实验报告

LINUX 环境和 GCC 工具链

班级：_____

学号：_____

姓名：_____

一、实验目的

1、熟悉 linux 操作的基本操作；
2、掌握 gcc 编译方法；
3、掌握 gdb 的调试工具使用；
4、掌握 objdump 反汇编工具使用；
5、熟悉理解反汇编程序（对照源程序与 objdump 生成的汇编程序）。

二、实验环境

ssh secure shell

三、实验概况

1、用 ssh secure shell 在 linux 环境下，用 VI 编辑书 116 页源程序：

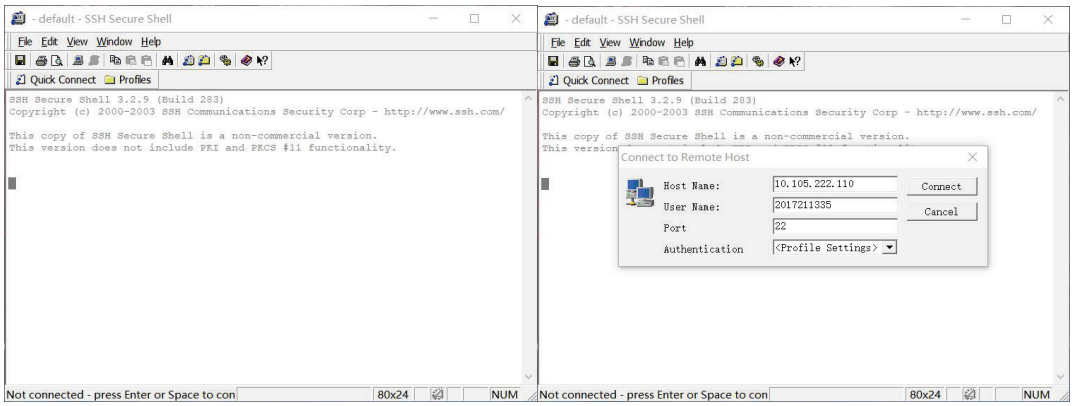
```
#include<stdio.h>
void multstore(long, long, long*);
long mult2(long, long);
int main()
{
    long d;
    multstore(2, 3, &d);
    printf("2 * 3 --> %ld\n", d);
    return 0;
}
void multstore(long x, long y, long *dest)
{
    long t = mult2(x, y);
    *dest = t;
}
long mult2(long a, long b)
{
    long s = a * b;
    return s;
    }
```

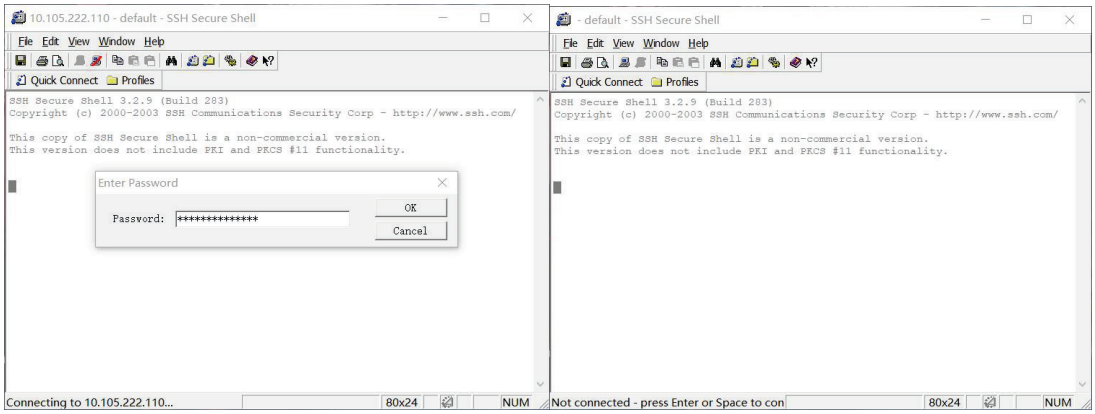
在 visualstudio 中编写好的源代码：

2、采用 gcc 编译该程序，分别采用-o 和-O 参数，并比较两者性能。
3、采用 gdb 进行调试，让程序运行到 mult2 函数的第一条语句。
4、运用 objdump 工具生成汇编程序。

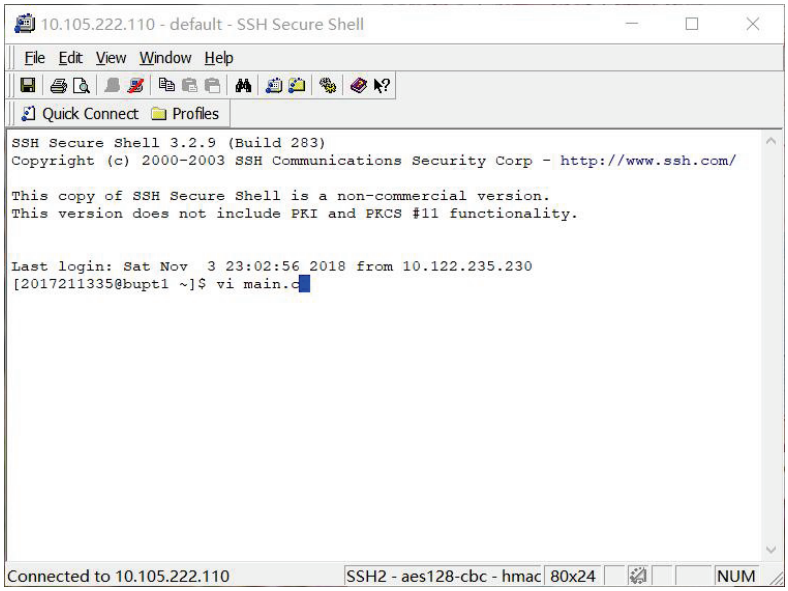
四、实验步骤

1、打开 ssh secure shell，登录到服务器。

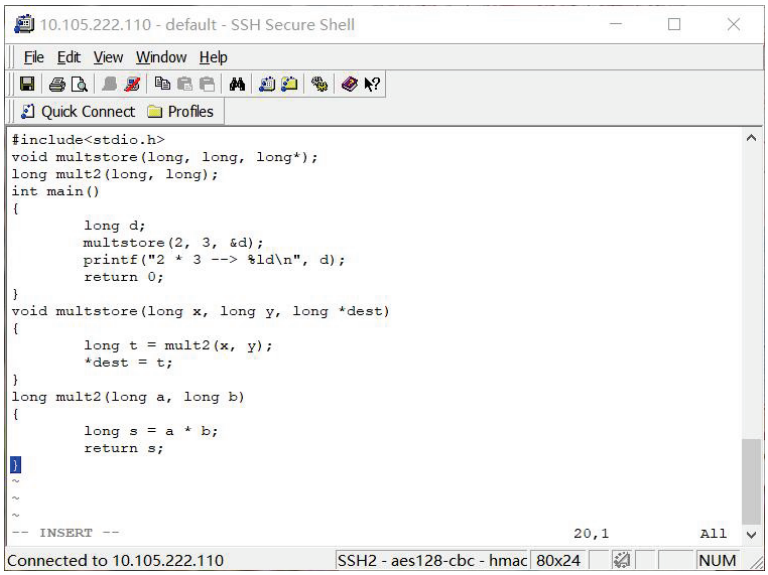




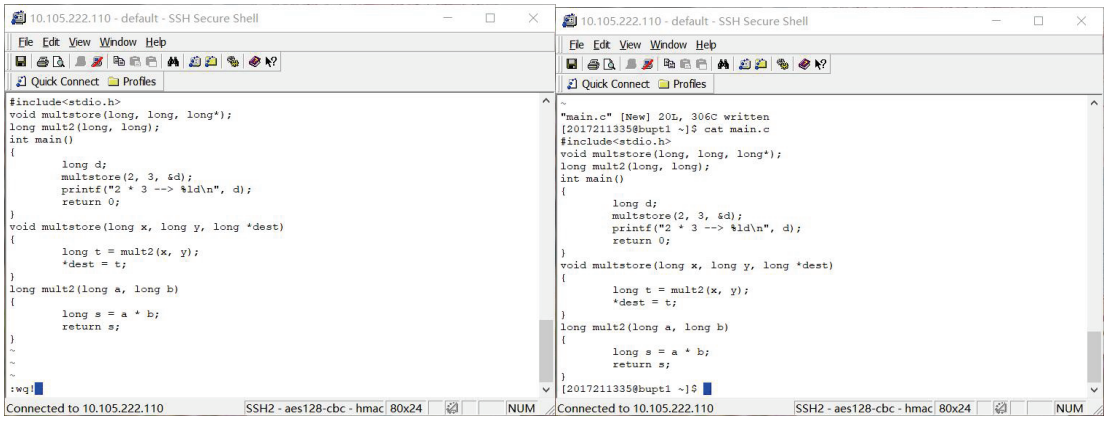
2、进入 VI，新建文件 mian.c。



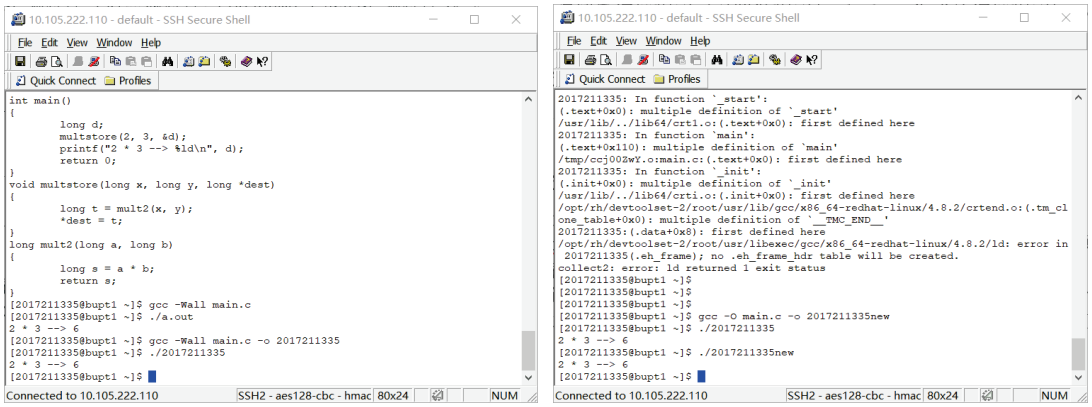
3、进入插入模式，编写书 116 页源程序。



4、保存并退出。

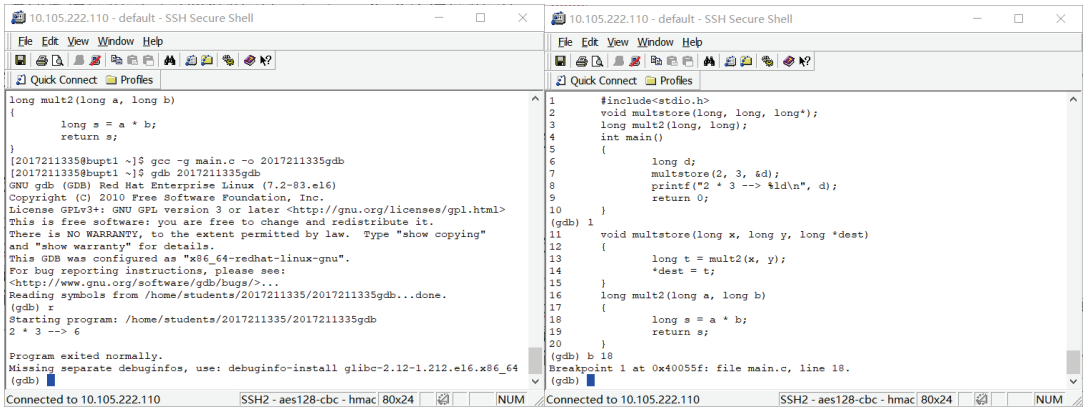


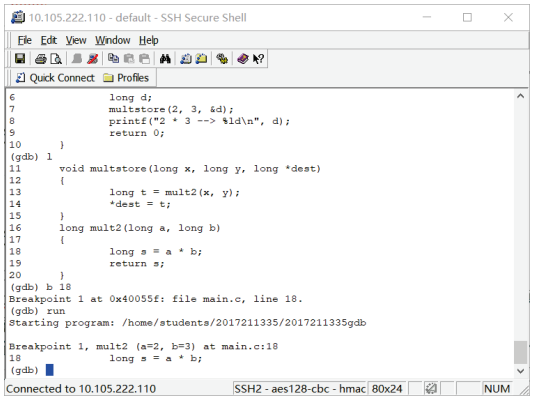
6、采用 gcc 编译该程序，分别用-o 和-O 参数，比较性能。

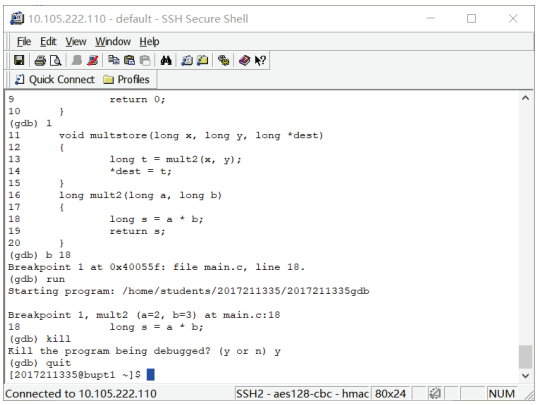


显然是-O 性能更好。

7、采用 gdb 进行调试，让程序运行到 mult2 函数的第一条语句，并退出 gdb。

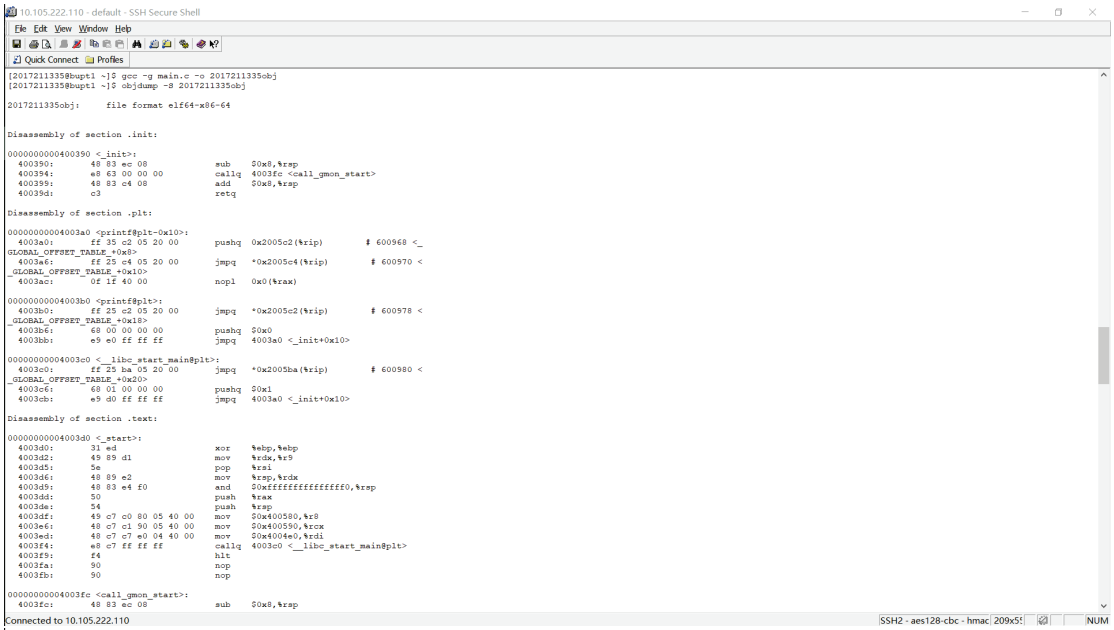


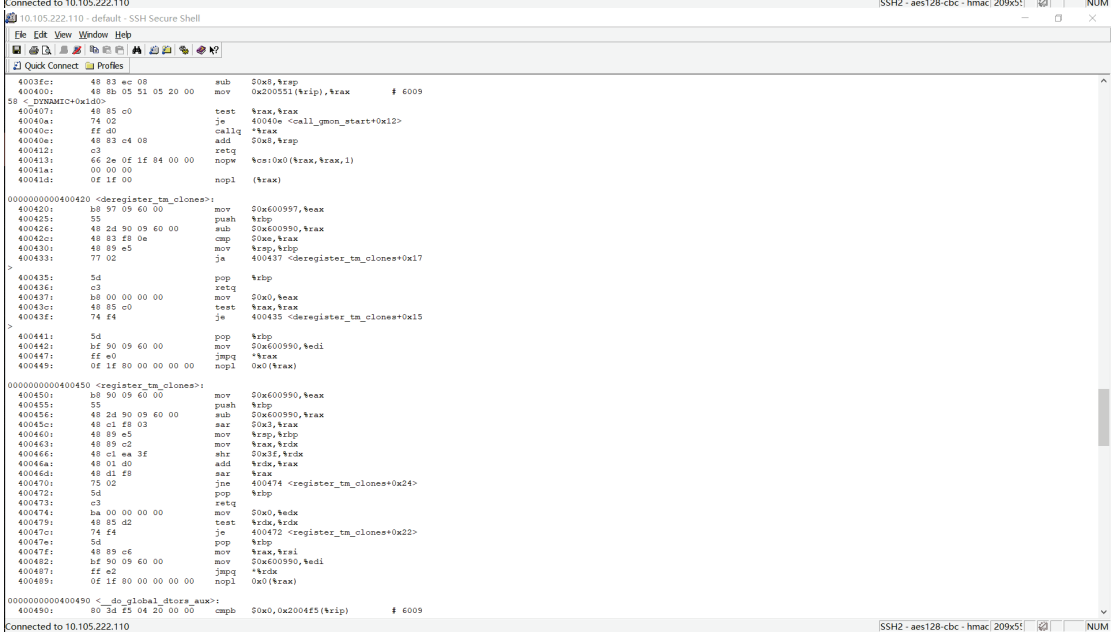




8、运用 objdump 工具生成汇编程序。

整个程序汇编代码：





10.105.222.110 - default - SSH Secure Shell

File Edit View Window Help

Quick Connect Profiles

```
  400490:       80 3d f5 04 20 00 00    cmpb   $0x0,0x2004f5(%rip)        # 6009
8c <_edata>
  400497:       75 11                   jne    4004aa <__do_global_dtors_aux+0x1
a>
  400499:       55                      push   %rbp
  40049a:       48 89 e5                mov    %rsp,%rbp
  40049d:       e8 7e ff ff ff          callq  400420 <deregister_tm_clones>
  4004a2:       5d                      pop    %rbp
  4004a3:       c6 05 e2 04 20 00 01    movb   $0x1,0x2004e2(%rip)        # 6009
8c <_edata>
  4004aa:       f3 c3                   repz retq
  4004ac:       0f 1f 40 00             nopl   0x0(%rax)

00000000004004b0 <frame_dummy>:
  4004b0:       48 83 3d c8 02 20 00    cmpq   $0x0,0x2002c8(%rip)        # 6007
80 <__JCR_END__>
  4004b7:       00
  4004b8:       74 1e                   je     4004d8 <frame_dummy+0x28>
  4004ba:       b8 00 00 00 00          mov    $0x0,%eax
  4004bf:       48 85 c0                test   %rax,%rax
  4004c2:       74 14                   je     4004d8 <frame_dummy+0x28>
  4004c4:       55                      push   %rbp
  4004c5:       bf 80 07 60 00          mov    $0x600780,%edi
  4004ca:       48 89 e5                mov    %rsp,%rbp
  4004cd:       ff d0                   callq  *%rax
  4004cf:       5d                      pop    %rbp
  4004d0:       e9 7b ff ff ff          jmpq   400450 <register_tm_clones>
  4004d5:       0f 1f 00                nopl   (%rax)
  4004d8:       e9 73 ff ff ff          jmpq   400450 <register_tm_clones>
  4004dd:       0f 1f 00                nopl   (%rax)

00000000004004e0 <main>:
#include<stdio.h>
void multstore(long, long, long*);
long mult2(long, long);
int main()
{
  4004e0:       55                      push   %rbp
  4004e1:       48 89 e5                mov    %rsp,%rbp
  4004e4:       48 83 ec 10             sub    $0x10,%rsp
        long d;
        multstore(2, 3, &d);
  4004e8:       48 8d 45 f8             lea    -0x8(%rbp),%rax
  4004ec:       48 89 c2                mov    %rax,%rdx
  4004ef:       be 03 00 00 00          mov    $0x3,%esi
  4004f4:       bf 02 00 00 00          mov    $0x2,%edi
  4004f9:       e8 1d 00 00 00          callq  40051b <multstore>
        printf("2 * 3 --> %ld\n", d);
  4004fe:       48 8b 45 f8             mov    -0x8(%rbp),%rax
  400502:       48 89 c6                mov    %rax,%rsi
  400505:       bf 38 06 40 00          mov    $0x400638,%edi
  40050a:       b8 00 00 00 00          mov    $0x0,%eax
  40050f:       e8 9c fe ff ff          callq  4003b0 <printf@plt>
        return 0;
  400514:       b8 00 00 00 00          mov    $0x0,%eax
```

Connected to 10.105.222.110 SSH2 - aes128-cbc - hmac 209x5 NUM

10.105.222.110 - default - SSH Secure Shell

File Edit View Window Help

Quick Connect Profiles

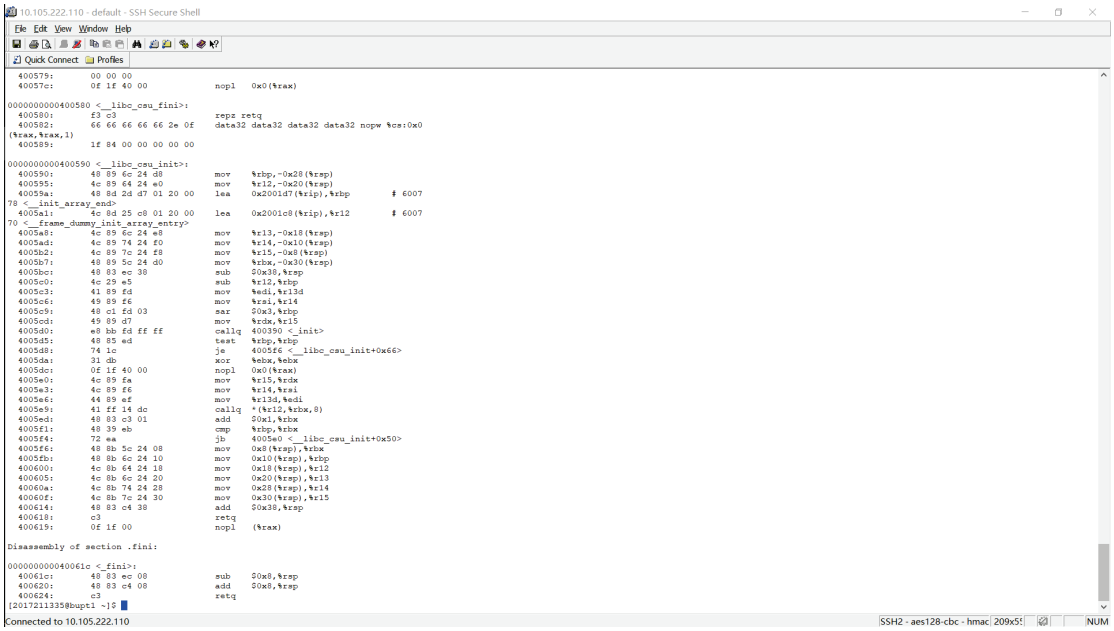
```
  400514:       b8 00 00 00 00          mov    $0x0,%eax
}
  400519:       c9                      leaveq
  40051a:       c3                      retq

000000000040051b <multstore>:
void multstore(long x, long y, long *dest)
{
  40051b:       55                      push   %rbp
  40051c:       48 89 e5                mov    %rsp,%rbp
  40051f:       48 83 ec 30             sub    $0x30,%rsp
  400523:       48 89 7d e8             mov    %rdi,-0x18(%rbp)
  400527:       48 89 75 e0             mov    %rsi,-0x20(%rbp)
  40052b:       48 89 55 d8             mov    %rdx,-0x28(%rbp)
        long t = mult2(x, y);
  40052f:       48 8b 55 e0             mov    -0x20(%rbp),%rdx
  400533:       48 8b 45 e8             mov    -0x18(%rbp),%rax
  400537:       48 89 d6                mov    %rdx,%rsi
  40053a:       48 89 c7                mov    %rax,%rdi
  40053d:       e8 11 00 00 00          callq  400553 <mult2>
  400542:       48 89 45 f8             mov    %rax,-0x8(%rbp)
        *dest = t;
  40054f:       48 8b 45 d8             mov    -0x28(%rbp),%rax
  40054a:       48 8b 55 f8             mov    -0x8(%rbp),%rdx
  40054e:       48 89 10                mov    %rdx,(%rax)
}
  400551:       c9                      leaveq
  400552:       c3                      retq

0000000000400553 <mult2>:
long mult2(long a, long b)
{
  400553:       55                      push   %rbp
  400554:       48 89 e5                mov    %rsp,%rbp
  400557:       48 89 7d e8             mov    %rdi,-0x18(%rbp)
  40055b:       48 89 75 e0             mov    %rsi,-0x20(%rbp)
        long s = a * b;
  40055f:       48 8b 45 e8             mov    -0x18(%rbp),%rax
  400563:       48 0f af 45 e0          imul   -0x20(%rbp),%rax
  400568:       48 89 45 f8             mov    %rax,-0x8(%rbp)
        return s;
  40056c:       48 8b 45 f8             mov    -0x8(%rbp),%rax
}
  400570:       5d                      pop    %rbp
  400571:       c3                      retq
  400572:       66 2e 0f 1f 84 00 00    nopw   %cs:0x0(%rax,%rax,1)
  400579:       00 00 00
  40057c:       0f 1f 40 00             nopl   0x0(%rax)

0000000000400580 <__libc_csu_fini>:
  400580:       f3 c3                   repz retq
  400582:       66 66 66 66 66 2e 0f    data32 data32 data32 data32 nopw %cs:0x0
(%rax,%rax,1)
  400589:       1f 84 00 00 00 00 00
```

Connected to 10.105.222.110 SSH2 - aes128-cbc - hmac 209x5 NUM



Main 函数的汇编代码：

```
int main()
{
  4004e0:       55                      push   %rbp
  4004e1:       48 89 e5                mov    %rsp,%rbp
  4004e4:       48 83 ec 10             sub    $0x10,%rsp
        long d;
        multstore(2, 3, &d);
  4004e8:       48 8d 45 f8             lea    -0x8(%rbp),%rax
  4004ec:       48 89 c2                mov    %rax,%rdx
  4004ef:       be 03 00 00 00          mov    $0x3,%esi
  4004f4:       bf 02 00 00 00          mov    $0x2,%edi
  4004f9:       e8 1d 00 00 00          callq  40051b <multstore>
        printf("2 * 3 --> %ld\n", d);
  4004fe:       48 8b 45 f8             mov    -0x8(%rbp),%rax
  400502:       48 89 c6                mov    %rax,%rsi
  400505:       bf 38 06 40 00          mov    $0x400638,%edi
  40050a:       b8 00 00 00 00          mov    $0x0,%eax
  40050f:       e8 9c fe ff ff          callq  4003b0 <printf@plt>
        return 0;
  400514:       b8 00 00 00 00          mov    $0x0,%eax
}
  400519:       c9                      leaveq
  40051a:       c3                      retq
```

五、实验分析

工作思路：打开 ssh secure shell，进入 VI，编辑好.c 文件，保存后用 gcc 编译，用 gdb 调试，最后用 objdump 生成汇编代码。

分析：完美实现了.c 文件的编译，调试和生成汇编代码，从截图即可看到效果很好。

六、实验总结

进行实验时遇到了好多意料之外的问题，比如 VI 保存不了、gcc 编译报错等，但我都通过百度或查资料解决了这些问题。应进一步加强对 gcc 编译指令的练习。