .text 00000000000004e8 main
0000000000000000 *UND* 0000000000000000 _GLOBAL_OFFSET_TABLE_
0000000000000000 *UND* 0000000000000000 printf
0000000000000000 *UND* 0000000000000000 initData1
0000000000000000 *UND* 0000000000000000 uninitialized1
0000000000000000 *UND* 0000000000000000 initData2
0000000000000000 *UND* 0000000000000000 uninitialized2
0000000000000000 *UND* 0000000000000000 nextStep
0000000000000000 *UND* 0000000000000000 factorial
0000000000000000 *UND* 0000000000000000 getpid
0000000000000000 *UND* 0000000000000000 malloc
0000000000000000 *UND* 0000000000000000 puts
0000000000000000 *UND* 0000000000000000 open
0000000000000000 *UND* 0000000000000000 write
0000000000000000 *UND* 0000000000000000 mmap
0000000000000000 *UND* 0000000000000000 putchar
0000000000000000 *UND* 0000000000000000 close

```

Disassembly of section .text:

0000000000000000 <main>:

```

0: 55 push %rbp
1: 48 89 e5 mov %rsp,%rbp
4: 48 83 ec 50 sub $0x50,%rsp
8: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # f <main+0xf>
   b: R_X86_64_PC32 .rodata-0x4
f: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 16 <main+0x16>
   12: R_X86_64_PC32 .rodata+0xd
16: b8 00 00 00 00 mov $0x0,%eax
1b: e8 00 00 00 00 callq 20 <main+0x20>
   1c: R_X86_64_PLT32 printf-0x4
20: 48 8d 05 00 00 00 00 lea 0x0(%rip),%rax # 27 <main+0x27>
   23: R_X86_64_PC32 main-0x4
27: 48 89 c2 mov %rax,%rdx
2a: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 31 <main+0x31>
   2d: R_X86_64_PC32 .rodata+0x12
31: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 38 <main+0x38>
   34: R_X86_64_PC32 .rodata+0x26
38: b8 00 00 00 00 mov $0x0,%eax
3d: e8 00 00 00 00 callq 42 <main+0x42>
   3e: R_X86_64_PLT32 printf-0x4
42: 48 8d 05 00 00 00 00 lea 0x0(%rip),%rax # 49 <main+0x49>
   45: R_X86_64_PC32 initData1-0x4
49: 48 89 c2 mov %rax,%rdx
4c: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 53 <main+0x53>
   4f: R_X86_64_PC32 .rodata+0x34
53: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 5a <main+0x5a>
   56: R_X86_64_PC32 .rodata+0x26
5a: b8 00 00 00 00 mov $0x0,%eax
5f: e8 00 00 00 00 callq 64 <main+0x64>

```

```

        60: R_X86_64_PLT32    printf-0x4
64:  48 8d 05 00 00 00 00    lea     0x0(%rip),%rax      # 6b <main+0x6b>
        67: R_X86_64_PC32    unutilized1-0x4
6b:  48 89 c2                mov     %rax,%rdx
6e:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # 75 <main+0x75>
        71: R_X86_64_PC32    .rodata+0x64
75:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # 7c <main+0x7c>
        78: R_X86_64_PC32    .rodata+0x26
7c:  b8 00 00 00 00          mov     $0x0,%eax
81:  e8 00 00 00 00          callq   86 <main+0x86>
        82: R_X86_64_PLT32    printf-0x4
86:  48 8d 05 00 00 00 00    lea     0x0(%rip),%rax      # 8d <main+0x8d>
        89: R_X86_64_PC32    initData2-0x4
8d:  48 89 c2                mov     %rax,%rdx
90:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # 97 <main+0x97>
        93: R_X86_64_PC32    .rodata+0x94
97:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # 9e <main+0x9e>
        9a: R_X86_64_PC32    .rodata+0x26
9e:  b8 00 00 00 00          mov     $0x0,%eax
a3:  e8 00 00 00 00          callq   a8 <main+0xa8>
        a4: R_X86_64_PLT32    printf-0x4
a8:  48 8d 05 00 00 00 00    lea     0x0(%rip),%rax      # af <main+0xaf>
        ab: R_X86_64_PC32    unutilized2-0x4
af:  48 89 c2                mov     %rax,%rdx
b2:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # b9 <main+0xb9>
        b5: R_X86_64_PC32    .rodata+0xc4
b9:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # c0 <main+0xc0>
        bc: R_X86_64_PC32    .rodata+0x26
c0:  b8 00 00 00 00          mov     $0x0,%eax
c5:  e8 00 00 00 00          callq   ca <main+0xca>
        c6: R_X86_64_PLT32    printf-0x4
ca:  48 8b 05 00 00 00 00    mov     0x0(%rip),%rax      # d1 <main+0xd1>
        cd: R_X86_64_REX_GOTPCRELX    nextStep-0x4
d1:  48 89 c2                mov     %rax,%rdx
d4:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # db <main+0xdb>
        d7: R_X86_64_PC32    .rodata+0xec
db:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # e2 <main+0xe2>
        de: R_X86_64_PC32    .rodata+0x26
e2:  b8 00 00 00 00          mov     $0x0,%eax
e7:  e8 00 00 00 00          callq   ec <main+0xec>
        e8: R_X86_64_PLT32    printf-0x4
ec:  48 8b 05 00 00 00 00    mov     0x0(%rip),%rax      # f3 <main+0xf3>
        ef: R_X86_64_REX_GOTPCRELX    factorial-0x4
f3:  48 89 c2                mov     %rax,%rdx
f6:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # fd <main+0xfd>
        f9: R_X86_64_PC32    .rodata+0x114
fd:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # 104 <main+0x104>
        100: R_X86_64_PC32    .rodata+0x26
104:  b8 00 00 00 00          mov     $0x0,%eax
109:  e8 00 00 00 00          callq   10e <main+0x10e>
        10a: R_X86_64_PLT32    printf-0x4
10e:  48 8b 05 00 00 00 00    mov     0x0(%rip),%rax      # 115 <main+0x115>
        111: R_X86_64_REX_GOTPCRELX    printf-0x4
115:  48 89 c2                mov     %rax,%rdx
118:  48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi      # 11f <main+0x11f>
        11b: R_X86_64_PC32    .rodata+0x13c
11f:  48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi      # 126 <main+0x126>

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122: R_X86_64_PC32 .rodata+0x26
126: b8 00 00 00 00 mov $0x0,%eax
12b: e8 00 00 00 00 callq 130 <main+0x130>
12c: R_X86_64_PLT32 printf-0x4
130: e8 00 00 00 00 callq 135 <main+0x135>
131: R_X86_64_PLT32 getpid-0x4
135: 89 c2 mov %eax,%edx
137: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 13e <main+0x13e>
13a: R_X86_64_PC32 .rodata+0x15c
13e: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 145 <main+0x145>
141: R_X86_64_PC32 .rodata+0x16a
145: b8 00 00 00 00 mov $0x0,%eax
14a: e8 00 00 00 00 callq 14f <main+0x14f>
14b: R_X86_64_PLT32 printf-0x4
14f: b8 00 00 00 00 mov $0x0,%eax
154: e8 00 00 00 00 callq 159 <main+0x159>
155: R_X86_64_PLT32 nextStep-0x4
159: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 160 <main+0x160>
15c: R_X86_64_PC32 .rodata+0x170
160: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 167 <main+0x167>
163: R_X86_64_PC32 .rodata+0xd
167: b8 00 00 00 00 mov $0x0,%eax
16c: e8 00 00 00 00 callq 171 <main+0x171>
16d: R_X86_64_PLT32 printf-0x4
171: bf 00 00 08 00 mov $0x80000,%edi
176: e8 00 00 00 00 callq 17b <main+0x17b>
177: R_X86_64_PLT32 malloc-0x4
17b: 48 89 45 d0 mov %rax,-0x30(%rbp)
17f: bf 00 00 04 00 mov $0x40000,%edi
184: e8 00 00 00 00 callq 189 <main+0x189>
185: R_X86_64_PLT32 malloc-0x4
189: 48 89 45 d8 mov %rax,-0x28(%rbp)
18d: bf 00 00 04 00 mov $0x40000,%edi
192: e8 00 00 00 00 callq 197 <main+0x197>
193: R_X86_64_PLT32 malloc-0x4
197: 48 89 45 e0 mov %rax,-0x20(%rbp)
19b: bf 00 00 10 00 mov $0x100000,%edi
1a0: e8 00 00 00 00 callq 1a5 <main+0x1a5>
1a1: R_X86_64_PLT32 malloc-0x4
1a5: 48 89 45 e8 mov %rax,-0x18(%rbp)
1a9: 48 8b 45 d0 mov -0x30(%rbp),%rax
1ad: 48 89 c2 mov %rax,%rdx
1b0: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 1b7 <main+0x1b7>
1b3: R_X86_64_PC32 .rodata+0x181
1b7: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 1be <main+0x1be>
1ba: R_X86_64_PC32 .rodata+0x26
1be: b8 00 00 00 00 mov $0x0,%eax
1c3: e8 00 00 00 00 callq 1c8 <main+0x1c8>
1c4: R_X86_64_PLT32 printf-0x4
1c8: 48 8b 45 d8 mov -0x28(%rbp),%rax
1cc: 48 89 c2 mov %rax,%rdx
1cf: 48 8d 35 00 00 00 00 lea 0x0(%rip),%rsi # 1d6 <main+0x1d6>
1d2: R_X86_64_PC32 .rodata+0x199
1d6: 48 8d 3d 00 00 00 00 lea 0x0(%rip),%rdi # 1dd <main+0x1dd>
1d9: R_X86_64_PC32 .rodata+0x26
1dd: b8 00 00 00 00 mov $0x0,%eax
1e2: e8 00 00 00 00 callq 1e7 <main+0x1e7>

```

```

1e3: R_X86_64_PLT32    printf-0x4
1e7: 48 8b 45 e0        mov     -0x20(%rbp),%rax
1eb: 48 89 c2           mov     %rax,%rdx
1ee: 48 8d 35 00 00 00 00 lea     0x0(%rip),%rsi    # 1f5 <main+0x1f5>
1f1: R_X86_64_PC32     .rodata+0x1b1
1f5: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 1fc <main+0x1fc>
1f8: R_X86_64_PC32     .rodata+0x26
1fc: b8 00 00 00 00     mov     $0x0,%eax
201: e8 00 00 00 00     callq   206 <main+0x206>
202: R_X86_64_PLT32    printf-0x4
206: 48 8b 45 e8        mov     -0x18(%rbp),%rax
20a: 48 89 c2           mov     %rax,%rdx
20d: 48 8d 35 00 00 00 00 lea     0x0(%rip),%rsi    # 214 <main+0x214>
210: R_X86_64_PC32     .rodata+0x1c9
214: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 21b <main+0x21b>
217: R_X86_64_PC32     .rodata+0x26
21b: b8 00 00 00 00     mov     $0x0,%eax
220: e8 00 00 00 00     callq   225 <main+0x225>
221: R_X86_64_PLT32    printf-0x4
225: b8 00 00 00 00     mov     $0x0,%eax
22a: e8 00 00 00 00     callq   22f <main+0x22f>
22b: R_X86_64_PLT32    nextStep-0x4
22f: 48 8d 35 00 00 00 00 lea     0x0(%rip),%rsi    # 236 <main+0x236>
232: R_X86_64_PC32     .rodata+0x1e1
236: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 23d <main+0x23d>
239: R_X86_64_PC32     .rodata+0xd
23d: b8 00 00 00 00     mov     $0x0,%eax
242: e8 00 00 00 00     callq   247 <main+0x247>
243: R_X86_64_PLT32    printf-0x4
247: bf 00 80 00 00     mov     $0x8000,%edi
24c: b8 00 00 00 00     mov     $0x0,%eax
251: e8 00 00 00 00     callq   256 <main+0x256>
252: R_X86_64_PLT32    factorial-0x4
256: 89 c2             mov     %eax,%edx
258: 48 8d 35 00 00 00 00 lea     0x0(%rip),%rsi    # 25f <main+0x25f>
25b: R_X86_64_PC32     .rodata+0x1f2
25f: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 266 <main+0x266>
262: R_X86_64_PC32     .rodata+0x16a
266: b8 00 00 00 00     mov     $0x0,%eax
26b: e8 00 00 00 00     callq   270 <main+0x270>
26c: R_X86_64_PLT32    printf-0x4
270: b8 00 00 00 00     mov     $0x0,%eax
275: e8 00 00 00 00     callq   27a <main+0x27a>
276: R_X86_64_PLT32    nextStep-0x4
27a: 48 8d 35 00 00 00 00 lea     0x0(%rip),%rsi    # 281 <main+0x281>
27d: R_X86_64_PC32     .rodata+0x1f9
281: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 288 <main+0x288>
284: R_X86_64_PC32     .rodata+0xd
288: b8 00 00 00 00     mov     $0x0,%eax
28d: e8 00 00 00 00     callq   292 <main+0x292>
28e: R_X86_64_PLT32    printf-0x4
292: 48 8d 3d 00 00 00 00 lea     0x0(%rip),%rdi    # 299 <main+0x299>
295: R_X86_64_PC32     .rodata+0x20a
299: e8 00 00 00 00     callq   29e <main+0x29e>
29a: R_X86_64_PLT32    puts-0x4
29e: ba 80 01 00 00     mov     $0x180,%edx
2a3: be 42 00 00 00     mov     $0x42,%esi

```

```

2a8: 48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi        # 2af <main+0x2af>
      2ab: R_X86_64_PC32    .rodata+0x219
2af: b8 00 00 00 00          mov     $0x0,%eax
2b4: e8 00 00 00 00          callq   2b9 <main+0x2b9>
      2b5: R_X86_64_PLT32    open-0x4
2b9: 89 45 cc                mov     %eax,-0x34(%rbp)
2bc: 48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi        # 2c3 <main+0x2c3>
      2bf: R_X86_64_PC32    .rodata+0x22c
2c3: e8 00 00 00 00          callq   2c8 <main+0x2c8>
      2c4: R_X86_64_PLT32    puts-0x4
2c8: c7 45 b8 00 00 00 00    movl    $0x0,-0x48(%rbp)
2cf: eb 1a                  jmp     2eb <main+0x2eb>
2d1: 8b 45 cc                mov     -0x34(%rbp),%eax
2d4: ba 20 00 00 00          mov     $0x20,%edx
2d9: 48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi        # 2e0 <main+0x2e0>
      2dc: R_X86_64_PC32    .rodata+0x254
2e0: 89 c7                  mov     %eax,%edi
2e2: e8 00 00 00 00          callq   2e7 <main+0x2e7>
      2e3: R_X86_64_PLT32    write-0x4
2e7: 83 45 b8 01            addl    $0x1,-0x48(%rbp)
2eb: 81 7d b8 ff 7f 00 00    cmpl    $0x7fff,-0x48(%rbp)
2f2: 7e dd                  jle     2d1 <main+0x2d1>
2f4: 48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi        # 2fb <main+0x2fb>
      2f7: R_X86_64_PC32    .rodata+0x27c
2fb: e8 00 00 00 00          callq   300 <main+0x300>
      2fc: R_X86_64_PLT32    puts-0x4
300: 8b 45 cc                mov     -0x34(%rbp),%eax
303: 41 b9 00 00 00 00 00    mov     $0x0,%r9d
309: 41 89 c0                mov     %eax,%r8d
30c: b9 02 00 00 00          mov     $0x2,%ecx
311: ba 03 00 00 00          mov     $0x3,%edx
316: be 00 00 10 00          mov     $0x100000,%esi
31b: bf 00 00 00 00          mov     $0x0,%edi
320: e8 00 00 00 00          callq   325 <main+0x325>
      321: R_X86_64_PLT32    mmap-0x4
325: 48 89 45 f0            mov     %rax,-0x10(%rbp)
329: 48 8b 45 f0            mov     -0x10(%rbp),%rax
32d: 48 89 c2                mov     %rax,%rdx
330: 48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi        # 337 <main+0x337>
      333: R_X86_64_PC32    .rodata+0x29b
337: 48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi        # 33e <main+0x33e>
      33a: R_X86_64_PC32    .rodata+0x26
33e: b8 00 00 00 00          mov     $0x0,%eax
343: e8 00 00 00 00          callq   348 <main+0x348>
      344: R_X86_64_PLT32    printf-0x4
348: b8 00 00 00 00          mov     $0x0,%eax
34d: e8 00 00 00 00          callq   352 <main+0x352>
      34e: R_X86_64_PLT32    nextStep-0x4
352: 48 8d 35 00 00 00 00    lea     0x0(%rip),%rsi        # 359 <main+0x359>
      355: R_X86_64_PC32    .rodata+0x2b3
359: 48 8d 3d 00 00 00 00    lea     0x0(%rip),%rdi        # 360 <main+0x360>
      35c: R_X86_64_PC32    .rodata+0xd
360: b8 00 00 00 00          mov     $0x0,%eax
365: e8 00 00 00 00          callq   36a <main+0x36a>
      366: R_X86_64_PLT32    printf-0x4
36a: c7 45 bc 00 00 00 00    movl    $0x0,-0x44(%rbp)
371: eb 26                  jmp     399 <main+0x399>

```



```

373: 8b 45 bc      mov     -0x44(%rbp),%eax
376: 99            cld
377: c1 ea 19      shr     $0x19,%edx
37a: 01 d0         add     %edx,%eax
37c: 83 e0 7f      and     $0x7f,%eax
37f: 29 d0         sub     %edx,%eax
381: 8d 48 28      lea     0x28(%rax),%ecx
384: 8b 45 bc      mov     -0x44(%rbp),%eax
387: 48 63 d0      movslq  %eax,%rdx
38a: 48 8b 45 f0   mov     -0x10(%rbp),%rax
38e: 48 01 d0      add     %rdx,%rax
391: 89 ca        mov     %ecx,%edx
393: 88 10         mov     %dl,(%rax)
395: 83 45 bc 01   addl    $0x1,-0x44(%rbp)
399: 81 7d bc ff ff 07 00  cmpl    $0x7fff,-0x44(%rbp)
3a0: 7e d1         jle     373 <main+0x373>
3a2: 48 8d 3d 00 00 00 00  lea     0x0(%rip),%rdi      # 3a9 <main+0x3a9>
      3a5: R_X86_64_PC32      .rodata+0x2c4
3a9: e8 00 00 00 00      callq  3ae <main+0x3ae>
      3aa: R_X86_64_PLT32      puts-0x4
3ae: c7 45 c0 00 00 00 00  movl    $0x0,-0x40(%rbp)
3b5: eb 1e         jmp     3d5 <main+0x3d5>
3b7: 8b 45 c0      mov     -0x40(%rbp),%eax
3ba: 48 63 d0      movslq  %eax,%rdx
3bd: 48 8b 45 f0   mov     -0x10(%rbp),%rax
3c1: 48 01 d0      add     %rdx,%rax
3c4: 0f b6 00      movzbl  (%rax),%eax
3c7: 0f be c0      movsbl  %al,%eax
3ca: 89 c7        mov     %eax,%edi
3cc: e8 00 00 00 00      callq  3d1 <main+0x3d1>
      3cd: R_X86_64_PLT32      putchar-0x4
3d1: 83 45 c0 01   addl    $0x1,-0x40(%rbp)
3d5: 83 7d c0 3f   cmpl    $0x3f,-0x40(%rbp)
3d9: 7e dc         jle     3b7 <main+0x3b7>
3db: 48 8d 35 00 00 00 00  lea     0x0(%rip),%rsi      # 3e2 <main+0x3e2>
      3de: R_X86_64_PC32      .rodata+0x2f4
3e2: 48 8d 3d 00 00 00 00  lea     0x0(%rip),%rdi      # 3e9 <main+0x3e9>
      3e5: R_X86_64_PC32      .rodata+0x321
3e9: b8 00 00 00 00      mov     $0x0,%eax
3ee: e8 00 00 00 00      callq  3f3 <main+0x3f3>
      3ef: R_X86_64_PLT32      printf-0x4
3f3: c7 45 c4 c0 ff 0f 00  movl    $0xffffc0,-0x3c(%rbp)
3fa: eb 1e         jmp     41a <main+0x41a>
3fc: 8b 45 c4      mov     -0x3c(%rbp),%eax
3ff: 48 63 d0      movslq  %eax,%rdx
402: 48 8b 45 f0   mov     -0x10(%rbp),%rax
406: 48 01 d0      add     %rdx,%rax
409: 0f b6 00      movzbl  (%rax),%eax
40c: 0f be c0      movsbl  %al,%eax
40f: 89 c7        mov     %eax,%edi
411: e8 00 00 00 00      callq  416 <main+0x416>
      412: R_X86_64_PLT32      putchar-0x4
416: 83 45 c4 01   addl    $0x1,-0x3c(%rbp)
41a: 81 7d c4 ff ff 0f 00  cmpl    $0xffff,-0x3c(%rbp)
421: 7e d9         jle     3fc <main+0x3fc>
423: 8b 45 cc      mov     -0x34(%rbp),%eax
426: 89 c7        mov     %eax,%edi

```

```

428:  e8 00 00 00 00          callq 42d <main+0x42d>
      429: R_X86_64_PLT32      close-0x4
42d:  b8 00 00 00 00          mov    $0x0,%eax
432:  e8 00 00 00 00          callq 437 <main+0x437>
      433: R_X86_64_PLT32      nextStep-0x4
437:  48 8d 35 00 00 00 00     lea    0x0(%rip),%rsi      # 43e <main+0x43e>
      43a: R_X86_64_PC32      .rodata+0x326
43e:  48 8d 3d 00 00 00 00     lea    0x0(%rip),%rdi      # 445 <main+0x445>
      441: R_X86_64_PC32      .rodata+0xd
445:  b8 00 00 00 00          mov    $0x0,%eax
44a:  e8 00 00 00 00          callq 44f <main+0x44f>
      44b: R_X86_64_PLT32      printf-0x4
44f:  48 8d 05 00 00 00 00     lea    0x0(%rip),%rax      # 456 <main+0x456>
      452: R_X86_64_PC32      main-0x4
456:  48 25 00 f0 ff ff      and    $0xffffffffffff000,%rax
45c:  48 89 45 f8            mov    %rax,-0x8(%rbp)
460:  c7 45 c8 00 00 00 00     movl   $0x0,-0x38(%rbp)
467:  eb 59                jmp    4c2 <main+0x4c2>
469:  8b 45 c8            mov    -0x38(%rbp),%eax
46c:  48 63 d0            movslq %eax,%rdx
46f:  48 8b 45 f8            mov    -0x8(%rbp),%rax
473:  48 01 d0            add    %rdx,%rax
476:  48 89 c2            mov    %rax,%rdx
479:  48 8d 35 00 00 00 00     lea    0x0(%rip),%rsi      # 480 <main+0x480>
      47c: R_X86_64_PC32      .rodata+0x337
480:  48 8d 3d 00 00 00 00     lea    0x0(%rip),%rdi      # 487 <main+0x487>
      483: R_X86_64_PC32      .rodata+0x26
487:  b8 00 00 00 00          mov    $0x0,%eax
48c:  e8 00 00 00 00          callq 491 <main+0x491>
      48d: R_X86_64_PLT32      printf-0x4
491:  8b 45 c8            mov    -0x38(%rbp),%eax
494:  48 63 d0            movslq %eax,%rdx
497:  48 8b 45 f8            mov    -0x8(%rbp),%rax
49b:  48 01 d0            add    %rdx,%rax
49e:  0f b6 00            movzbl (%rax),%eax
4a1:  0f b6 c0            movzbl %al,%eax
4a4:  89 c2            mov    %eax,%edx
4a6:  48 8d 35 00 00 00 00     lea    0x0(%rip),%rsi      # 4ad <main+0x4ad>
      4a9: R_X86_64_PC32      .rodata+0x341
4ad:  48 8d 3d 00 00 00 00     lea    0x0(%rip),%rdi      # 4b4 <main+0x4b4>
      4b0: R_X86_64_PC32      .rodata+0x34b
4b4:  b8 00 00 00 00          mov    $0x0,%eax
4b9:  e8 00 00 00 00          callq 4be <main+0x4be>
      4ba: R_X86_64_PLT32      printf-0x4
4be:  83 45 c8 01          addl   $0x1,-0x38(%rbp)
4c2:  81 7d c8 ff 0f 00 00     cmpl   $0xffff,-0x38(%rbp)
4c9:  7e 9e                jle    469 <main+0x469>
4cb:  48 8d 3d 00 00 00 00     lea    0x0(%rip),%rdi      # 4d2 <main+0x4d2>
      4ce: R_X86_64_PC32      .rodata+0x353
4d2:  e8 00 00 00 00          callq 4d7 <main+0x4d7>
      4d3: R_X86_64_PLT32      puts-0x4
4d7:  b8 00 00 00 00          mov    $0x0,%eax
4dc:  e8 00 00 00 00          callq 4e1 <main+0x4e1>
      4dd: R_X86_64_PLT32      nextStep-0x4
4e1:  b8 00 00 00 00          mov    $0x0,%eax
4e6:  c9                leaveq
4e7:  c3                retq

```

Output of step 6

Address: 400000 Data	: 7f	Address: 400001 Data	: 45
Address: 400002 Data	: 4c	Address: 400003 Data	: 46
Address: 400004 Data	: 02	Address: 400005 Data	: 01
Address: 400006 Data	: 01	Address: 400007 Data	: 00
Address: 400008 Data	: 00	Address: 400009 Data	: 00
Address: 40000a Data	: 00	Address: 40000b Data	: 00
Address: 40000c Data	: 00	Address: 40000d Data	: 00
Address: 40000e Data	: 00	Address: 40000f Data	: 00
Address: 400010 Data	: 02	Address: 400011 Data	: 00
Address: 400012 Data	: 3e	Address: 400013 Data	: 00
Address: 400014 Data	: 01	Address: 400015 Data	: 00
Address: 400016 Data	: 00	Address: 400017 Data	: 00
Address: 400018 Data	: 00	Address: 400019 Data	: 07
Address: 40001a Data	: 40	Address: 40001b Data	: 00
Address: 40001c Data	: 00	Address: 40001d Data	: 00
Address: 40001e Data	: 00	Address: 40001f Data	: 00
Address: 400020 Data	: 40	Address: 400021 Data	: 00
Address: 400022 Data	: 00	Address: 400023 Data	: 00
Address: 400024 Data	: 00	Address: 400025 Data	: 00
Address: 400026 Data	: 00	Address: 400027 Data	: 00
Address: 400028 Data	: 08	Address: 400029 Data	: 2d
Address: 40002a Data	: 00	Address: 40002b Data	: 00
Address: 40002c Data	: 00	Address: 40002d Data	: 00
Address: 40002e Data	: 00	Address: 40002f Data	: 00
Address: 400030 Data	: 00	Address: 400031 Data	: 00
Address: 400032 Data	: 00	Address: 400033 Data	: 00
Address: 400034 Data	: 40	Address: 400035 Data	: 00
Address: 400036 Data	: 38	Address: 400037 Data	: 00
Address: 400038 Data	: 09	Address: 400039 Data	: 00
Address: 40003a Data	: 40	Address: 40003b Data	: 00
Address: 40003c Data	: 1e	Address: 40003d Data	: 00
Address: 40003e Data	: 1d	Address: 40003f Data	: 00
Address: 400040 Data	: 06	Address: 400041 Data	: 00
Address: 400042 Data	: 00	Address: 400043 Data	: 00
Address: 400044 Data	: 04	Address: 400045 Data	: 00
Address: 400046 Data	: 00	Address: 400047 Data	: 00
Address: 400048 Data	: 40	Address: 400049 Data	: 00
Address: 40004a Data	: 00	Address: 40004b Data	: 00
Address: 40004c Data	: 00	Address: 40004d Data	: 00
Address: 40004e Data	: 00	Address: 40004f Data	: 00
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Address: 400052 Data	: 40	Address: 400053 Data	: 00
Address: 400054 Data	: 00	Address: 400055 Data	: 00
Address: 400056 Data	: 00	Address: 400057 Data	: 00
Address: 400058 Data	: 40	Address: 400059 Data	: 00
Address: 40005a Data	: 40	Address: 40005b Data	: 00
Address: 40005c Data	: 00	Address: 40005d Data	: 00
Address: 40005e Data	: 00	Address: 40005f Data	: 00
Address: 400060 Data	: f8	Address: 400061 Data	: 01
Address: 400062 Data	: 00	Address: 400063 Data	: 00
Address: 400064 Data	: 00	Address: 400065 Data	: 00

Address: 400066	Data : 00	Address: 400067	Data : 00
Address: 400068	Data : f8	Address: 400069	Data : 01
Address: 40006a	Data : 00	Address: 40006b	Data : 00
Address: 40006c	Data : 00	Address: 40006d	Data : 00
Address: 40006e	Data : 00	Address: 40006f	Data : 00
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Address: 400072	Data : 00	Address: 400073	Data : 00
Address: 400074	Data : 00	Address: 400075	Data : 00
Address: 400076	Data : 00	Address: 400077	Data : 00
Address: 400078	Data : 03	Address: 400079	Data : 00
Address: 40007a	Data : 00	Address: 40007b	Data : 00
Address: 40007c	Data : 04	Address: 40007d	Data : 00
Address: 40007e	Data : 00	Address: 40007f	Data : 00
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Address: 400086	Data : 00	Address: 400087	Data : 00
Address: 400088	Data : 38	Address: 400089	Data : 02
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Address: 40008c	Data : 00	Address: 40008d	Data : 00
Address: 40008e	Data : 00	Address: 40008f	Data : 00
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Address: 400094	Data : 00	Address: 400095	Data : 00
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Address: 40009e	Data : 00	Address: 40009f	Data : 00
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Address: 4000ac	Data : 00	Address: 4000ad	Data : 00
Address: 4000ae	Data : 00	Address: 4000af	Data : 00
Address: 4000b0	Data : 01	Address: 4000b1	Data : 00
Address: 4000b2	Data : 00	Address: 4000b3	Data : 00
Address: 4000b4	Data : 05	Address: 4000b5	Data : 00
Address: 4000b6	Data : 00	Address: 4000b7	Data : 00
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Address: 4000ba	Data : 00	Address: 4000bb	Data : 00
Address: 4000bc	Data : 00	Address: 4000bd	Data : 00
Address: 4000be	Data : 00	Address: 4000bf	Data : 00
Address: 4000c0	Data : 00	Address: 4000c1	Data : 00
Address: 4000c2	Data : 40	Address: 4000c3	Data : 00
Address: 4000c4	Data : 00	Address: 4000c5	Data : 00
Address: 4000c6	Data : 00	Address: 4000c7	Data : 00
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Address: 4000ce	Data : 00	Address: 4000cf	Data : 00
Address: 4000d0	Data : 38	Address: 4000d1	Data : 13
Address: 4000d2	Data : 00	Address: 4000d3	Data : 00
Address: 4000d4	Data : 00	Address: 4000d5	Data : 00
Address: 4000d6	Data : 00	Address: 4000d7	Data : 00

Address: 4000d8	Data	: 38	Address: 4000d9	Data	: 13
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Address: 4000dc	Data	: 00	Address: 4000dd	Data	: 00
Address: 4000de	Data	: 00	Address: 4000df	Data	: 00
Address: 4000e0	Data	: 00	Address: 4000e1	Data	: 00
Address: 4000e2	Data	: 20	Address: 4000e3	Data	: 00
Address: 4000e4	Data	: 00	Address: 4000e5	Data	: 00
Address: 4000e6	Data	: 00	Address: 4000e7	Data	: 00
Address: 4000e8	Data	: 01	Address: 4000e9	Data	: 00
Address: 4000ea	Data	: 00	Address: 4000eb	Data	: 00
Address: 4000ec	Data	: 06	Address: 4000ed	Data	: 00
Address: 4000ee	Data	: 00	Address: 4000ef	Data	: 00
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Address: 4000f4	Data	: 00	Address: 4000f5	Data	: 00
Address: 4000f6	Data	: 00	Address: 4000f7	Data	: 00
Address: 4000f8	Data	: 08	Address: 4000f9	Data	: 1e
Address: 4000fa	Data	: 60	Address: 4000fb	Data	: 00
Address: 4000fc	Data	: 00	Address: 4000fd	Data	: 00
Address: 4000fe	Data	: 00	Address: 4000ff	Data	: 00
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Address: 400106	Data	: 00	Address: 400107	Data	: 00
Address: 400108	Data	: 58	Address: 400109	Data	: 03
Address: 40010a	Data	: 00	Address: 40010b	Data	: 00
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Address: 400112	Data	: 00	Address: 400113	Data	: 00
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Address: 400134	Data	: 00	Address: 400135	Data	: 00
Address: 400136	Data	: 00	Address: 400137	Data	: 00
Address: 400138	Data	: 18	Address: 400139	Data	: 1e
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Address: 40013e	Data	: 00	Address: 40013f	Data	: 00
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Address: 400144	Data	: 00	Address: 400145	Data	: 00
Address: 400146	Data	: 00	Address: 400147	Data	: 00
Address: 400148	Data	: d0	Address: 400149	Data	: 01

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Address: 40014e Data : 00 Address: 40014f Data : 00  
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Address: 400158 Data : 04 Address: 400159 Data : 00  
Address: 40015a Data : 00 Address: 40015b Data : 00  
Address: 40015c Data : 04 Address: 40015d Data : 00  
Address: 40015e Data : 00 Address: 40015f Data : 00  
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Address: 40016e Data : 00 Address: 40016f Data : 00  
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Address: 4001b0 Data : 54 Address: 4001b1 Data : 00  
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Address: 4001b4 Data : 00 Address: 4001b5 Data : 00  
Address: 4001b6 Data : 00 Address: 4001b7 Data : 00  
Address: 4001b8 Data : 54 Address: 4001b9 Data : 00  
Address: 4001ba Data : 00 Address: 4001bb Data : 00

Address: 4001bc Data : 00 Address: 4001bd Data : 00  
Address: 4001be Data : 00 Address: 4001bf Data : 00  
Address: 4001c0 Data : 04 Address: 4001c1 Data : 00  
Address: 4001c2 Data : 00 Address: 4001c3 Data : 00  
Address: 4001c4 Data : 00 Address: 4001c5 Data : 00  
Address: 4001c6 Data : 00 Address: 4001c7 Data : 00  
Address: 4001c8 Data : 51 Address: 4001c9 Data : e5  
Address: 4001ca Data : 74 Address: 4001cb Data : 64  
Address: 4001cc Data : 06 Address: 4001cd Data : 00  
Address: 4001ce Data : 00 Address: 4001cf Data : 00  
Address: 4001d0 Data : 00 Address: 4001d1 Data : 00  
Address: 4001d2 Data : 00 Address: 4001d3 Data : 00  
Address: 4001d4 Data : 00 Address: 4001d5 Data : 00  
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Address: 4001e4 Data : 00 Address: 4001e5 Data : 00  
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Address: 400202 Data : 74 Address: 400203 Data : 64  
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Address: 400206 Data : 00 Address: 400207 Data : 00  
Address: 400208 Data : 08 Address: 400209 Data : 1e  
Address: 40020a Data : 00 Address: 40020b Data : 00  
Address: 40020c Data : 00 Address: 40020d Data : 00  
Address: 40020e Data : 00 Address: 40020f Data : 00  
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Address: 400216 Data : 00 Address: 400217 Data : 00  
Address: 400218 Data : 08 Address: 400219 Data : 1e  
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Address: 40021c Data : 00 Address: 40021d Data : 00  
Address: 40021e Data : 00 Address: 40021f Data : 00  
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Address: 400228 Data : f8 Address: 400229 Data : 01  
Address: 40022a Data : 00 Address: 40022b Data : 00  
Address: 40022c Data : 00 Address: 40022d Data : 00

Address: 40022e	Data : 00	Address: 40022f	Data : 00
Address: 400230	Data : 01	Address: 400231	Data : 00
Address: 400232	Data : 00	Address: 400233	Data : 00
Address: 400234	Data : 00	Address: 400235	Data : 00
Address: 400236	Data : 00	Address: 400237	Data : 00
Address: 400238	Data : 2f	Address: 400239	Data : 6c
Address: 40023a	Data : 69	Address: 40023b	Data : 62
Address: 40023c	Data : 36	Address: 40023d	Data : 34
Address: 40023e	Data : 2f	Address: 40023f	Data : 6c
Address: 400240	Data : 64	Address: 400241	Data : 2d
Address: 400242	Data : 6c	Address: 400243	Data : 69
Address: 400244	Data : 6e	Address: 400245	Data : 75
Address: 400246	Data : 78	Address: 400247	Data : 2d
Address: 400248	Data : 78	Address: 400249	Data : 38
Address: 40024a	Data : 36	Address: 40024b	Data : 2d
Address: 40024c	Data : 36	Address: 40024d	Data : 34
Address: 40024e	Data : 2e	Address: 40024f	Data : 73
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Address: 400252	Data : 32	Address: 400253	Data : 00
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Address: 400256	Data : 00	Address: 400257	Data : 00
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Address: 40025c	Data : 01	Address: 40025d	Data : 00
Address: 40025e	Data : 00	Address: 40025f	Data : 00
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Address: 400262	Data : 55	Address: 400263	Data : 00
Address: 400264	Data : 00	Address: 400265	Data : 00
Address: 400266	Data : 00	Address: 400267	Data : 00
Address: 400268	Data : 03	Address: 400269	Data : 00
Address: 40026a	Data : 00	Address: 40026b	Data : 00
Address: 40026c	Data : 02	Address: 40026d	Data : 00
Address: 40026e	Data : 00	Address: 40026f	Data : 00
Address: 400270	Data : 00	Address: 400271	Data : 00
Address: 400272	Data : 00	Address: 400273	Data : 00
Address: 400274	Data : 04	Address: 400275	Data : 00
Address: 400276	Data : 00	Address: 400277	Data : 00
Address: 400278	Data : 14	Address: 400279	Data : 00
Address: 40027a	Data : 00	Address: 40027b	Data : 00
Address: 40027c	Data : 03	Address: 40027d	Data : 00
Address: 40027e	Data : 00	Address: 40027f	Data : 00
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Address: 400282	Data : 55	Address: 400283	Data : 00
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Address: 400286	Data : ad	Address: 400287	Data : fc
Address: 400288	Data : 75	Address: 400289	Data : 89
Address: 40028a	Data : ca	Address: 40028b	Data : f3
Address: 40028c	Data : aa	Address: 40028d	Data : b8
Address: 40028e	Data : 88	Address: 40028f	Data : 86
Address: 400290	Data : bc	Address: 400291	Data : 10
Address: 400292	Data : 4f	Address: 400293	Data : 97
Address: 400294	Data : 16	Address: 400295	Data : 56
Address: 400296	Data : 23	Address: 400297	Data : 85
Address: 400298	Data : 02	Address: 400299	Data : 00
Address: 40029a	Data : 00	Address: 40029b	Data : 00
Address: 40029c	Data : 0d	Address: 40029d	Data : 00
Address: 40029e	Data : 00	Address: 40029f	Data : 00



Address: 4002a0 Data : 01 Address: 4002a1 Data : 00  
Address: 4002a2 Data : 00 Address: 4002a3 Data : 00  
Address: 4002a4 Data : 06 Address: 4002a5 Data : 00  
Address: 4002a6 Data : 00 Address: 4002a7 Data : 00  
Address: 4002a8 Data : 00 Address: 4002a9 Data : 00  
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Address: 4002ae Data : 00 Address: 4002af Data : 01  
Address: 4002b0 Data : 0d Address: 4002b1 Data : 00  
Address: 4002b2 Data : 00 Address: 4002b3 Data : 00  
Address: 4002b4 Data : 00 Address: 4002b5 Data : 00  
Address: 4002b6 Data : 00 Address: 4002b7 Data : 00  
Address: 4002b8 Data : b9 Address: 4002b9 Data : 2b  
Address: 4002ba Data : 6b Address: 4002bb Data : 15  
Address: 4002bc Data : 00 Address: 4002bd Data : 00  
Address: 4002be Data : 00 Address: 4002bf Data : 00  
Address: 4002c0 Data : 00 Address: 4002c1 Data : 00  
Address: 4002c2 Data : 00 Address: 4002c3 Data : 00  
Address: 4002c4 Data : 00 Address: 4002c5 Data : 00  
Address: 4002c6 Data : 00 Address: 4002c7 Data : 00  
Address: 4002c8 Data : 00 Address: 4002c9 Data : 00  
Address: 4002ca Data : 00 Address: 4002cb Data : 00  
Address: 4002cc Data : 00 Address: 4002cd Data : 00  
Address: 4002ce Data : 00 Address: 4002cf Data : 00  
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Address: 4002d2 Data : 00 Address: 4002d3 Data : 00  
Address: 4002d4 Data : 00 Address: 4002d5 Data : 00  
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Address: 4002d8 Data : 21 Address: 4002d9 Data : 00  
Address: 4002da Data : 00 Address: 4002db Data : 00  
Address: 4002dc Data : 12 Address: 4002dd Data : 00  
Address: 4002de Data : 00 Address: 4002df Data : 00  
Address: 4002e0 Data : 00 Address: 4002e1 Data : 00  
Address: 4002e2 Data : 00 Address: 4002e3 Data : 00  
Address: 4002e4 Data : 00 Address: 4002e5 Data : 00  
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Address: 4002ec Data : 00 Address: 4002ed Data : 00  
Address: 4002ee Data : 00 Address: 4002ef Data : 00  
Address: 4002f0 Data : 0b Address: 4002f1 Data : 00  
Address: 4002f2 Data : 00 Address: 4002f3 Data : 00  
Address: 4002f4 Data : 12 Address: 4002f5 Data : 00  
Address: 4002f6 Data : 00 Address: 4002f7 Data : 00  
Address: 4002f8 Data : 00 Address: 4002f9 Data : 00  
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Address: 4002fc Data : 00 Address: 4002fd Data : 00  
Address: 4002fe Data : 00 Address: 4002ff Data : 00  
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Address: 400304 Data : 00 Address: 400305 Data : 00  
Address: 400306 Data : 00 Address: 400307 Data : 00  
Address: 400308 Data : 68 Address: 400309 Data : 00  
Address: 40030a Data : 00 Address: 40030b Data : 00  
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Address: 40030e Data : 00 Address: 40030f Data : 00  
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Address:	400316	Data :	00
Address:	400318	Data :	00
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Address:	40031c	Data :	00
Address:	40031e	Data :	00
Address:	400320	Data :	29
Address:	400322	Data :	00
Address:	400324	Data :	12
Address:	400326	Data :	00
Address:	400328	Data :	00
Address:	40032a	Data :	00
Address:	40032c	Data :	00
Address:	40032e	Data :	00
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Address:	400332	Data :	00
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Address:	400336	Data :	00
Address:	400338	Data :	10
Address:	40033a	Data :	00
Address:	40033c	Data :	12
Address:	40033e	Data :	00
Address:	400340	Data :	00
Address:	400342	Data :	00
Address:	400344	Data :	00
Address:	400346	Data :	00
Address:	400348	Data :	00
Address:	40034a	Data :	00
Address:	40034c	Data :	00
Address:	40034e	Data :	00
Address:	400350	Data :	37
Address:	400352	Data :	00
Address:	400354	Data :	12
Address:	400356	Data :	00
Address:	400358	Data :	00
Address:	40035a	Data :	00
Address:	40035c	Data :	00
Address:	40035e	Data :	00
Address:	400360	Data :	00
Address:	400362	Data :	00
Address:	400364	Data :	00
Address:	400366	Data :	00
Address:	400368	Data :	4b
Address:	40036a	Data :	00
Address:	40036c	Data :	12
Address:	40036e	Data :	00
Address:	400370	Data :	00
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Address:	400376	Data :	00
Address:	400378	Data :	00
Address:	40037a	Data :	00
Address:	40037c	Data :	00
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Address: 4003fc Data	: 12	Address: 4003fd Data	: 00
Address: 4003fe Data	: 00	Address: 4003ff Data	: 00
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Address: 400402 Data	: 00	Address: 400403 Data	: 00
Address: 400404 Data	: 00	Address: 400405 Data	: 00
Address: 400406 Data	: 00	Address: 400407 Data	: 00
Address: 400408 Data	: 00	Address: 400409 Data	: 00
Address: 40040a Data	: 00	Address: 40040b Data	: 00
Address: 40040c Data	: 00	Address: 40040d Data	: 00
Address: 40040e Data	: 00	Address: 40040f Data	: 00
Address: 400410 Data	: 00	Address: 400411 Data	: 6c
Address: 400412 Data	: 69	Address: 400413 Data	: 62
Address: 400414 Data	: 63	Address: 400415 Data	: 2e
Address: 400416 Data	: 73	Address: 400417 Data	: 6f
Address: 400418 Data	: 2e	Address: 400419 Data	: 36
Address: 40041a Data	: 00	Address: 40041b Data	: 70
Address: 40041c Data	: 75	Address: 40041d Data	: 74
Address: 40041e Data	: 73	Address: 40041f Data	: 00
Address: 400420 Data	: 5f	Address: 400421 Data	: 5f
Address: 400422 Data	: 73	Address: 400423 Data	: 74
Address: 400424 Data	: 61	Address: 400425 Data	: 63
Address: 400426 Data	: 6b	Address: 400427 Data	: 5f
Address: 400428 Data	: 63	Address: 400429 Data	: 68
Address: 40042a Data	: 6b	Address: 40042b Data	: 5f
Address: 40042c Data	: 66	Address: 40042d Data	: 61
Address: 40042e Data	: 69	Address: 40042f Data	: 6c
Address: 400430 Data	: 00	Address: 400431 Data	: 70
Address: 400432 Data	: 75	Address: 400433 Data	: 74
Address: 400434 Data	: 63	Address: 400435 Data	: 68
Address: 400436 Data	: 61	Address: 400437 Data	: 72
Address: 400438 Data	: 00	Address: 400439 Data	: 67
Address: 40043a Data	: 65	Address: 40043b Data	: 74
Address: 40043c Data	: 70	Address: 40043d Data	: 69
Address: 40043e Data	: 64	Address: 40043f Data	: 00
Address: 400440 Data	: 70	Address: 400441 Data	: 72
Address: 400442 Data	: 69	Address: 400443 Data	: 6e
Address: 400444 Data	: 74	Address: 400445 Data	: 66
Address: 400446 Data	: 00	Address: 400447 Data	: 6d
Address: 400448 Data	: 6d	Address: 400449 Data	: 61
Address: 40044a Data	: 70	Address: 40044b Data	: 00
Address: 40044c Data	: 67	Address: 40044d Data	: 65
Address: 40044e Data	: 74	Address: 40044f Data	: 63
Address: 400450 Data	: 68	Address: 400451 Data	: 61
Address: 400452 Data	: 72	Address: 400453 Data	: 00
Address: 400454 Data	: 6d	Address: 400455 Data	: 61
Address: 400456 Data	: 6c	Address: 400457 Data	: 6c
Address: 400458 Data	: 6f	Address: 400459 Data	: 63
Address: 40045a Data	: 00	Address: 40045b Data	: 63
Address: 40045c Data	: 6c	Address: 40045d Data	: 6f
Address: 40045e Data	: 73	Address: 40045f Data	: 65
Address: 400460 Data	: 00	Address: 400461 Data	: 6f
Address: 400462 Data	: 70	Address: 400463 Data	: 65
Address: 400464 Data	: 6e	Address: 400465 Data	: 00
Address: 400466 Data	: 5f	Address: 400467 Data	: 5f

Address: 400468	Data : 6c	Address: 400469	Data : 69
Address: 40046a	Data : 62	Address: 40046b	Data : 63
Address: 40046c	Data : 5f	Address: 40046d	Data : 73
Address: 40046e	Data : 74	Address: 40046f	Data : 61
Address: 400470	Data : 72	Address: 400471	Data : 74
Address: 400472	Data : 5f	Address: 400473	Data : 6d
Address: 400474	Data : 61	Address: 400475	Data : 69
Address: 400476	Data : 6e	Address: 400477	Data : 00
Address: 400478	Data : 77	Address: 400479	Data : 72
Address: 40047a	Data : 69	Address: 40047b	Data : 74
Address: 40047c	Data : 65	Address: 40047d	Data : 00
Address: 40047e	Data : 47	Address: 40047f	Data : 4c
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Address: 400482	Data : 43	Address: 400483	Data : 5f
Address: 400484	Data : 32	Address: 400485	Data : 2e
Address: 400486	Data : 34	Address: 400487	Data : 00
Address: 400488	Data : 47	Address: 400489	Data : 4c
Address: 40048a	Data : 49	Address: 40048b	Data : 42
Address: 40048c	Data : 43	Address: 40048d	Data : 5f
Address: 40048e	Data : 32	Address: 40048f	Data : 2e
Address: 400490	Data : 32	Address: 400491	Data : 2e
Address: 400492	Data : 35	Address: 400493	Data : 00
Address: 400494	Data : 5f	Address: 400495	Data : 5f
Address: 400496	Data : 67	Address: 400497	Data : 6d
Address: 400498	Data : 6f	Address: 400499	Data : 6e
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Address: 40049c	Data : 74	Address: 40049d	Data : 61
Address: 40049e	Data : 72	Address: 40049f	Data : 74
Address: 4004a0	Data : 5f	Address: 4004a1	Data : 5f
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Address: 4004ac	Data : 02	Address: 4004ad	Data : 00
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Address: 4004b0	Data : 02	Address: 4004b1	Data : 00
Address: 4004b2	Data : 02	Address: 4004b3	Data : 00
Address: 4004b4	Data : 02	Address: 4004b5	Data : 00
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Address: 4004ba	Data : 02	Address: 4004bb	Data : 00
Address: 4004bc	Data : 02	Address: 4004bd	Data : 00
Address: 4004be	Data : 02	Address: 4004bf	Data : 00
Address: 4004c0	Data : 01	Address: 4004c1	Data : 00
Address: 4004c2	Data : 02	Address: 4004c3	Data : 00
Address: 4004c4	Data : 01	Address: 4004c5	Data : 00
Address: 4004c6	Data : 00	Address: 4004c7	Data : 00
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Address: 4004ce	Data : 00	Address: 4004cf	Data : 00
Address: 4004d0	Data : 14	Address: 4004d1	Data : 69
Address: 4004d2	Data : 69	Address: 4004d3	Data : 0d
Address: 4004d4	Data : 00	Address: 4004d5	Data : 00
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Address: 4004d8	Data : 6e	Address: 4004d9	Data : 00

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Address: 4004de Data : 00 Address: 4004df Data : 00  
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Address: 4004e2 Data : 69 Address: 4004e3 Data : 09  
Address: 4004e4 Data : 00 Address: 4004e5 Data : 00  
Address: 4004e6 Data : 02 Address: 4004e7 Data : 00  
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Address: 4004ec Data : 00 Address: 4004ed Data : 00  
Address: 4004ee Data : 00 Address: 4004ef Data : 00  
Address: 4004f0 Data : e8 Address: 4004f1 Data : 1f  
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Address: 4004f4 Data : 00 Address: 4004f5 Data : 00  
Address: 4004f6 Data : 00 Address: 4004f7 Data : 00  
Address: 4004f8 Data : 06 Address: 4004f9 Data : 00  
Address: 4004fa Data : 00 Address: 4004fb Data : 00  
Address: 4004fc Data : 0d Address: 4004fd Data : 00  
Address: 4004fe Data : 00 Address: 4004ff Data : 00  
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Address: 400506 Data : 00 Address: 400507 Data : 00  
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Address: 40050c Data : 00 Address: 40050d Data : 00  
Address: 40050e Data : 00 Address: 40050f Data : 00  
Address: 400510 Data : 06 Address: 400511 Data : 00  
Address: 400512 Data : 00 Address: 400513 Data : 00  
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Address: 400518 Data : 00 Address: 400519 Data : 00  
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Address: 40051c Data : 00 Address: 40051d Data : 00  
Address: 40051e Data : 00 Address: 40051f Data : 00  
Address: 400520 Data : f8 Address: 400521 Data : 1f  
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Address: 400524 Data : 00 Address: 400525 Data : 00  
Address: 400526 Data : 00 Address: 400527 Data : 00  
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Address: 40052c Data : 0a Address: 40052d Data : 00  
Address: 40052e Data : 00 Address: 40052f Data : 00  
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Address: 40053a Data : 60 Address: 40053b Data : 00  
Address: 40053c Data : 00 Address: 40053d Data : 00  
Address: 40053e Data : 00 Address: 40053f Data : 00  
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Address: 400542 Data : 00 Address: 400543 Data : 00  
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Address: 40054a Data : 00 Address: 40054b Data : 00

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Address: 4005c2 Data	: 00	Address: 4005c3 Data	: 00
Address: 4005c4 Data	: 00	Address: 4005c5 Data	: 00
Address: 4005c6 Data	: 00	Address: 4005c7 Data	: 00
Address: 4005c8 Data	: 48	Address: 4005c9 Data	: 20
Address: 4005ca Data	: 60	Address: 4005cb Data	: 00
Address: 4005cc Data	: 00	Address: 4005cd Data	: 00
Address: 4005ce Data	: 00	Address: 4005cf Data	: 00
Address: 4005d0 Data	: 07	Address: 4005d1 Data	: 00
Address: 4005d2 Data	: 00	Address: 4005d3 Data	: 00
Address: 4005d4 Data	: 07	Address: 4005d5 Data	: 00
Address: 4005d6 Data	: 00	Address: 4005d7 Data	: 00
Address: 4005d8 Data	: 00	Address: 4005d9 Data	: 00
Address: 4005da Data	: 00	Address: 4005db Data	: 00
Address: 4005dc Data	: 00	Address: 4005dd Data	: 00
Address: 4005de Data	: 00	Address: 4005df Data	: 00
Address: 4005e0 Data	: 50	Address: 4005e1 Data	: 20
Address: 4005e2 Data	: 60	Address: 4005e3 Data	: 00
Address: 4005e4 Data	: 00	Address: 4005e5 Data	: 00
Address: 4005e6 Data	: 00	Address: 4005e7 Data	: 00
Address: 4005e8 Data	: 07	Address: 4005e9 Data	: 00
Address: 4005ea Data	: 00	Address: 4005eb Data	: 00
Address: 4005ec Data	: 09	Address: 4005ed Data	: 00
Address: 4005ee Data	: 00	Address: 4005ef Data	: 00
Address: 4005f0 Data	: 00	Address: 4005f1 Data	: 00
Address: 4005f2 Data	: 00	Address: 4005f3 Data	: 00
Address: 4005f4 Data	: 00	Address: 4005f5 Data	: 00
Address: 4005f6 Data	: 00	Address: 4005f7 Data	: 00
Address: 4005f8 Data	: 58	Address: 4005f9 Data	: 20
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Address: 4005fc Data	: 00	Address: 4005fd Data	: 00
Address: 4005fe Data	: 00	Address: 4005ff Data	: 00
Address: 400600 Data	: 07	Address: 400601 Data	: 00
Address: 400602 Data	: 00	Address: 400603 Data	: 00
Address: 400604 Data	: 0b	Address: 400605 Data	: 00
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Address: 400608 Data	: 00	Address: 400609 Data	: 00
Address: 40060a Data	: 00	Address: 40060b Data	: 00
Address: 40060c Data	: 00	Address: 40060d Data	: 00
Address: 40060e Data	: 00	Address: 40060f Data	: 00
Address: 400610 Data	: 60	Address: 400611 Data	: 20
Address: 400612 Data	: 60	Address: 400613 Data	: 00
Address: 400614 Data	: 00	Address: 400615 Data	: 00
Address: 400616 Data	: 00	Address: 400617 Data	: 00
Address: 400618 Data	: 07	Address: 400619 Data	: 00
Address: 40061a Data	: 00	Address: 40061b Data	: 00
Address: 40061c Data	: 0c	Address: 40061d Data	: 00
Address: 40061e Data	: 00	Address: 40061f Data	: 00
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Address: 400622 Data	: 00	Address: 400623 Data	: 00
Address: 400624 Data	: 00	Address: 400625 Data	: 00
Address: 400626 Data	: 00	Address: 400627 Data	: 00
Address: 400628 Data	: 48	Address: 400629 Data	: 83
Address: 40062a Data	: ec	Address: 40062b Data	: 08
Address: 40062c Data	: 48	Address: 40062d Data	: 8b
Address: 40062e Data	: 05	Address: 40062f Data	: c5



Address: 400630 Data	: 19	Address: 400631 Data	: 20
Address: 400632 Data	: 00	Address: 400633 Data	: 48
Address: 400634 Data	: 85	Address: 400635 Data	: c0
Address: 400636 Data	: 74	Address: 400637 Data	: 02
Address: 400638 Data	: ff	Address: 400639 Data	: d0
Address: 40063a Data	: 48	Address: 40063b Data	: 83
Address: 40063c Data	: c4	Address: 40063d Data	: 08
Address: 40063e Data	: c3	Address: 40063f Data	: 00
Address: 400640 Data	: ff	Address: 400641 Data	: 35
Address: 400642 Data	: c2	Address: 400643 Data	: 19
Address: 400644 Data	: 20	Address: 400645 Data	: 00
Address: 400646 Data	: ff	Address: 400647 Data	: 25
Address: 400648 Data	: c4	Address: 400649 Data	: 19
Address: 40064a Data	: 20	Address: 40064b Data	: 00
Address: 40064c Data	: 0f	Address: 40064d Data	: 1f
Address: 40064e Data	: 40	Address: 40064f Data	: 00
Address: 400650 Data	: ff	Address: 400651 Data	: 25
Address: 400652 Data	: c2	Address: 400653 Data	: 19
Address: 400654 Data	: 20	Address: 400655 Data	: 00
Address: 400656 Data	: 68	Address: 400657 Data	: 00
Address: 400658 Data	: 00	Address: 400659 Data	: 00
Address: 40065a Data	: 00	Address: 40065b Data	: e9
Address: 40065c Data	: e0	Address: 40065d Data	: ff
Address: 40065e Data	: ff	Address: 40065f Data	: ff
Address: 400660 Data	: ff	Address: 400661 Data	: 25
Address: 400662 Data	: ba	Address: 400663 Data	: 19
Address: 400664 Data	: 20	Address: 400665 Data	: 00
Address: 400666 Data	: 68	Address: 400667 Data	: 01
Address: 400668 Data	: 00	Address: 400669 Data	: 00
Address: 40066a Data	: 00	Address: 40066b Data	: e9
Address: 40066c Data	: d0	Address: 40066d Data	: ff
Address: 40066e Data	: ff	Address: 40066f Data	: ff
Address: 400670 Data	: ff	Address: 400671 Data	: 25
Address: 400672 Data	: b2	Address: 400673 Data	: 19
Address: 400674 Data	: 20	Address: 400675 Data	: 00
Address: 400676 Data	: 68	Address: 400677 Data	: 02
Address: 400678 Data	: 00	Address: 400679 Data	: 00
Address: 40067a Data	: 00	Address: 40067b Data	: e9
Address: 40067c Data	: c0	Address: 40067d Data	: ff
Address: 40067e Data	: ff	Address: 40067f Data	: ff
Address: 400680 Data	: ff	Address: 400681 Data	: 25
Address: 400682 Data	: aa	Address: 400683 Data	: 19
Address: 400684 Data	: 20	Address: 400685 Data	: 00
Address: 400686 Data	: 68	Address: 400687 Data	: 03
Address: 400688 Data	: 00	Address: 400689 Data	: 00
Address: 40068a Data	: 00	Address: 40068b Data	: e9
Address: 40068c Data	: b0	Address: 40068d Data	: ff
Address: 40068e Data	: ff	Address: 40068f Data	: ff
Address: 400690 Data	: ff	Address: 400691 Data	: 25
Address: 400692 Data	: a2	Address: 400693 Data	: 19
Address: 400694 Data	: 20	Address: 400695 Data	: 00
Address: 400696 Data	: 68	Address: 400697 Data	: 04
Address: 400698 Data	: 00	Address: 400699 Data	: 00
Address: 40069a Data	: 00	Address: 40069b Data	: e9
Address: 40069c Data	: a0	Address: 40069d Data	: ff
Address: 40069e Data	: ff	Address: 40069f Data	: ff
Address: 4006a0 Data	: ff	Address: 4006a1 Data	: 25

Address: 4006a2	Data : 9a	Address: 4006a3	Data : 19
Address: 4006a4	Data : 20	Address: 4006a5	Data : 00
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Address: 4006a8	Data : 00	Address: 4006a9	Data : 00
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Address: 4006ac	Data : 90	Address: 4006ad	Data : ff
Address: 4006ae	Data : ff	Address: 4006af	Data : ff
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Address: 4006b4	Data : 20	Address: 4006b5	Data : 00
Address: 4006b6	Data : 68	Address: 4006b7	Data : 06
Address: 4006b8	Data : 00	Address: 4006b9	Data : 00
Address: 4006ba	Data : 00	Address: 4006bb	Data : e9
Address: 4006bc	Data : 80	Address: 4006bd	Data : ff
Address: 4006be	Data : ff	Address: 4006bf	Data : ff
Address: 4006c0	Data : ff	Address: 4006c1	Data : 25
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Address: 4006c4	Data : 20	Address: 4006c5	Data : 00
Address: 4006c6	Data : 68	Address: 4006c7	Data : 07
Address: 4006c8	Data : 00	Address: 4006c9	Data : 00
Address: 4006ca	Data : 00	Address: 4006cb	Data : e9
Address: 4006cc	Data : 70	Address: 4006cd	Data : ff
Address: 4006ce	Data : ff	Address: 4006cf	Data : ff
Address: 4006d0	Data : ff	Address: 4006d1	Data : 25
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Address: 4006d4	Data : 20	Address: 4006d5	Data : 00
Address: 4006d6	Data : 68	Address: 4006d7	Data : 08
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Address: 4006da	Data : 00	Address: 4006db	Data : e9
Address: 4006dc	Data : 60	Address: 4006dd	Data : ff
Address: 4006de	Data : ff	Address: 4006df	Data : ff
Address: 4006e0	Data : ff	Address: 4006e1	Data : 25
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Address: 400968 Data	: 00	Address: 400969 Data	: 04
Address: 40096a Data	: 00	Address: 40096b Data	: e8
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Address: 40097c Data	: ff	Address: 40097d Data	: ff
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Address: 40098e Data	: 45	Address: 40098f Data	: e8
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Address: 400992 Data	: 45	Address: 400993 Data	: d0
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Address: 400996 Data	: c2	Address: 400997 Data	: 48
Address: 400998 Data	: 8d	Address: 400999 Data	: 35
Address: 40099a Data	: df	Address: 40099b Data	: 05
Address: 40099c Data	: 00	Address: 40099d Data	: 00
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Address: 400c0c	Data : cc	Address: 400c0d	Data : 89
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Address: 400c5e	Data : 89	Address: 400c5f	Data : c2
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Address: 400c76 Data	: ff	Address: 400c77 Data	: ff
Address: 400c78 Data	: 8b	Address: 400c79 Data	: 45
Address: 400c7a Data	: c8	Address: 400c7b Data	: 48
Address: 400c7c Data	: 63	Address: 400c7d Data	: d0
Address: 400c7e Data	: 48	Address: 400c7f Data	: 8b
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Address: 400c8c Data	: c2	Address: 400c8d Data	: 48
Address: 400c8e Data	: 8d	Address: 400c8f Data	: 35
Address: 400c90 Data	: b0	Address: 400c91 Data	: 04
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Address: 400cc2 Data	: 00	Address: 400cc3 Data	: e8
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Address: 400ccc Data	: 00	Address: 400ccd Data	: c9
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Address: 400cd2 Data	: e5	Address: 400cd3 Data	: 48
Address: 400cd4 Data	: 83	Address: 400cd5 Data	: ec
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Address: 400cd8 Data	: 7d	Address: 400cd9 Data	: ec
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Address: 400cdc Data	: 8b	Address: 400cdd Data	: 04

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Address: 400fc4 Data	: 00	Address: 400fc5 Data	: 41
Address: 400fc6 Data	: 64	Address: 400fc7 Data	: 64
Address: 400fc8 Data	: 72	Address: 400fc9 Data	: 65
Address: 400fca Data	: 73	Address: 400fcb Data	: 73
Address: 400fcc Data	: 20	Address: 400fcd Data	: 6f
Address: 400fce Data	: 66	Address: 400fcf Data	: 20
Address: 400fd0 Data	: 68	Address: 400fd1 Data	: 65
Address: 400fd2 Data	: 61	Address: 400fd3 Data	: 70
Address: 400fd4 Data	: 20	Address: 400fd5 Data	: 64
Address: 400fd6 Data	: 61	Address: 400fd7 Data	: 74
Address: 400fd8 Data	: 61	Address: 400fd9 Data	: 34
Address: 400fda Data	: 3a	Address: 400fdb Data	: 20
Address: 400fdc Data	: 00	Address: 400fdd Data	: 53
Address: 400fde Data	: 74	Address: 400fdf Data	: 65
Address: 400fe0 Data	: 70	Address: 400fel Data	: 20
Address: 400fe2 Data	: 33	Address: 400fe3 Data	: 20
Address: 400fe4 Data	: 49	Address: 400fe5 Data	: 6e
Address: 400fe6 Data	: 69	Address: 400fe7 Data	: 74
Address: 400fe8 Data	: 69	Address: 400fe9 Data	: 61
Address: 400fea Data	: 74	Address: 400feb Data	: 65
Address: 400fec Data	: 64	Address: 400fed Data	: 00
Address: 400fee Data	: 46	Address: 400fef Data	: 61
Address: 400ff0 Data	: 63	Address: 400ff1 Data	: 74
Address: 400ff2 Data	: 3a	Address: 400ff3 Data	: 20
Address: 400ff4 Data	: 00	Address: 400ff5 Data	: 53
Address: 400ff6 Data	: 74	Address: 400ff7 Data	: 65
Address: 400ff8 Data	: 70	Address: 400ff9 Data	: 20
Address: 400ffa Data	: 34	Address: 400ffb Data	: 20

```
Address: 400ffc Data   : 49 Address: 400ffd Data   : 6e
Address: 400ffe Data   : 69 Address: 400fff Data   : 74
Enter n to exit
```

## Module1.c

```
#define PAGESIZE 4096

#include <unistd.h>
#include <stdio.h>
#include <fcntl.h>
#include <stdlib.h>
#include <sys/mman.h>
#include <string.h>

extern char initData1[];
extern char initData2[];
extern char unutilized1[];
extern char unutilized2[];
extern void nextStep();
extern int factorial();

int main() {
    // Step 1
    printf("%s\n\n", "Step 1 Initiated");

    printf("%s\n", "Address of main is ", (long unsigned int) main);
    printf("%s\n", "Address of initialized data 1 (128B) is: ", (long unsigned int)
initData1);
    printf("%s\n", "Address of unutilized data 1 (16KB) is: ", (long unsigned int)
unutilized1);
    printf("%s\n", "Address of initialized data 2 (64B) is: ", (long unsigned int)
initData2);
    printf("%s\n", "Address of unutilized data 2 (8KB) is: ", (long unsigned int)
unutilized2);
    printf("%s\n", "Address of nextStep function is: ", (long unsigned int) nextStep);
    printf("%s\n", "Address of factorial function is: ", (long unsigned int) factorial);
    printf("%s\n", "Address of printf function is: ", (long unsigned int) printf);

    printf("%s\n", "Process PID: ", getpid());

    nextStep();
    printf("%s\n\n", "Step 2 Initiated");
    // Step 2

    void *heap_data1 = malloc(512 * 1024);
    void *heap_data2 = malloc(256 * 1024);
    void *heap_data3 = malloc(256 * 1024);
    void *heap_data4 = malloc(1024 * 1024);

    printf("%s\n", "Address of heap data1: ", (long unsigned int) heap_data1);
    printf("%s\n", "Address of heap data2: ", (long unsigned int) heap_data2);
    printf("%s\n", "Address of heap data3: ", (long unsigned int) heap_data3);
    printf("%s\n", "Address of heap data4: ", (long unsigned int) heap_data4);
```

```

nextStep();
printf("%s\n\n", "Step 3 Initiated");

// stack size doesn't shrink
https://stackoverflow.com/questions/8203110/will-the-stack-of-a-c-program-ever-shrink
printf("%s%d\n", "Fact: ", factorial(1024 * 32));

nextStep();
printf("%s\n\n", "Step 4 Initiated");

printf("%s\n", "Creating File!");

int fd = open("project_file", O_RDWR | O_CREAT, 0600);
printf("%s\n", "Created file with name: project_file");

for(int i = 0; i < 1024 * 32; i++) {
write(fd, "abcdefghijklmnopqrstuvwxyz12345\n", 32);
}

printf("%s\n", "Wrote 1MB data to project_file");

void *memmap = mmap(NULL, 1024 * 1024, PROT_READ | PROT_WRITE, MAP_PRIVATE, fd, 0);
printf("%s%lx\n", "Address of memory map: ", (long unsigned int) memmap);

nextStep();
printf("%s\n\n", "Step 5 Initiated");

for (int i = 0; i < 1024 * 512; i++) {
((char *)memmap)[i] = i % 128 + 40;
}

printf("%s\n", "Reading some values from the start of the mmap");
for (int i = 0; i < 64; i++) {
printf("%c", ((char *)memmap)[i] );
}

printf("\n%s\n", "Reading some values from the end of the mmap");
for (int i = 1024 * 1024 - 64; i < 1024 * 1024; i++) {
printf("%c", ((char *)memmap)[i] );
}

close(fd);
nextStep();
printf("%s\n\n", "Step 6 Initiated");

unsigned char *mainPage = (unsigned char *) (PAGESIZE * ((long unsigned int) main /
PAGESIZE));

for( int i = 0; i < PAGESIZE; i += 1) {
printf("%s%lx ", "Address: ", (long unsigned int) (mainPage + i));
printf("%s%02x\n", "Data   : ", mainPage[i]);
}

printf("%s\n", "Enter n to exit");
nextStep();

```



```
        return 0;//
    }
```

## module2.c

```
#include <stdio.h>
// Initialized data with size of 128 Bytes.
char initData1 [128] = {'O'};
// Uninitialized data, size 16KB.
char unutilized1 [16 * 1024];

extern void nextStep();

int factorial(int num) {
    if (num == 0) {
        return 1;
    }
    int local;

    if (num < 16) {
        printf("%s%lx\n", "Address of local variable: ", (unsigned long int) &local);
    }
    int result;
    result = num * factorial(num - 1);
    return result;
}
```

## module3.c

```
#include <stdio.h>
// Initialized data, size 64 Bytes.
char initData2 [64] = {'S'};
// Uninitialized data, size 8KB.
char unutilized2 [8 * 1024];

// Waits until n is pressed.
void nextStep() {
    char stepCheck = ' ';
    while(stepCheck != 'n') {
        stepCheck = getchar();
    }
}
```