ged function in sml, C, and asm

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gcd

The greatest common divisor (gcd) of two positive natural numbers is the largest natural number that exactly divides both numbers. The gcd of 14 and 12 is 2, while the gcd of 14 and 11 is 1. The gcd is given by this specification:

$$\gcd:(\mathbb{N}\times\mathbb{N})\to\mathbb{N}$$

$$\gcd(m,n)=\max\{d\in\mathbb{N}|m\bmod d=0\land n\bmod d=0\}$$

One algorithm for calculating the gcd follows Euclid's method. If, for two positive natural numbers m and n, we have that m > n, then the gcd of m and n is defined by:

$$\operatorname{euclid}: (\mathbb{N} \times \mathbb{N}) \to \mathbb{N}$$

$$\operatorname{euclid}(m,n) = \left\{ \begin{array}{ll} \operatorname{euclid}(n,m \bmod n), & \text{ if } n > 0 \\ m, & \text{ otherwise} \end{array} \right.$$

gcd in sml

This can be written in SML like this:

```
fun euclid m n = if n > 0
then euclid n (m \mod n)
else m;
euclid 558 198; (* expect 18 *)
```

Although a short program, we may not be familiar with the use of recursion because it is not commonly used for C programs due to its inefficiency. But let's implement it that way anyway to follow the math definition more closely.

SML code result

gcd in c

```
C source code written to file lab3.c
\#include < stdio.h >
int \ euclid(int \ m, \ int \ n)
  if (n > 0) return euclid(n, m \% n);
  else return m;
int main()
  printf("GCD\ output = \%i \backslash n", euclid(558,198));
  return 0;
debian@debian:~/labs/lab3$ ./labc
GCD output = 18
```

The first line of this C code is an include to get access to the library. We need it here to use printf.

```
#include <stdio.h>
```

In ASM, we do not need to include any files in order to link to the C library, so we can skip this.

gcd in c: euclid function

```
int euclid(int m, int n)
{
   if( n > 0) return euclid(n, m % n);
   else return m;
}
```

These lines are the function definition. There are several techniques to be studied to implement it in assembler:

- syntax for function definitions
 C: int euclid(){}
 ASM: function is declared using "euclid:"
 euclid:
- parameter passing C: int m, int n ASM: variables are placed in stack.
 push \$198

push \$558

```
    decision (if statement)
    C: if() return euclid(); else return m; ASM: the procedure will simply jump to endif.
    jmp endif
    endif:
```

conditional (relational expression to compare values) C:
 if (n>0) return euclid()
 else reutrn m;

ASM:eax is compared with zero. If eax is equal to zero, it will go to "else". If not it will keep repeating the first function.

```
cmp $0, %eax
jle else
...
else:
...
```

• return statement C:

```
return ASM: "ret" is simply used as "return" ret
```

calling a function (recursively in this case) C:
 euclid(558,198)
 ASM In ASM function called using "call function.

ASM: In ASM, function called using "call function-name" call euclid

• calculating modulus C: m % n

ASM: two numbers are kept in the stack for one operation then placed in ebx and eax registers. edx is set to zero to clear off the previous value. idiv command is used to divide eax by, ebx giving out the remainder of edx. Click here for detailed explanation for idiv.

mov 12(%ebp), %ebx
mov 8(%ebp), %eax
mov \$0, %edx
idiv %ebx

gcd in asm: main

The main function is simpler, but we need to also learn how to:

- call printf
- end the program

ASM code is put in the "text" section. The entry point is named "_start". It is a label (indicated by the colon). We make it global so the linker will make it visible to be called externally (by the operating system).

```
ASM source code written to file lab3.s
```

.text

.globl _start

 $_start$:

printf needs 2 parameters: a format string and a value. That value must be determined by called our function euclid. Return values are found in the EAX register. The euclid function also requires 2 parameters which must be pushed onto the system stack so they can be retrieved within the function. Parameters are pushed right to left (the C convention). Immediate (literal) values are prefixed with the \$ sign. Register names are prefixed with the % sign.

```
ASM source code appended to file lab3.s  push \$198  push \$558  call \ euclid  add \$8, \%esp \#two \ of \ them \ 4 \ bytes \ each  .data  fmt: .string "GCD \ output = \%d \ "  .text  push \ \%eax  push \ \$fmt  call \ printf  add \ \$8, \%esp
```

The program is ended by calling software interrupt 0x80. The 1 in EAX means exit command and the 0 in EBX is the convention to mean program had no errors.

ASM source code appended to file lab3.s

 $mov ~\$1,\% \, eax$

mov \$0,%ebx

int \$0x80

gcd in asm: euclid function

The euclid function uses the same technique of creating a label to indicate start of function. It ends with the ret instruction. The first 2 instructions set up a stack frame base pointer (EBP) to give us access to paramters even if the stack pointer (ESP) moves.

```
ASM source code appended to file lab3.s euclid: \\push \ensuremath{\%ebp}
```

Now we can access the 2 parameters using register EBP. 4 bytes above EBP is the return address, 8 is the 1st parm, and 12 is the second. i.e.

```
n is on stack at 12(%ebp)m is on stack at 8(%ebp)
```

The if statement has to be simulated by branching to labels depending of results of doing the comparison of n to zero.

```
ASM source code appended to file lab3.s mov~\%esp,\%ebp mov~12(\%ebp),\%eax cmp~\$0,\%eax jle~else
```

This is the "then" part of the if statement. We need to calculate $m \mod n$ and call euclid again! Integer division is done by putting dividend in EDX:EAX as 64-bit value, and divisor in EBX. The remainder will be in EDX.

```
mov 12(%ebp), %ebx

mov 8(%ebp), %eax

mov $0, %edx # clear upper 32 bits of the 64-bit divident edx:eax

idiv %ebx # modulus is in edx (quotient is in eax)

push %edx

push %ebx

call euclid

add $8,%esp

jmp endif

else:

mov 8(%ebp),%eax

endif:
```

These last 2 instructions undo the first 2–they restore the original stack as it was found on entry to the function.

```
ASM source code appended to file lab3.s |mov|\% ebp,\% esp |pop|\% ebp |ret
```

Here is output from running the ASM program:

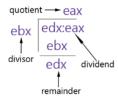
```
debian@debian:~/labs/lab3$ ./labasm
GCD output = 18
```

This is my own lab explanation.

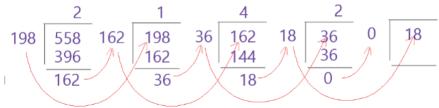
I made this lab report as simple as possible so that anyone without computing knowledge will be able to understand the content of this lab. In this lab, there are two most important things to understand fully: Euclidean Algorithm and Stackframe.

What is Euclidean Algorithm

According to wikipedia, Euclidean algorithm is an efficient method for computing the greatest common divisor(gcd) of two numbers, the largest number that divides both of them without leaving a remainder. Below is the sample long division components compared with registers. Ok, what are those eax, ebx and edx? They are general purpose registers, where values are stored to do the calculation, and they have specific purposes. We will have to deal more with these registers when we write this algorithm using assembly language.



Lets say there are two numbers: 558 and 198. As we can see below, in the first step, dividend, 558 is divided by divisor, 198, resulting the remainder of 162. Then the remainder, 162 becomes the divisor in the second step, dividing the new dividend, 198 to give the new result of the remainder which is 36. The same procedure is repeated until the divisor becomes zero. So in this case, the GCD



of 558 and 198 is 18.

This link is the youtube video explanation for Euclidean Algorithm.

Now if you feel confident enough with your Euclidean Algorithm understanding, try to answer GCD for these numbers: (255,245), (531,234) and (126,186).

Using this online GCD calculator you can check your answer here.

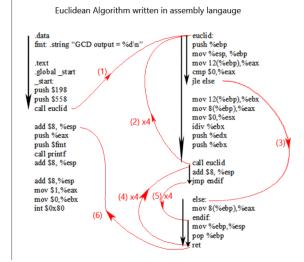
Click here for the Euclidean Algorithm in mathematical expression.

Click here for the alogrithm written in SML functional programming language.

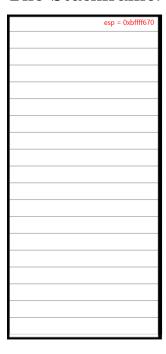
Click here for the alogirthm written in C programming language.

Euclidean Algorithm in Assembly Language(ASM)

Now, lets begin with what assembly language is. It is a low-level programming language. This programming language is simple to write codes, if you understand the concept well, but you will have to write a lot just for a short program of high-level programming languages such as C, C++, and so on. Below is the Euclidean Algorithm in ASM.

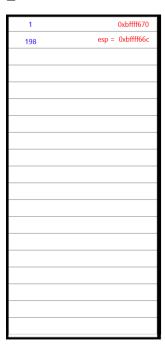


The Stackframe: 1



This is the first time checking the stackframe before running the program.

```
(gdb) info r
eax
                0x1c
                          28
                0xb7fffc1c
ecx
                                   -1207960548
                0xb7fedc90
                                   -1208034160
edx
                0xb7fff000
                                   -1207963648
ebx
                0xbffff670
                                   0xbffff670
esp
ebp
                0 \times 0
                          0 \times 0
esi
                0xbffff67c
                                   -1073744260
edi
                0x8048200
                                   134513152
eip
                                   0x8048200 <_start>
                0x8048200
(gdb) x/8w $esp
0xbffff670:
                    -1073743937
                                        -1073743907
0xbffff680:
             -1073743889
                          -1073743871
                                        -1073743855
                                                     -1073743844
(gdb) backtrace
#0 _start () at lab3.s:4
```



push \$198

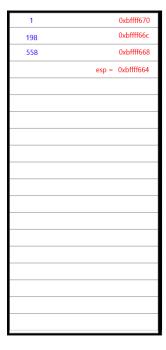
```
(gdb) info r
                 0x1c
                           28
eax
ecx
                 0xb7fffc1c
                                     -1207960548
edx
                 0xb7fedc90
                                     -1208034160
ebx
                 0xb7fff000
                                    -1207963648
                 0xbffff66c
                                    0xbffff66c
esp
ebp
                 0 \times 0
                           0 \times 0
esi
                 0xbffff67c
                                     -1073744260
edi
                 0x8048200
                                    134513152
                 0x8048205
eip
                                     0x8048205 <_start+5>
(gdb) x/8w $esp
0xbffff66c:
             198
                           -1073743937
             -1073743907
0xbffff67c:
                           -1073743889
                                         -1073743871
                                                       -1073743855
(gdb) backtrace
```

_start () at lab3.s:5

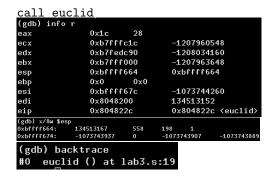


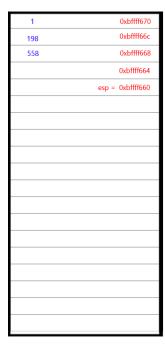
push \$558

```
(gdb) info r
                0x1c
                          28
eax
ecx
                0xb7fffc1c
                                   -1207960548
edx
                0xb7fedc90
                                   -1208034160
ebx
                0xb7fff000
                                   -1207963648
                                   0xbffff668
                0xbffff668
esp
                0x0
ebp
                          0 \times 0
esi
                0xbffff67c
                                   -1073744260
                0x8048200
edi
                                   134513152
eip
                0x804820a
                                   0x804820a <_start+10>
(gdb) x/8w $esp
0xbffff668:
                    198
                                 -1073743937
0xbffff678:
                    -1073743907
                                 -1073743889
                                              -1073743871
(gdb) backtrace
#0 _start () at lab3.s:6
```



call euclid





call euclid push %ebp

```
push %ebp
(gdb) info r
                0x1c
                          28
eax
                0xb7fffc1c
                                  -1207960548
ecx
edx
                0xb7fedc90
                                  -1208034160
ebx
                0xb7fff000
                                  -1207963648
esp
                0xbffff660
                                  0xbffff660
ebp
                0x0
                          0 \times 0
                0xbffff67c
                                  -1073744260
esi
edi
                0x8048200
                                  134513152
                0x804822d
                                  0x804822d <euclid+1>
eip
gdb) x/8w $esp
0xbffff660:
                   134513167
                                      198
                                558
0xbffff670:
                   -1073743937
                                      -1073743907
(gdb) backtrace
#0 euclid () at lab3.s:21
```

1		0xbffff670
198		0xbffff66c
558		0xbffff668
		0xbffff664
	ebp = esp =	0xbffff660

call euclid push %ebp

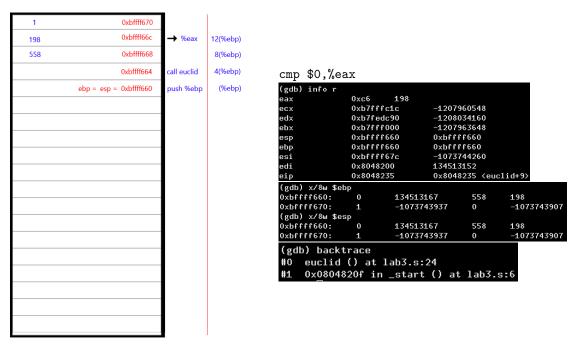
mov %esp,%ebp

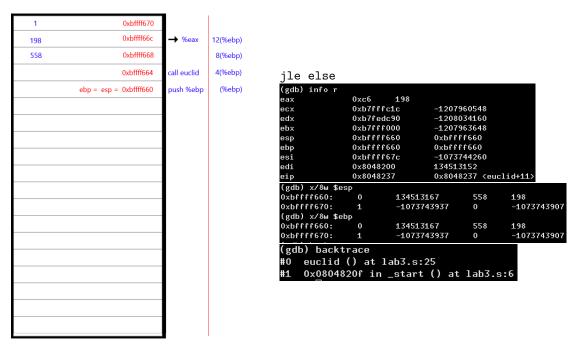
```
(gdb) infor
               0x1c
                        28
eax
               0xb7fffc1c
ecx
                                 -1207960548
               0xb7fedc90
                                 -1208034160
edx
ebx
               0xb7fff000
                                 -1207963648
esp
               0xbffff660
                                 0xbffff660
ebp
               0xbffff660
                                 0xbffff660
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                 134513152
eip
               0x804822f
                                 0x804822f <euclid+3>
```

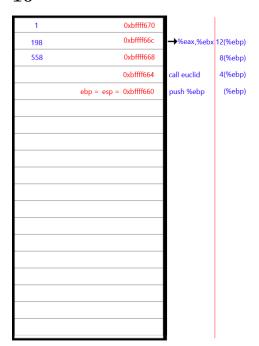
(gdb) x/8w \$ebp 0xbffff660: 558 0 134513167 198 0xbffff670: -1073743937 -1073743907 0 (gdb) x/8w \$esp 0xbffff660: 0 134513167 558 198 0xbffff670: -1073743937 -1073743907 0

```
(gdb) backtrace
#0 euclid () at lab3.s:22
#1 0x0804820f in _start () at lab3.s:6
```



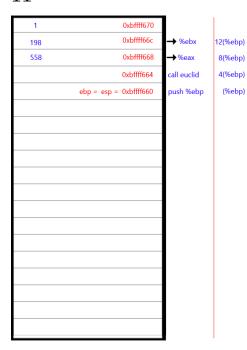






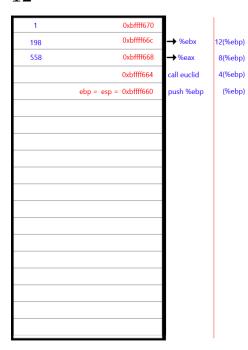
mov 12(%ebp), %ebx

```
(gdb) bt
#0 euclid () at lab3.s:26
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                         0
                                                 -1073743907
(gdb) x/8w $ebp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                 -1073743907
                                         0
(gdb) info r
               0xc6
                        198
eax
               0xb7fffc1c
ecx
                                -1207960548
               0xb7fedc90
                                -1208034160
edx
ebx
               0xc6
                        198
               0xbffff660
                                0xbffff660
esp
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x804823a <euclid+14>
eip
               0x804823a
```



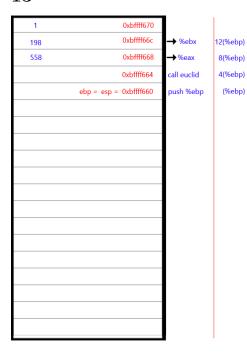
mov 8(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:27
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff660:
                        134513167
                                         558
                                                198
0xbffff670:
                        -1073743937
                                         0
                                                 -1073743907
(gdb) x/8w $ebp
0xbffff660:
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                 -1073743907
                                         0
(gdb) info r
               0x22e
                        558
eax
               0xb7fffc1c
ecx
                                -1207960548
               0xb7fedc90
                                -1208034160
edx
               0xc6
                        198
ebx
               0xbffff660
                                0xbffff660
esp
                                0xbffff660
ebp
               0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x804823d
                                0x804823d <euclid+17>
eip
```



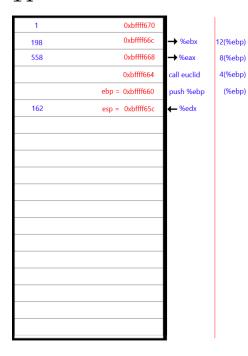
mov 0, %edx

```
(gdb) bt
#0 euclid () at lab3.s:28
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff660:
                        134513167
                                         558
                                                 198
0xbffff670:
                        -1073743937
                                         0
                                                 -1073743907
(gdb) x/8w $ebp
0xbffff660:
                        134513167
                                         558
                                                 198
0xbffff670:
                        -1073743937
                                         0
                                                 -1073743907
(gdb) info r
               0x22e
                        558
eax
ecx
               0xb7fffc1c
                                 -1207960548
edx
               0 \times 0
                        0
ebx
               0xc6
                        198
               0xbffff660
                                 0xbffff660
esp
               0xbffff660
                                 0xbffff660
ebp
esi
               0xbffff67c
                                 -1073744260
               0x8048200
                                 134513152
edi
               0x8048242
                                 0x8048242 <euclid+22>
eip
```



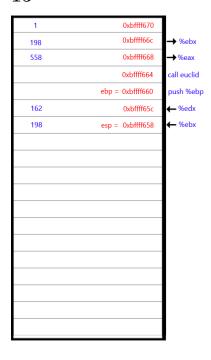
idiv %ebx

```
(gdb) bt
#0 euclid () at lab3.s:29
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff660:
                        134513167
                0
                                        558
                                                198
0xbffff670:
                        -1073743937
                                        0
                                                 -1073743907
(gdb) x/8w $ebp
0xbffff660:
                        134513167
                0
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                 -1073743907
                                         0
(gdb) info r
               0x2
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0xa2
                        162
                        198
ebx
               0xc6
               0xbffff660
                                0xbffff660
esp
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048244 <euclid+24>
               0x8048244
```



push %edx

```
(gdb) bt
#0 euclid () at lab3.s:30
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff65c:
                162
                                                558
                        0
                                134513167
0xbffff66c:
                198
                                -1073743937
                                                 0
(gdb) x/8w $ebp
0xbffff660:
                        134513167
                                        558
                                                 198
0xbffff670:
                        -1073743937
                                        0
                                                 -1073743907
(gdb) info r
               0x2
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0xa2
                        162
ebx
               0xc6
                        198
               0xbffff65c
                                0xbffff65c
esp
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x8048245
                                0x8048245 <euclid+25>
eip
```



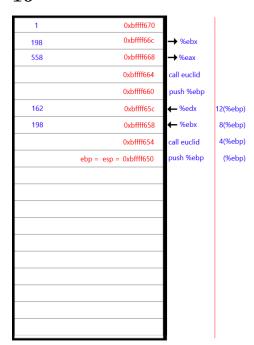
push %ebx

12(%ebp)

8(%ebp)

4(%ebp)

```
(gdb) bt
#0 euclid () at lab3.s:31
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff658:
                198
                        162
                                0
                                        134513167
0xbffff668:
                558
                        198
                                        -1073743937
(gdb) x/8w $ebp
                        134513167
0xbffff660:
                0
                                        558
                                                 198
0xbffff670:
                        -1073743937
                                                 -1073743907
                                        0
(gdb) info r
               0x2
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0xa2
                        162
ebx
               0xc6
                        198
               0xbffff658
                                0xbffff658
esp
ebp
               0xbffff660
                                0xbffff660
               0xbffff67c
esi
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048246 <euclid+26>
eip
               0x8048246
```



call euclid There are a few things happened after calling the euclid function, and they are not obviously seen in the gdb. But by seeing the address changes we can say what happened there.

```
(gdb) bt
#0 euclid () at lab3.s:22
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                 134513227
                                                          162
                                                  198
0xbffff660:
                         134513167
                                          558
                                                  198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                 134513227
                                                  198
                                                          162
0xbffff660:
                         134513167
                                         558
                                                  198
(gdb) info r
               0x2
eax
               0xb7fffc1c
                                 -1207960548
ecx
edx
               0xa2
                         162
ebx
               0xc6
                         198
esp
               0xbffff650
                                 0xbffff650
ebp
               0xbffff650
                                 0xbffff650
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                 134513152
eip
                                 0x804822f <euclid+3>
                0x804822f
```

1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	call euclid
	0xbffff660	push %ebp
162	0xbffff65c	→ %eax
198	0xbffff658	
	0xbffff654	call euclid
	ebp = esp = 0xbffff650	push %ebp

mov 12(%ebp), %eax

12(%ebp)

8(%ebp)

4(%ebp)

```
(gdb) bt
#0 euclid () at lab3.s:23
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
0xbffff660:
                        134513167
                                        558
                                                198
                0
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
0xbffff660:
                        134513167
                                        558
                0
                                                 198
(gdb) info r
                        162
               0xa2
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0xa2
                        162
ebx
               0xc6
                        198
esp
               0xbffff650
                                0xbffff650
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048232 <euclid+6>
eip
               0x8048232
```

		_
1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	call euclid
	0xbffff660	push %ebp
162	0xbffff65c	→ %eax
198	0xbffff658	
	0xbffff654	call euclid
	ebp = esp = 0xbffff650	push %ebp

cmp \$0, %eax

12(%ebp)

8(%ebp)

4(%ebp)

```
(gdb) bt
#0 euclid () at lab3.s:24
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
0xbffff660:
                0
                        134513167
                                        558
                                                198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                198
0xbffff660:
                        134513167
                                        558
                                                198
                0
(gdb) info r
                        162
eax
               0xa2
ecx
               0xb7fffc1c
                                -1207960548
edx
               0xa2
                        162
ebx
               0xc6
                        198
esp
               0xbffff650
                                0xbffff650
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048235
                                0x8048235 <euclid+9>
```

		-	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %eax	12(%ebp)
198	0xbffff658		8(%ebp)
	0xbffff654	call euclid	4(%ebp)
	ebp = esp = 0xbffff650	push %ebp	(%ebp)

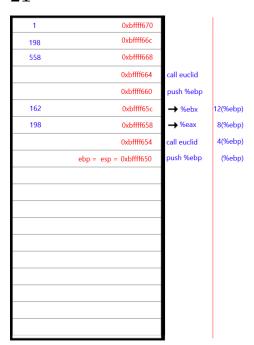
jle else

```
(gdb) bt
#0 euclid () at lab3.s:25
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                0
                        134513167
                                         558
                                                 198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                         162
                                                 198
0xbffff660:
                        134513167
                                         558
                                                 198
                0
(gdb) info r
               0xa2
                        162
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0xa2
                        162
                        198
ebx
               0xc6
               0xbffff650
                                0xbffff650
esp
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048237 <euclid+11>
eip
               0x8048237
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	12(%ebp)
198	0xbffff658		8(%ebp)
	0xbffff654	call euclid	4(%ebp)
	ebp = esp = 0xbffff650	push %ebp	(%ebp)
]

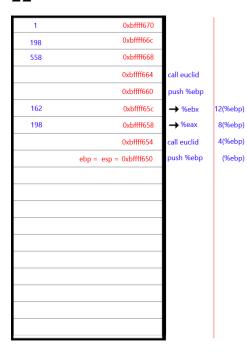
mov 12(%ebp), %ebx

```
(gdb) bt
#0 euclid () at lab3.s:26
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
0xbffff660:
                        134513167
                                        558
                                                198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
0xbffff660:
                        134513167
                                        558
                                                198
(gdb) info r
                        162
eax
               0xa2
ecx
               0xb7fffc1c
                                -1207960548
edx
               0xa2
                        162
ebx
               0xa2
                        162
               0xbffff650
esp
                                0xbffff650
               0xbffff650
                                0xbffff650
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x804823a
                                0x804823a <euclid+14>
```



mov 8(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:27
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                                         558
                                                 198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                                                 198
                                         558
(gdb) info r
                        198
eax
               0xc6
ecx
               0xb7fffc1c
                                -1207960548
edx
               0xa2
                        162
ebx
               0xa2
                        162
esp
               0xbffff650
                                0xbffff650
               0xbffff650
                                0xbffff650
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x804823d
                                0x804823d <euclid+17>
```



mov \$0, %edx (gdb) bt #0 euclid () at lab3.s:28 #1 0x0804824b in euclid () at lab3.s:31 #2 0x0804820f in _start () at lab3.s:6 (gdb) x/8w \$esp 0xbffff650: -1073744288 134513227 198 162 0xbffff660: 134513167 558 198 (gdb) x/8w \$ebp 0xbffff650: -1073744288 162 134513227 198 0xbffff660: 134513167 198 558 (gdb) info r 0xc6 198 eax ecx 0xb7fffc1c -1207960548 edx 0×0 0 ebx 0xa2162 esp 0xbffff650 0xbffff650 ebp 0xbffff650 0xbffff650 esi 0xbffff67c -1073744260 134513152 edi 0x8048200 eip 0x8048242 <euclid+22> 0x8048242

		-
1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	call euclid
	0xbffff660	push %ebp
162	0xbffff65c	→ %ebx
198	0xbffff658	→ %eax
	0xbffff654	call euclid
	ebp = esp = 0xbffff650	push %ebp

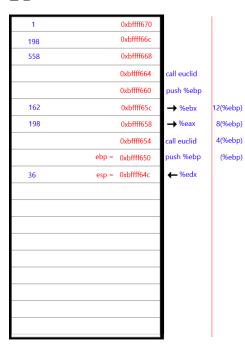
```
idiv %ebx
(gdb) bt
#0 euclid () at lab3.s:29
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                198
0xbffff660:
                        134513167
                0
                                        558
                                                198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
0xbffff660:
                0
                        134513167
                                        558
                                                198
(gdb) info r
eax
               0x1
                                -1207960548
ecx
               0xb7fffc1c
edx
               0x24
                        36
                        162
ebx
               0xa2
               0xbffff650
                                0xbffff650
esp
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048244
                                0x8048244 <euclid+24>
```

12(%ebp)

8(%ebp)

4(%ebp)

(%ebp)



push %edx

```
(gdb) bt
#0 euclid () at lab3.s:30
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff64c:
                36
                        -1073744288
                                                         198
                                         134513227
0xbffff65c:
                162
                                134513167
                                                 558
                        0
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                                        558
                                                 198
(gdb) info r
eax
               0x1
               0xb7fffc1c
                                -1207960548
ecx
               0x24
edx
                        36
ebx
               0xa2
                        162
esp
               0xbffff64c
                                0xbffff64c
ebp
               0xbffff650
                                0xbffff650
               0xbffff67c
                                -1073744260
esi
               0x8048200
                                134513152
edi
eip
               0x8048245
                                0x8048245 <euclid+25>
```

		-	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	12(%ebp)
198	0xbffff658	→ %eax	8(%ebp)
	0xbffff654	call euclid	4(%ebp)
	ebp = 0xbffff650	push %ebp	(%ebp)
36	0xbffff64c	← %edx	
162	esp = 0xbffff648	← %ebx	
			I

```
push %ebx
(gdb) bt
#0 euclid () at lab3.s:31
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff648:
                162
                        36
                                -1073744288
                                                 134513227
0xbffff658:
                198
                        162
                                0
                                        134513167
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                                        558
                                                 198
                0
(gdb) info r
eax
               0 \times 1
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x24
                        36
ebx
               0xa2
                        162
esp
               0xbffff648
                                0xbffff648
               0xbffff650
                                0xbffff650
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048246 <euclid+26>
eip
               0x8048246
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	
198	0xbffff658	→ %eax	
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	← %edx	12(%ebp)
162	0xbffff648	← %ebx	8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)

call euclid

```
(gdb) bt
#0 euclid () at lab3.s:22
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                        36
                                                162
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                 198
(gdb) info r
               0x1
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x24
                        36
                        162
ebx
               0xa2
               0xbffff640
                                0xbffff640
esp
               0xbffff640
                                0xbffff640
ebp
esi
               0xbffff67c
                                -1073744260
               0x8048200
                                134513152
edi
                                0x804822f <euclid+3>
eip
               0x804822f
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	
198	0xbffff658	→ %eax	
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %eax	12(%ebp)
162	0xbffff648		8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)
		I	I

mov 12(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:23
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
(gdb) info r
               0x24
                        36
eax
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x24
                        36
ebx
                        162
               0xa2
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
eip
                                0x8048232 <euclid+6>
               0x8048232
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	
198	0xbffff658	→ %eax	
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %eax	12(%ebp)
162	0xbffff648		8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)
			1

cmp \$0, %eax

```
(gdb) bt
#0 euclid () at lab3.s:24
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
0xbffff650:
                -1073744288
                                                         162
                                134513227
                                                 198
(gdb) x/8w $ebp
0xbffff640:
                                                         36
                -1073744304
                                134513227
                                                 162
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
(gdb) info r
               0x24
                        36
eax
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x24
                        36
               0xa2
                        162
ebx
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
                                0x8048235 <euclid+9>
eip
               0x8048235
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c	→ %ebx	
198	0xbffff658	→ %eax	
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %eax	12(%ebp)
162	0xbffff648		8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)
			I

jle else

```
(gdb) bt
#0 euclid () at lab3.s:25
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                         36
                                                 162
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                         162
                                                 198
(gdb) info r
               0 \times 24
                        36
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x24
                        36
                        162
ebx
               0xa2
               0xbffff640
                                0xbffff640
esp
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048237
                                0x8048237 <euclid+11>
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648		8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)

mov 12(%ebp), %ebx

```
(gdb) bt
#0 euclid () at lab3.s:26
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                 198
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
(gdb) info r
               0x24
                        36
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x24
                        36
ebx
               0x24
                        36
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
               0x804823a
                                0x804823a <euclid+14>
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648	→ %eax	8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)

mov 8(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:27
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
(gdb) x/8w $ebp
0xbffff640:
                                134513227
                                                162
                -1073744304
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
(gdb) info r
               0xa2
                        162
eax
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x24
                        36
ebx
               0x24
                        36
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
                                0x804823d <euclid+17>
eip
               0x804823d
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648	→ %eax	8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)
			l .

(gdb) bt #0 euclid () at lab3.s:28 #1 0x0804824b in euclid () at lab3.s:31 #2 0x0804824b in euclid () at lab3.s:31 #3 0x0804820f in _start () at lab3.s:6 (gdb) x/8w \$esp 0xbffff640: -1073744304 134513227 162 36 0xbffff650: -1073744288 162 134513227 198 (gdb) x/8w \$ebp 0xbffff640: -1073744304 134513227 162 36 0xbffff650: -1073744288 134513227 198 162 (gdb) info r 162 eax 0xa20xb7fffc1c -1207960548 ecx edx

0xbffff640

0xbffff640

134513152

-1073744260

0x8048242 <euclid+22>

ebx

esp

ebp

esi

edi

eip

mov \$0, %edx

0x0

0x24

0xbffff640

0xbffff640

0xbffff67c

0x8048200

0x8048242

0

36

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648	→ %eax	8(%ebp)
	0xbffff664	call euclid	4(%ebp)
	ebp =esp =0xbffff650	push %ebp	(%ebp)
			1

idiv %ebx (gdb) bt #0 euclid () at lab3.s:29 #1 0x0804824b in euclid () at lab3.s:31 #2 0x0804824b in euclid () at lab3.s:31 #3 0x0804820f in _start () at lab3.s:6 (gdb) x/8w \$esp 0xbffff640: -1073744304 134513227 36 162 0xbffff650: -1073744288 134513227 198 162 (gdb) x/8w \$ebp 0xbffff640: 134513227 -1073744304 162 36 0xbffff650: -1073744288 134513227 198 162 (gdb) info r eax 0x4 ecx 0xb7fffc1c -1207960548 edx 0x12 18 ebx 0x24 36 0xbffff640 0xbffff640 esp ebp 0xbffff640 0xbffff640 esi 0xbffff67c -1073744260 edi 0x8048200 134513152 eip 0x8048244 0x8048244 <euclid+24>

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648	→ %eax	8(%ebp)
	0xbffff644	call euclid	4(%ebp)
	ebp = 0xbffff640	push %ebp	(%ebp)
18	esp = 0xbffff63c	← %edx	
			1

push %edx

```
(gdb) bt
#0 euclid () at lab3.s:30
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff63c:
                18
                        -1073744304
                                        134513227
                                                         162
0xbffff64c:
                36
                        -1073744288
                                        134513227
                                                         198
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                         36
                                                 162
0xbffff650:
                                                         162
                -1073744288
                                134513227
                                                198
(gdb) info r
                        4
eax
               0x4
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x12
                        18
ebx
               0x24
                        36
               0xbffff63c
                                0xbffff63c
esp
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
                                0x8048245 <euclid+25>
eip
               0x8048245
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	12(%ebp)
162	0xbffff648	→ %eax	8(%ebp)
	0xbffff644	call euclid	4(%ebp)
	ebp = 0xbffff640	push %ebp	(%ebp)
18	0xbffff63c	← %edx	
36	esp = 0xbffff638	← %ebx	

push %ebx

```
(gdb) bt
#0 euclid () at lab3.s:31
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff638:
                36
                        18
                                -1073744304
                                                134513227
0xbffff648:
                                                134513227
                162
                        36
                                -1073744288
(gdb) x/8w $ebp
0xbffff640:
                                134513227
                                                162
                -1073744304
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
(gdb) info r
               0x4
                        4
eax
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x12
                        18
ebx
               0x24
                        36
esp
               0xbffff638
                                0xbffff638
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048246 <euclid+26>
               0x8048246
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c	→ %ebx	
162	0xbffff648	→ %eax	
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	← %edx	12(%ebp)
36	0xbffff638	← %ebx	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

```
call euclid
(gdb) bt
#0 euclid () at lab3.s:22
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                        36
                                                162
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                        18
                -1073744320
                                                36
0xbffff640:
                -1073744304
                                134513227
                                                        36
                                                162
(gdb) info r
eax
               0x4
ecx
              0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
ebx
              0x24
                        36
               0xbffff630
                                0xbffff630
esp
ebp
              0xbffff630
                                0xbffff630
esi
              0xbffff67c
                                -1073744260
edi
              0x8048200
                                134513152
eip
              0x804822f
                                0x804822f <euclid+3>
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %eax	12(%ebp)
36	0xbffff638		8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

mov 12(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:23
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                                                         18
                -1073744320
                                134513227
                                                 36
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
               0x12
                        18
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
ebx
               0x24
                        36
esp
               0xbffff630
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048232
                                0x8048232 <euclid+6>
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %eax	12(%ebp)
36	0xbffff638		8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

cmp \$0, %eax

```
(gdb) bt
#0 euclid () at lab3.s:24
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                                36
                                                        18
                                134513227
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                -1073744320
                                                36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
               0x12
eax
                        18
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
ebx
               0x24
                        36
               0xbffff630
esp
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048235
                                0x8048235 <euclid+9>
```

		_		
1	0xbffff670			
198	0xbffff66c			
558	0xbffff668			
	0xbffff664	call euclid		
	0xbffff660	push %ebp		
162	0xbffff65c			
198	0xbffff658			
	0xbffff654	call euclid		
	0xbffff650	push %ebp		
36	0xbffff64c			
162	0xbffff648			
	0xbffff644	call euclid		
	0xbffff640	push %ebp		
18	0xbffff63c	→ %eax	12(%ebp)	
36	0xbffff638		8(%ebp)	
	0xbffff634	call euclid	4(%ebp)	
	ebp = esp = 0xbffff630	push %ebp	(%ebp)	

jle else

```
(gdb) bt
#0 euclid () at lab3.s:25
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
0xbffff640:
                -1073744304
                                                        36
                                134513227
                                                162
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                36
                                                        18
                -1073744320
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
(gdb) infor
               0x12
                       18
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
                        36
ebx
               0x24
               0xbffff630
esp
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
               0xbffff67c
esi
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048237 <euclid+11>
eip
               0x8048237
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638		8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

mov 12(%ebp), %ebx

```
(gdb) bt
#0 euclid () at lab3.s:26
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                         18
                -1073744320
                                                 36
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
eax
               0x12
                        18
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
ebx
                        18
               0x12
esp
               0xbffff630
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x804823a <euclid+14>
               0x804823a
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638	→ %eax	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

mov 8(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:27
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                36
                                                         18
                -1073744320
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
               0x24
                        36
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x12
                        18
ebx
               0x12
                        18
               0xbffff630
esp
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x804823d <euclid+17>
               0x804823d
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638	→ %eax	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

```
mov $0, %edx
(gdb) bt
#0 euclid () at lab3.s:28
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
(gdb) x/8w $ebp
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
(gdb) info r
eax
               0x24
                        36
               0xb7fffc1c
                                -1207960548
ecx
edx
                        0
               0x0
ebx
               0x12
                        18
               0xbffff630
                                0xbffff630
esp
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
eip
               0x8048242
                                0x8048242 <euclid+22>
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638	→ %eax	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = esp = 0xbffff630	push %ebp	(%ebp)

idiv %ebx

```
(gdb) bt
#0 euclid () at lab3.s:29
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                 36
                                                        18
                -1073744320
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
eax
               0x2
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
                                0xbffff630
               0xbffff630
esp
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
                                134513152
               0x8048200
eip
               0x8048244
                                0x8048244 <euclid+24>
```

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638	→ %eax	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = 0xbffff630	push %ebp	(%ebp)
0	esp = 0xbffff62c	← %edx	

push %edx

```
(gdb) bt
#0 euclid () at lab3.s:30
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff62c:
               0
                        -1073744320
                                        134513227
                                                         36
0xbffff63c:
                        -1073744304
                                                        162
                18
                                        134513227
(gdb) x/8w $ebp
0xbffff630:
                                                        18
                -1073744320
                                134513227
                                                 36
0xbffff640:
                -1073744304
                                                         36
                                134513227
                                                162
(gdb) info r
eax
               0x2
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff62c
                                0xbffff62c
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048245 <euclid+25>
               0x8048245
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	12(%ebp)
36	0xbffff638	→ %eax	8(%ebp)
	0xbffff634	call euclid	4(%ebp)
	ebp = 0xbffff630	push %ebp	(%ebp)
0	0xbffff62c	← %edx	
18	esp = 0xbffff628	← %ebx	

push %ebx

```
(gdb) bt
#0 euclid () at lab3.s:31
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff628:
                        0
                18
                                 -1073744320
                                                 134513227
0xbffff638:
                36
                        18
                                 -1073744304
                                                 134513227
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                                                 36
                                                         18
                -1073744320
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
(gdb) info r
               0x2
eax
ecx
               0xb7fffc1c
                                 -1207960548
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff628
                                0xbffff628
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048246 <euclid+26>
               0x8048246
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	
36	0xbffff638	→ %eax	
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
0	0xbffff62c	← %edx	12(%ebp)
18	0xbffff628	← %ebx	8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)
			I .

```
call euclid
(gdb) bt
#0 euclid () at lab3.s:22
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff620:
                -1073744336
                                134513227
                                                18
                                                        0
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
(gdb) x/8w $ebp
0xbffff620:
               -1073744336
                                134513227
                                                18
                                                        0
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
(gdb) info r
eax
               0x2
                                -1207960548
ecx
               0xb7fffc1c
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff620
                                0xbffff620
ebp
               0xbffff620
                                0xbffff620
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x804822f
                                0x804822f <euclid+3>
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	
36	0xbffff638	→ %eax	
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
0	0xbffff62c	→ %eax	12(%ebp)
18	0xbffff628		8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)

mov 12(%ebp), %eax

```
(gdb) bt
#0 euclid () at lab3.s:23
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff620:
                -1073744336
                                 134513227
                                                 18
                                                         0
0xbffff630:
                -1073744320
                                 134513227
                                                 36
                                                         18
(gdb) x/8w $ebp
0xbffff620:
                                 134513227
                -1073744336
                                                 18
0xbffff630:
                -1073744320
                                 134513227
                                                 36
                                                         18
(gdb) info r
eax
               0x0
                        0
               0xb7fffc1c
                                 -1207960548
ecx
edx
                        0
               0 \times 0
ebx
               0x12
                        18
esp
               0xbffff620
                                 0xbffff620
ebp
               0xbffff620
                                 0xbffff620
               0xbffff67c
                                 -1073744260
esi
edi
                                 134513152
               0x8048200
                                 0x8048232 <euclid+6>
eip
               0x8048232
```

		_	
1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	
36	0xbffff638	→ %eax	
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
0	0xbffff62c	→ %eax	12(%ebp)
18	0xbffff628		8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)

(gdb) bt #0 euclid () at lab3.s:24 #1 0x0804824b in euclid () at lab3.s:31 #2 0x0804824b in euclid () at lab3.s:31 #3 0x0804824b in euclid () at lab3.s:31 #4 0x0804824b in euclid () at lab3.s:31 #5 0x0804820f in _start () at lab3.s:6 (gdb) x/8w \$esp 0xbffff620: -1073744336 134513227 0 18 0xbffff630: -1073744320 134513227 36 18 (gdb) x/8w \$ebp 0xbffff620: 0 -1073744336 134513227 18 0xbffff630: -1073744320 134513227 36 18 (gdb) info r eax 0×0 0

-1207960548

0xbffff620

0xbffff620

134513152

-1073744260

0x8048235 <euclid+9>

0xb7fffc1c

0xbffff620

0xbffff67c

0x8048200

0x8048235

0

18 0xbffff620

0x0

0x12

ecx

edx

ebx

esp ebp

esi

edi

eip

cmp \$0, %eax

1	0xbffff670		
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c	→ %ebx	
36	0xbffff638	→ %eax	
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
О	0xbffff62c	→ %eax	12(%ebp)
18	0xbffff628		8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)

jle else

```
(gdb) bt
#0 else () at lab3.s:35
#1 0xbffff630 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804824b in euclid () at lab3.s:31
#6 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff620:
                                134513227
                -1073744336
                                                 18
                                                         0
0xbffff630:
                                                 36
                -1073744320
                                134513227
                                                         18
(gdb) x/8w $ebp
0xbffff620:
                -1073744336
                                134513227
                                                 18
                                                         0
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
(gdb) info r
eax
               0 \times 0
                        0
               0xb7fffc1c
ecx
                                 -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
               0xbffff620
esp
                                 0xbffff620
ebp
               0xbffff620
                                0xbffff620
esi
               0xbffff67c
                                 -1073744260
edi
                                134513152
               0x8048200
eip
               0x8048250
                                 0x8048250 <else>
```

1	0xbffff670		1
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c		
36	0xbffff638		
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
0	0xbffff62c		12(%ebp)
18	0xbffff628	→ %eax	8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)
			I

mov 8(%ebp), %eax

```
(gdb) bt
#0 endif () at lab3.s:37
#1 0xbffff630 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804824b in euclid () at lab3.s:31
#6 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff620:
                -1073744336
                                134513227
                                                18
                                                         0
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                        18
(gdb) x/8w $ebp
0xbffff620:
                -1073744336
                                134513227
                                                18
                                                         0
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                        18
(gdb) info r
eax
               0x12
                        18
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
               0xbffff620
                                0xbffff620
esp
ebp
               0xbffff620
                                0xbffff620
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048253 <endif>
               0x8048253
```

1	0xbffff670	1	
198	0xbffff66c		
558	0xbffff668		
	0xbffff664	call euclid	
	0xbffff660	push %ebp	
162	0xbffff65c		
198	0xbffff658		
	0xbffff654	call euclid	
	0xbffff650	push %ebp	
36	0xbffff64c		
162	0xbffff648		
	0xbffff644	call euclid	
	0xbffff640	push %ebp	
18	0xbffff63c		
36	0xbffff638		
	0xbffff634	call euclid	
	0xbffff630	push %ebp	
o	0xbffff62c		12(%ebp)
18	0xbffff628	→ %eax	8(%ebp)
	0xbffff624	call euclid	4(%ebp)
	ebp =esp = 0xbffff620	push %ebp	(%ebp)

mov %ebp, %esp

```
(gdb) bt
#0 endif () at lab3.s:38
#1 0xbffff630 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804824b in euclid () at lab3.s:31
#6 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff620:
                -1073744336
                                134513227
                                                 18
                                                         0
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
(gdb) x/8w $ebp
0xbffff620:
                -1073744336
                                134513227
                                                 18
                                                         0
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
(gdb) info r
               0x12
eax
                        18
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff620
                                0xbffff620
ebp
               0xbffff620
                                0xbffff620
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048255
                                0x8048255 <endif+2>
```

1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	
	0xbffff660	
162	0xbffff65c	
198	0xbffff658	
	0xbffff654	
	0xbffff650	
36	0xbffff64c	
162	0xbffff648	
	0xbffff644	
	0xbffff640	
18	0xbffff63c	
36	0xbffff638	
	0xbffff634	
	ebp = 0xbffff630	
О	0xbffff62c	
18	0xbffff628 → %	eax
	esp = 0xbffff624 pop 9	6ebp

pop %ebp

```
(gdb) bt
#0 endif () at lab3.s:39
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff624:
                134513227
                                18
                                                -1073744320
0xbffff634:
                134513227
                                36
                                                -1073744304
                                        18
(gdb) x/8w $ebp
0xbffff630:
                -1073744320
                                134513227
                                                        18
                                                36
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                         36
(gdb) info r
                        18
eax
               0x12
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff624
                                0xbffff624
ebp
               0xbffff630
                                0xbffff630
               0xbffff67c
esi
                                -1073744260
edi
               0x8048200
                                134513152
eip
                                0x8048256 <endif+3>
               0x8048256
```

1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	
	0xbffff660	
162	0xbffff65c	
198	0xbffff658	
	0xbffff654	
	0xbffff650	
36	0xbffff64c	
162	0xbffff648	
	0xbffff644	
	0xbffff640	
18	0xbffff63c	
36	0xbffff638	
	0xbffff634	
	ebp = 0xbffff630	
0	0xbffff62c	
18	esp = 0xbffff628	ret
	0xbffff624	pop %ebp

```
ret
(gdb) bt
#0 euclid () at lab3.s:32
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff628:
                18
                        0
                                -1073744320
                                                 134513227
0xbffff638:
                36
                        18
                                -1073744304
                                                 134513227
(gdb) x/8w $ebp
0xbffff630:
                -1073744320
                                134513227
                                                 36
                                                         18
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
(gdb) info r
eax
               0x12
                        18
               0xb7fffc1c
                                -1207960548
ecx
edx
               0 \times 0
                        0
               0x12
ebx
                        18
               0xbffff628
                                0xbffff628
esp
               0xbffff630
                                0xbffff630
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0х804824Ь
                                0x804824b <euclid+31>
```

1 Oxl	offff670
198 Oxt	offff66c
558 Oxt	offff668
Oxb	ffff664
0xb	offff660
162 Oxl	offff65c
198 Oxi	offff658
Oxt	ffff654
Oxb	ffff650
36 Oxb	ffff64c
162 0xb	ffff648
0xb	ffff644
0xb	ffff640
18 0xb	offff63c
36 Oxt	offff638
Oxi	offff634
esp =ebp = 0xi	offff630
o Ox	bffff62c
18 0x	bffff628
Oxi	offff624

add \$8. %esp

add \$8, %esp

```
(gdb) bt
#0 euclid () at lab3.s:33
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                                                 36
                -1073744320
                                134513227
                                                         18
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
(gdb) x/8w $ebp
0xbffff630:
                                                         18
                -1073744320
                                134513227
                                                 36
0xbffff640:
                -1073744304
                                134513227
                                                 162
                                                         36
(gdb) info r
               0x12
                        18
eax
ecx
               0xb7fffc1c
                                 -1207960548
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff630
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x804824e
                                0x804824e <euclid+34>
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	esp =ebp = 0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

jmp endif

```
(gdb) bt
#0 endif () at lab3.s:37
#1 0xbffff640 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                        18
                                                36
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
(gdb) x/8w $ebp
0xbffff630:
                                134513227
                -1073744320
                                                36
                                                        18
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
(gdb) info r
eax
               0x12
                        18
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
               0xbffff630
                                0xbffff630
esp
               0xbffff630
                                0xbffff630
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x8048253
                                0x8048253 <endif>
eip
```

	0.1777
1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	esp =ebp = 0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

mov %ebp, %esp

```
(gdb) bt
#0 endif () at lab3.s:38
#1 0xbffff640 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804824b in euclid () at lab3.s:31
#5 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff630:
                -1073744320
                                134513227
                                                36
                                                         18
0xbffff640:
                                                         36
                -1073744304
                                134513227
                                                162
(gdb) x/8w $ebp
0xbffff630:
                -1073744320
                                                        18
                                134513227
                                                36
0xbffff640:
                                                         36
                -1073744304
                                134513227
                                                162
(gdb) info r
               0x12
                        18
eax
               0xb7fffc1c
ecx
                                -1207960548
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff630
                                0xbffff630
ebp
               0xbffff630
                                0xbffff630
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048255 <endif+2>
eip
               0x8048255
```

	- 1 6666
1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	ebp = 0xbffff640
18	0xbffff63c
36	0xbffff638
	esp = 0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

pop %ebp

pop %ebp

```
(gdb) bt
#0 endif () at lab3.s:39
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff634:
                134513227
                                36
                                        18
                                                -1073744304
0xbffff644:
                                162
                134513227
                                        36
                                                 -1073744288
(gdb) x/8w $ebp
0xbffff640:
                                134513227
                                                162
                                                         36
                -1073744304
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
(gdb) infor
               0x12
                        18
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff634
                                0xbffff634
ebp
               0xbffff640
                                0xbffff640
               0xbffff67c
esi
                                -1073744260
edi
               0x8048200
                                134513152
                                0x8048256 <endif+3>
eip
               0x8048256
```

1 Oxbifff670 198 Oxbifff665 558 Oxbifff666 558 Oxbifff664 Oxbifff656 162 Oxbifff658 Oxbifff654 Oxbifff654 Oxbifff654 162 Oxbifff648 162 Oxbifff648 0xbifff648 0xbifff648 0xbifff636 18 Oxbifff636 0xbifff636 18 Oxbifff636 Oxbifff636 Oxbifff636 Oxbifff636 Oxbifff636 Oxbifff636		
SSB Oxbifff688	1	0xbffff670
0xbfff664 0xbfff660 162 0xbfff65c 198 0xbfff658 0xbfff654 0xbfff650 36 0xbfff64c 162 0xbfff648 ebp = 0xbfff640 0xbfff63c 18 0xbfff63c 36 esp = 0xbfff63c 0xbfff634 0xbfff63c 0 0xbfff62c 18 0xbfff62c	198	0xbffff66c
Oxbffff660 162 0xbfff65c 198 0xbfff658 Oxbfff654 0xbfff654 36 0xbfff64c 162 0xbfff648 0xbfff640 ebp = 0xbfff640 18 0xbfff63c 36 esp = 0xbfff63s 0xbfff634 0xbfff63d 0 0xbfff62c 18 0xbfff62c	558	0xbffff668
162 Oxbfff65c 198 Oxbfff658 Oxbfff654 Oxbfff650 36 Oxbfff646 162 Oxbfff646 Oxbfff640 ebp = 0xbfff640 18 Oxbfff630 Oxbfff630 Oxbfff630 Oxbfff630 Oxbfff630		0xbffff664
198 Oxbfff658 Oxbfff654 Oxbfff650 36 Oxbfff64c 162 Oxbfff640 Oxbfff640 ebp = 0xbfff640 18 Oxbfff63c 36 esp = 0xbfff63c Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d		0xbffff660
Oxbfff654	162	0xbffff65c
Oxbffff650 36 Oxbffff64c 162 Oxbffff64B Oxbffff64 Oxbffff64A ebp = 0xbffff63c Oxbffff63c 36 esp = 0xbffff63s Oxbfff63c Oxbfff63c 0 Oxbfff63c 18 Oxbfff62c 18 Oxbfff62c	198	0xbffff658
36		0xbffff654
162		0xbffff650
Oxbffff644 ebp = 0xbffff640 18 0xbffff63c 36 esp = 0xbfff638 0xbfff634 0xbfff630 0 0xbfff62c 18 0xbfff628	36	0xbffff64c
ebp = 0xbffff640	162	0xbffff648
18		0xbffff644
36 esp = 0xbfff638		ebp = 0xbffff640
0xbfff634 0xbfff630 0 0xbfff62c 18 0xbfff628	18	0xbffff63c
Oxbffff630 O 0xbffff62c 18 0xbffff628	36	esp = 0xbffff638
0 0xbffff62c 18 0xbffff628		0xbffff634
18 0xbffff628		0xbffff630
	0	0xbffff62c
0xbffff624	18	0xbffff628
		0xbffff624

ret pop %ebp

```
ret
(gdb) bt
#0 euclid () at lab3.s:32
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff638:
                36
                        18
                                -1073744304
                                                 134513227
0xbffff648:
                162
                        36
                                 -1073744288
                                                 134513227
(gdb) x/8w $ebp
0xbffff640:
                                134513227
                -1073744304
                                                162
                                                         36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
(gdb) info r
               0x12
                        18
eax
               0xb7fffc1c
                                 -1207960548
ecx
edx
               0 \times 0
                        0
ebx
               0x12
                        18
               0xbffff638
                                0xbffff638
esp
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0х804824Ь
                                0x804824b <euclid+31>
```

1	0xbffff670	
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	
	0xbffff660	
162	0xbffff65c	
198	0xbffff658	
	0xbffff654	
	0xbffff650	
36	0xbffff64c	
162	0xbffff648	
	0xbffff644	
	esp =ebp = 0xbffff640	
18	0xbffff63c	
36	0xbffff638	add \$8, %esp
	0xbffff634	
	0xbffff630	
О	0xbffff62c	
18	0xbffff628	
	0xbffff624	

add \$8, %esp

```
(gdb) bt
#0 euclid () at lab3.s:33
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
(gdb) x/8w $ebp
0xbffff640:
                                                        36
                -1073744304
                                134513227
                                                162
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                198
(gdb) info r
eax
               0x12
                        18
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x804824e
                                0x804824e <euclid+34>
eip
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	esp =ebp = 0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

jmp endif

(gdb) x/8w \$esp	р			
0xbffff640:	-1073744304	134513227 1	62 3	6
0xbffff650:	-1073744288	134513227 1	98 1	62
(gdb) x/8w \$ebp	P			
0xbffff640:	-1073744304	134513227 1	62 3	6
0xbffff650:	-1073744288	134513227 1	98 1	62
(gdb) info r				
eax	0x12 18			
ecx	0xb7fffc1c	-1207960548		
edx	0x0 0			
ebx	0x12 18			
esp	0xbffff640	0xbffff640		
ebp	0xbffff640	0xbffff640		
esi	0xbffff67c	-1073744260		
edi	0x8048200	134513152		
eip	0x8048253	0x8048253 <endif></endif>		

1	0xbffff670
	0xbffff66c
198	
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	esp =ebp = 0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

mov %ebp, %esp

```
(gdb) bt
#0 endif () at lab3.s:38
#1 0xbffff650 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804824b in euclid () at lab3.s:31
#4 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                198
(gdb) x/8w $ebp
0xbffff640:
                -1073744304
                                134513227
                                                162
                                                        36
0xbffff650:
                -1073744288
                                134513227
                                                        162
                                                198
(gdb) info r
               0x12
                       18
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
ebx
               0x12
                        18
esp
               0xbffff640
                                0xbffff640
ebp
               0xbffff640
                                0xbffff640
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048255
                                0x8048255 <endif+2>
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	ebp = 0xbffff650
36	0xbffff64c
162	0xbffff648
	esp = 0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

pop %ebp

pop %ebp

```
(gdb) bt
#0 endif () at lab3.s:39
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff644:
                134513227
                                 162
                                                 -1073744288
                                         36
0xbffff654:
                134513227
                                 198
                                         162
                                                 0
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                                         162
                                 134513227
                                                 198
0xbffff660:
                        134513167
                0
                                         558
                                                 198
(gdb) info r
eax
               0x12
                        18
               0xb7fffc1c
ecx
                                 -1207960548
edx
               0 \times 0
                        0
                        18
ebx
               0x12
               0xbffff644
                                 0xbffff644
esp
ebp
               0xbffff650
                                 0xbffff650
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                 134513152
eip
               0x8048256
                                 0x8048256 <endif+3>
```

1 Oxbfff670 198 Oxbfff66c 558 Oxbfff66c 0xbfff666 0xbfff666 162 Oxbfff658 198 Oxbfff658 0xbfff654 ebp = 0xbfff650 36 Oxbfff640 0xbfff640 0xbfff640 0xbfff640 0xbfff640 0xbfff640 0xbfff658 18 Oxbfff658 0xbfff658	198 Oxbfff66c 558 Oxbfff666		
S58	SSB Oxbfff668	1	0xbffff670
0xbfff664 0xbfff660 162 0xbfff65c 198 0xbfff658 0xbfff654 0xbfff650 36 0xbfff64c 162 esp = 0xbfff648 0xbfff644 0xbfff643 18 0xbfff63c 0xbfff634 0xbfff636 0xbfff630 0xbfff63c 0 0xbfff62c 18 0xbfff62c	Oxbfff664 Oxbfff665 162 Oxbfff656 198 Oxbfff658 Oxbfff654 ebp = 0xbfff650 36 Oxbfff64c 162 esp = 0xbfff644 Oxbfff63c Oxbfff63c 36 Oxbfff63c Oxbfff63c Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d	198	0xbffff66c
Oxbffff660 162 0xbfff65c 198 0xbfff658 Oxbfff654 ebp = 0xbfff650 36 0xbfff64c 162 esp = 0xbfff64 0xbfff640 0xbfff636 36 0xbfff63c 0xbfff63c 0xbfff63c 0xbfff63d 0xbfff63d 0xbfff63c 0xbfff62c 18 0xbfff62c 18 0xbfff62c	Oxbfff660 162 0xbfff65c 198 0xbfff658 0xbfff654 0xbfff654 ebp = 0xbfff650 36 0xbfff64c 162 esp = 0xbfff644 0xbfff644 0xbfff640 0xbfff63c 0xbfff63c 36 0xbfff63c 0xbfff63c 0 0xbfff63c 0xbfff63c 0 0xbfff63c 0xbfff63c 0 0xbfff62c 18 0xbfff62c	558	0xbffff668
162 Oxbfff65c 198 Oxbfff658 Oxbfff654 ebp = Oxbfff650 36 Oxbfff64c 162 esp = Oxbfff640 Oxbfff640 Oxbfff640 Oxbfff636 36 Oxbfff636 Oxbfff636 Oxbfff636 Oxbfff636 Oxbfff636 Oxbfff636	162 Oxbfff65c 198 Oxbfff658 Oxbfff654 ebp = Oxbfff650 36 Oxbfff64c 162 esp = Oxbfff644 Oxbfff644 Oxbfff644 Oxbfff63c 36 Oxbfff63c 0xbfff63c Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d Oxbfff63d		0xbffff664
198 Oxbfff658	198		0xbffff660
Oxbffff634	Oxbfff654	162	0xbffff65c
ebp = 0xbffff650 36	ebp = 0xbfff650 36	198	0xbffff658
36	36 Oxbfff64c 162 esp = 0xbfff648 Oxbfff644 Oxbfff640 18 Oxbfff638 Oxbfff638 Oxbfff634 Oxbfff636 Oxbfff636 Oxbfff636		0xbffff654
162 esp = 0xbffff648	162 esp = 0xbfff648		ebp = 0xbffff650
0xbfff644 0xbfff640 18 0xbfff63c 36 0xbfff638 0xbfff634 0xbfff630 0 0xbfff630 0 0xbfff630	Oxbffff644 Oxbffff640 18 Oxbffff63c 36 Oxbffff638 Oxbffff634 Oxbffff630 O Oxbffff630 O Oxbfff62c 18 Oxbfff628	36	0xbffff64c
Oxbffff640 18 Oxbffff63c 36 Oxbfff638 Oxbfff634 Oxbfff630 O Oxbfff63c 18 Oxbfff628	Oxbfff640 18 Oxbfff63c 36 Oxbfff638 Oxbfff634 Oxbfff630 O Oxbfff62c 18 Oxbfff628	162	esp = 0xbffff648
18 Oxbfff63c 36 Oxbfff638 Oxbfff634 Oxbfff630 Oxbfff630 Oxbfff630	18		0xbffff644
36 Oxbfff638	36 Oxbfff638		0xbffff640
0xbfff634 0xbfff630 0 0xbfff62c 18 0xbfff628	0xbffff634 0xbffff630 0 0xbffff62c 18 0xbfff628	18	0xbffff63c
0xbfff630 0 0xbfff62c 18 0xbfff628	0 0xbfff630 0 0xbfff62c 18 0xbfff628	36	0xbffff638
0 0xbffff62c 18 0xbffff628	0 0xbffff62c 18 0xbffff628		0xbffff634
18 0xbffff628	18 0xbffff628		0xbffff630
		0	0xbffff62c
0xbffff624	0xbffff624	18	0xbffff628
			0xbffff624

ret pop %ebp

```
ret
(gdb) bt
#0 euclid () at lab3.s:32
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff648:
                162
                        36
                                -1073744288
                                                 134513227
0xbffff658:
                198
                        162
                                        134513167
                                0
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                0
                        134513167
                                        558
                                                 198
(gdb) info r
                        18
eax
               0x12
               0xb7fffc1c
                                 -1207960548
ecx
edx
               0 \times 0
                        0
ebx
               0x12
                        18
               0xbffff648
                                0xbffff648
esp
ebp
               0xbffff650
                                0xbffff650
               0xbffff67c
                                 -1073744260
esi
edi
               0x8048200
                                134513152
eip
               0х804824ь
                                0x804824b <euclid+31>
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	esp = ebp = 0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
О	0xbffff62c
18	0xbffff628
	0xbffff624

add \$8, %esp

add \$8, %esp

```
(gdb) bt
#0 euclid () at lab3.s:33
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
0xbffff660:
                        134513167
                                        558
                                                198
                0
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                        162
0xbffff660:
                        134513167
                                                198
                0
                                        558
(gdb) info r
               0x12
                        18
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff650
                                0xbffff650
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
                                0x804824e <euclid+34>
eip
               0x804824e
```

_	- 1 444
1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	esp = ebp = 0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

jmp endif

```
(gdb) bt
#0 endif () at lab3.s:37
#1 0xbffff660 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                         162
                                                 198
0xbffff660:
                        134513167
                                                 198
                0
                                        558
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                                                 198
                0
                                        558
(gdb) info r
               0x12
                        18
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff650
                                0xbffff650
ebp
               0xbffff650
                                0xbffff650
               0xbffff67c
                                -1073744260
esi
edi
               0x8048200
                                134513152
                                0x8048253 <endif>
eip
               0x8048253
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	esp = ebp = 0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

mov %ebp, %esp

```
(gdb) bt
#0 endif () at lab3.s:38
#1 0xbffff660 in ?? ()
#2 0x0804824b in euclid () at lab3.s:31
#3 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff650:
                -1073744288
                                134513227
                                                 198
                                                         162
0xbffff660:
                        134513167
                0
                                         558
                                                 198
(gdb) x/8w $ebp
0xbffff650:
                -1073744288
                                134513227
                                                198
                                                         162
0xbffff660:
                        134513167
                0
                                         558
                                                 198
(gdb) info r
                        18
eax
               0x12
               0xb7fffc1c
                                -1207960548
ecx
edx
               0 \times 0
                        0
ebx
               0x12
                        18
esp
               0xbffff650
                                0xbffff650
ebp
               0xbffff650
                                0xbffff650
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0x8048255
                                0x8048255 <endif+2>
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	ebp = 0xbffff660
162	0xbffff65c
198	0xbffff658
	esp = 0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

pop %ebp

pop %ebp

```
(gdb) bt
#0 endif () at lab<u>3.s:39</u>
#1 0x0804824b in euclid () at lab3.s:31
#2 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff654:
                134513227
                                198
                                         162
                                                 0
0xbffff664:
                134513167
                                558
                                        198
(gdb) x/8w $ebp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                        0
                                                -1073743907
(gdb) info r
                        18
eax
               0x12
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff654
                                0xbffff654
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x8048256
                                0x8048256 <endif+3>
eip
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	0xbffff664
	ebp = 0xbffff660
162	0xbffff65c
198	esp = 0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

ret pop %ebp

```
ret
(gdb) bt
#0 euclid () at lab3.s:32
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff658:
                198
                        162
                                0
                                        134513167
0xbffff668:
                558
                        198
                                        -1073743937
(gdb) x/8w $ebp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                        0
                                                -1073743907
(gdb) info r
               0x12
                        18
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
               0x12
                       18
ebx
esp
               0xbffff658
                                0xbffff658
               0xbffff660
                                0xbffff660
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
eip
               0х804824ь
                                0x804824b <euclid+31>
```

1		0xbffff670	
198		0xbffff66c	
558		0xbffff668	
558			
		0xbffff664	
	esp =ebp =	0xbffff660	
162		0xbffff65c	
198		0xbffff658	add \$8, %esp
		0xbffff654	
		0xbffff650	
36		0xbffff64c	
162		0xbffff648	
		0xbffff644	
		0xbffff640	
18		0xbffff63c	
36		0xbffff638	
		0xbffff634	
		0xbffff630	
o		0xbffff62c	
18		0xbffff628	
		0xbffff624	
			l

add \$8, %esp

```
(gdb) bt
#0 euclid () at lab3.s:33
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                -1073743907
                                        0
(gdb) x/8w $ebp
0xbffff660:
                0
                                        558
                        134513167
                                                198
0xbffff670:
                        -1073743937
                                                -1073743907
                                        0
(gdb) info r
               0x12
                        18
eax
                                -1207960548
               0xb7fffc1c
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
               0xbffff660
                                0xbffff660
esp
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x804824e
                                0x804824e <euclid+34>
eip
```

1		0xbffff670
198		0xbffff66c
558		0xbffff668
		0xbffff664
	esp =ebp =	0xbffff660
162		0xbffff65c
198		0xbffff658
		0xbffff654
		0xbffff650
36		0xbffff64c
162		0xbffff648
		0xbffff644
		0xbffff640
18		0xbffff63c
36		0xbffff638
		0xbffff634
		0xbffff630
0		0xbffff62c
18		0xbffff628
		0xbffff624

jmp endif

```
(gdb) bt
#0 endif () at lab3.s:37
#1 0x00000000 in ?? ()
(gdb) x/8w $esp
0xbffff660:
                        134513167
                0
                                        558
                                                198
0xbffff670:
                        -1073743937
                                        0
                                                -1073743907
(gdb) x/8w $ebp
0xbffff660:
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                -1073743907
                                        0
(gdb) info r
               0x12
                        18
eax
ecx
               0xb7fffc1c
                                -1207960548
edx
               0x0
                        0
               0x12
ebx
                        18
               0xbffff660
                                0xbffff660
esp
               0xbffff660
                                0xbffff660
ebp
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x8048253
                                0x8048253 <endif>
eip
```

1		0xbffff670
198		0xbffff66c
558		0xbffff668
		0xbffff664
	esp =ebp =	0xbffff660
162		0xbffff65c
198		0xbffff658
		0xbffff654
		0xbffff650
36		0xbffff64c
162		0xbffff648
		0xbffff644
		0xbffff640
18		0xbffff63c
36		0xbffff638
		0xbffff634
		0xbffff630
0		0xbffff62c
18		0xbffff628
		0xbffff624

mov %ebp, %esp

```
(gdb) bt
#0 endif () at lab3.s:38
#1 0x00000000 in ?? ()
(gdb) x/8w $esp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                        0
                                                -1073743907
(gdb) x/8w $ebp
0xbffff660:
                0
                        134513167
                                        558
                                                198
0xbffff670:
                        -1073743937
                                                -1073743907
                                        0
(gdb) info r
               0x12
                       18
eax
               0xb7fffc1c
                                -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
esp
               0xbffff660
                                0xbffff660
ebp
               0xbffff660
                                0xbffff660
esi
               0xbffff67c
                                -1073744260
edi
               0x8048200
                                134513152
               0x8048255
                                0x8048255 <endif+2>
eip
```

1	0xbffff670
198	0xbffff66c
558	0xbffff668
	esp = 0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
18	0xbffff628
	0xbffff624

pop %ebp

pop %ebp

```
(gdb) bt
#0 endif () at lab3.s:39
#1 0x0804820f in _start () at lab3.s:6
(gdb) x/8w $esp
0xbffff664:
                134513167
                                 558
                                         198
0xbffff674:
                                 0
                                         -1073743907
                -1073743937
                                                          -1073743889
(gdb) x/8w $ebp
        Cannot access memory at address 0x0
0x0:
(gdb) info r
               0x12
                        18
eax
               0xb7fffc1c
                                 -1207960548
ecx
edx
               0x0
                        0
ebx
               0x12
                        18
               0xbffff664
                                 0xbffff664
esp
ebp
               0 \times 0
                         0 \times 0
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                 134513152
eip
               0x8048256
                                 0x8048256 <endif+3>
```

1	0xbffff670	
198	0xbffff66c	
558	esp = 0xbffff668	
	0xbffff664	ret
	0xbffff660	
162	0xbffff65c	
198	0xbffff658	
	0xbffff654	
	0xbffff650	
36	0xbffff64c	
162	0xbffff648	
	0xbffff644	
	0xbffff640	
18	0xbffff63c	
36	0xbffff638	
	0xbffff634	
	0xbffff630	
0	0xbffff62c	
18	0xbffff628	
	0xbffff624	
		I
		•

ret (gdb) bt #0 _start () at lab3.s:7 (gdb) x/8w \$esp 0xbffff668: 558 198 1 -1073743937 0xbffff678: -1073743907 -1073743889 -1073743871 (gdb) x/8w \$ebp 0x0: Cannot access memory at address 0x0 (gdb) info r eax 0x12 18 ecx 0xb7fffc1c -1207960548 edx 0×0 ebx 0x12 18 esp ebp esi edi 89911119×0 0xbffff668 0×0 0×0 0xbffff67c -1073744260 0x8048200 134513152 eip 0x804820f 0x804820f <_start+15>

1	esp = 0xbffff670	add \$8, %esp
198	0xbffff66c	
558	0xbffff668	
	0xbffff664	
	0xbffff660	
162	0xbffff65c	
198	0xbffff658	
	0xbffff654	
	0xbffff650	
36	0xbffff64c	
162	0xbffff648	
	0xbffff644	
	0xbffff640	
18	0xbffff63c	
36	0xbffff638	
	0xbffff634	
	0xbffff630	
0	0xbffff62c	
18	0xbffff628	
	0xbffff624	

add \$8, %esp

```
(gdb) bt
#0 _start () at lab3.s:11
(gdb) x/8w $esp
0xbffff670: 1
0xbffff680: -10
                           -1073743937
                                                      -1073743907
                 -1073743889
                                    -1073743871
                                                      -1073743855
                                                                        -1073743844
(gdb) x/8w $ebp
0x0: Cannot access memory at address 0x0
(gdb) info r
                0x12
eax
ecx
                0xb7fffc1c
                                    -1207960548
edx
                0x0
ebx
                0x12
esp
ebp
esi
edi
                                    0xbffff670
                0xbffff670
                0 \times 0
                           0 \times 0
                0xbfffff67c
                                    -1073744260
                0x8048200
                                    134513152
eip
                0x8048212
                                    0x8048212 <_start+18>
```

1	0xbffff670
18	esp = 0xbffff66c
558	0xbffff668
	0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
	0xbffff628
	0xbffff624

push %eax

push %eax

```
(gdb) bt
#0 _start () at lab3.s:12
(gdb) x/8w $esp
0xbffff66c: 18 1
                                   -1073743937
0xbffff67c:
                 -1073743907
                                    -1073743889
                                                      -1073743871
                                                                        -1073743855
(gdb) x/8w $ebp
0x0: Cannot access memory at address 0x0
(gdb) info r
                0x12
                          18
eax
ecx
                 0xb7fffc1c
                                    -1207960548
edx
                 0x0
ebx
                 0x12
                           18
esp
ebp
esi
                 0xbffff66c
                                   0xbffff66c
                 0x0
                          0x0
                 0xbffff67c
                                   -1073744260
134513152
edi
                 0x8048200
eip
                 0x8048213
                                   0x8048213 <_start+19>
```

1	0xbffff670
18	0xbffff66c
\$fmt	0xbffff668
	esp = 0xbffff664
	0xbffff660
162	0xbffff65c
198	0xbffff658
	0xbffff654
	0xbffff650
36	0xbffff64c
162	0xbffff648
	0xbffff644
	0xbffff640
18	0xbffff63c
36	0xbffff638
	0xbffff634
	0xbffff630
0	0xbffff62c
	0xbffff628
	0xbffff624

call printf

push \$fmt

```
(gdb) bt
#0 _start () at lab3.s:13
(gdb) x/8w $esp
0xbffff668: 134517520
0xbffff678: 0 -10
                                      18
                                                          -1073743937
                            -1073743907
                                                 -1073743889
                                                                    -1073743871
(gdb) x/8w $ebp
0x0: Cannot access memory at address 0x0
(gdb) info r
                  0x12
                             18
eax
ecx
                  0xb7fffc1c
                                       -1207960548
edx
                  0 \times 0
ebx
                  0x12
esp
ebp
esi
edi
                                      0xbffff668
                  8991114x0
                  0 \times 0
                             0 \times 0
                  0xbffff67c
                                       -1073744260
                  0x8048200
                                      134513152
eip
                  0x8048218
                                      0x8048218 <_start+24>
```

1	0xbffff670	
18	0xbffff66c	
\$fmt	0xbffff668	
	esp = 0xbffff664	call printf

call printf

```
(gdb) bt
#0 0x080481f0 in printf@plt ()
(gdb) x/8w $esp
0xbffff664:
0xbffff674:
                 134513181
-1073743937
                                   134517520
                                                     18
                                            -1073743907
                                                               -1073743889
(gdb) x/8w $ebp
0x0: Cannot access memory at address 0x0
(gdb) info r
                0x12
eax
ecx
                0xb7fffc1c
                                   -1207960548
edx
ebx
                0 \times 0
                0x12
                          18
esp
ebp
esi
edi
                0xbffff664
                                   0xbffff664
                0 \times 0
                          0x0
                0xbffff67c
                                   -1073744260
                                   134513152
                0x8048200
                0x80481f0
                                   0x80481f0 <printf@plt>
```



0x080481f0 in printf@plt ()

```
(gdb) bt
#0 0x080481e0 in ?? ()
(gdb) x/8w $esp
0xbffff660:
                        134513181
                                         134517520
0xbffff670:
                         -1073743937
                                                  -1073743907
(gdb) x/8w $ebp
       Cannot access memory at address 0x0
0×0:
(gdb) info r
               0x12
                         18
eax
               0xb7fffc1c
ecx
                                 -1207960548
edx
               0 \times 0
                         0
ebx
               0x12
                         18
esp
               0xbffff660
                                 0xbffff660
ebp
               0x0
                         0 \times 0
esi
               0xbffff67c
                                 -1073744260
edi
               0x8048200
                                 134513152
eip
               0x80481e0
                                 0x80481e0
```

```
Text written to file labcode.sh
```

Text written to file labcode2.sh

$$gcc - Wall - o \ labc \ lab.c$$
 $gcc - Wall - o \ labasm \ lab.s$

Text written to file labdoc.sh

doctex lab3.doc pptexenv /home/debian/texfot.pl pdflatex lab3.tex

Bourne Shell

chmod 755 labcode2.sh chmod 755 labcode.sh chmod 755 labdoc.sh