Embedded Programmer과정 1,2일차 학습내용

김형주

Linux ubuntu 설치

- Iso 파일을 다운로드한다.(16.04.3 ver 권장)
- https://www.ubuntu.com/download/desktop
- Google에 Universal USB Installer 검색 후 다운로드한다.
- USB에 ubuntu iso파일을 설치한다.(usb에 자료가 있을 시 백업해둘 것!)
- 부팅옵션을 usb를 최우선으로 설정 후, 설명에 따라 설치를 진행한다.

주의사항) window도 사용할 경우, aside window 옵션을 선택한다. 다른거 선택 시 window 제거 후 Linux 설치. 내용 읽어보고 진행할것

Linux 기본 명령어

- pwd : 현재 디렉토리 위치를 보여준다
- Ctrl + Alt T : 터미널 open
- ls : 현재 디렉토리 목록 display(list)
- cd 디렉토리 이동('절대경로'or'상대경로' 이용) (chage directory)
- vi filename.c : .c파일 생성 / '편집모드'or'명령모드' 사용 / :w :q :wq 저장,종료,저장후 종료
- mkdir directoryname : 디렉토리 만들기
- Gcc filename.c : filename.c를 컴파일
- Gcc –o test filename.c : test 이름으로 실행파일생성
- Gcc –g –o debug filename.c : 디버깅 파일 생성

Linux 기본 명령어 (명령모드)

- d3d, d5d 등 숫자만큼 줄 제거
- y3y, y5y 등 숫자만큼 줄 복사
- pp 붙여넣기
- u 되돌리기(ctrl z)
- ctrl r 되돌리기 취소(ctrl shift z)
- :set ~ 기타 편집기 환경설정
  ex) :set number 행 줄수 표시

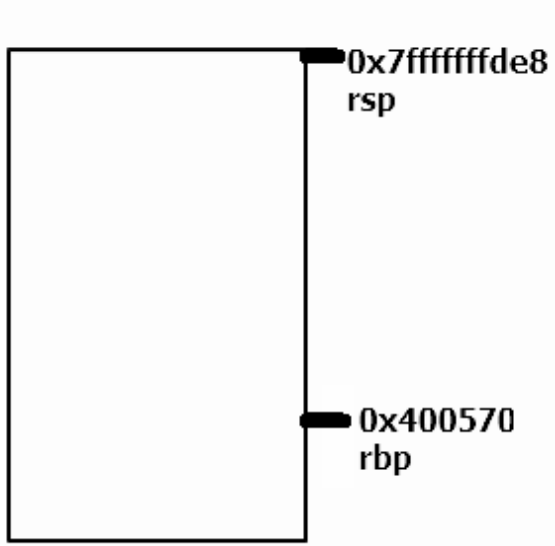
C언어 프로그래밍

- 변수 : 메모리로부터 할당받은 data를 저장할 수 있는 공간
- Data형 : int(정수형), float(실수형), double(실수형)
- 함수 : int sum(int num1,int num2)처럼 반환값, 입력값이 존재

기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

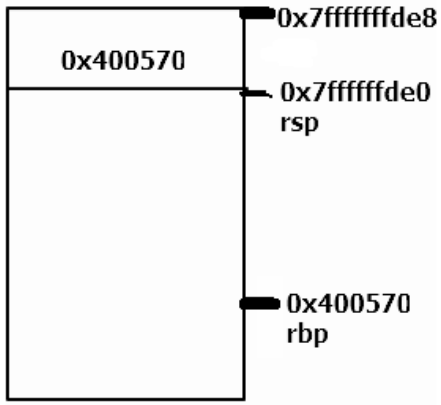
```
(gdb) disas
Dump of assembler code for function main:
=> 0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $rbp
$1 = 0x400570
(gdb) p/x $rsp
$2 = 0x7fffffffdce8
```



기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

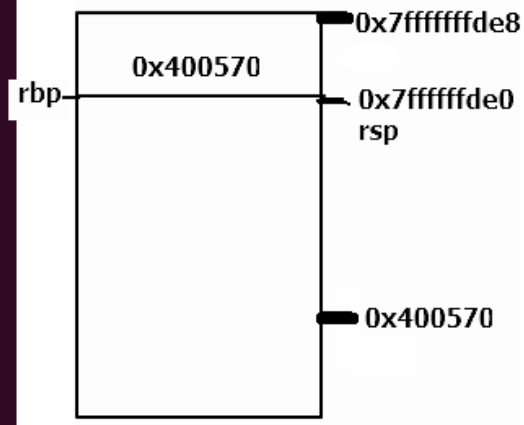
```
0x0000000000400536      10      {
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
=> 0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x rsp
No symbol "rsp" in current context.
(gdb) p/x $rsp
$3 = 0x7fffffffdce0
(gdb) p/x $rbp
$4 = 0x400570
(gdb) x $rsp
0x7fffffffdce0: 0x00400570
(gdb)
```



기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

```
$3 = 0x7fffffffdce0
(gdb) p/x $rbp
$4 = 0x400570
(gdb) x $rsp
0x7fffffffdce0: 0x00400570
(gdb) si
0x0000000000400539      10      {
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
=> 0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $rbp
$5 = 0x7fffffffdce0
(gdb)
```

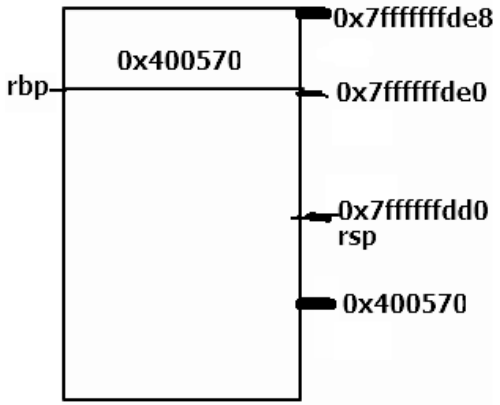


기계어 분석

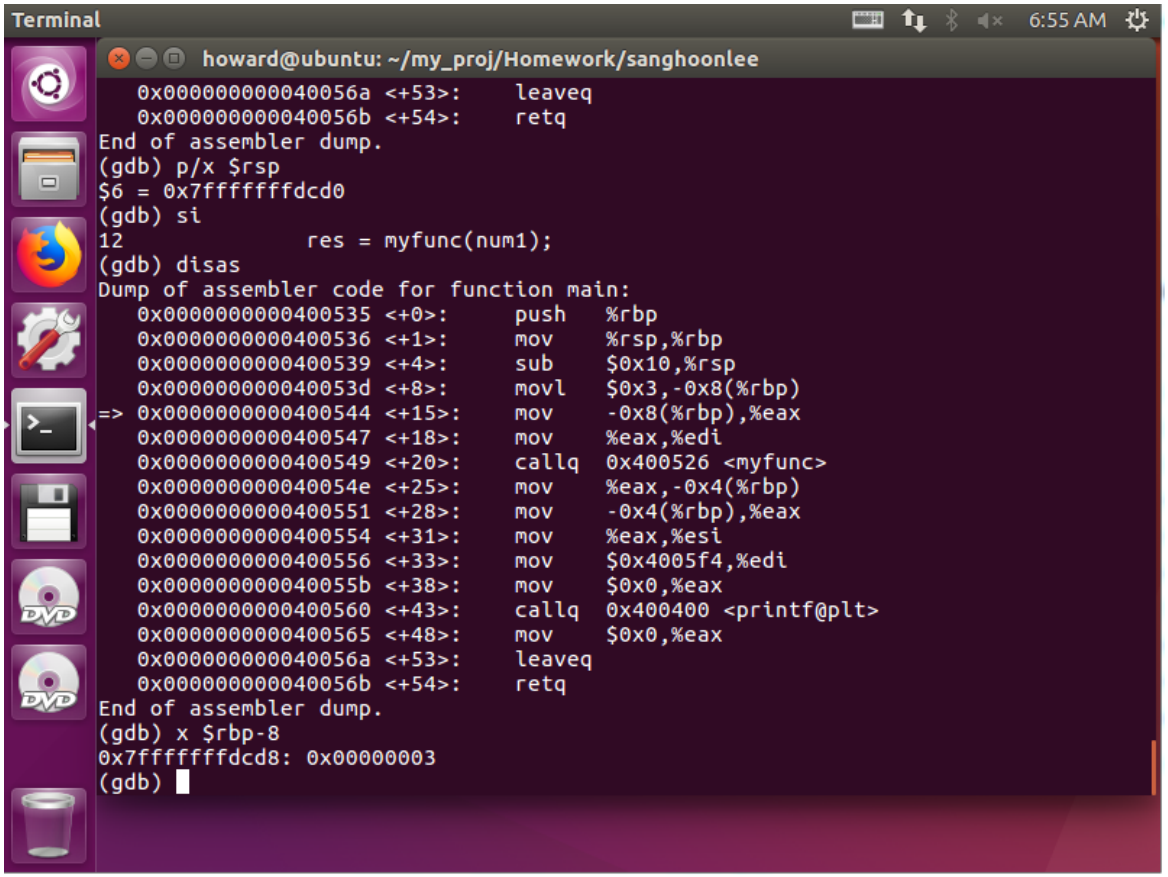
howard@ubuntu: ~/my_proj/Homework/sanghoonlee

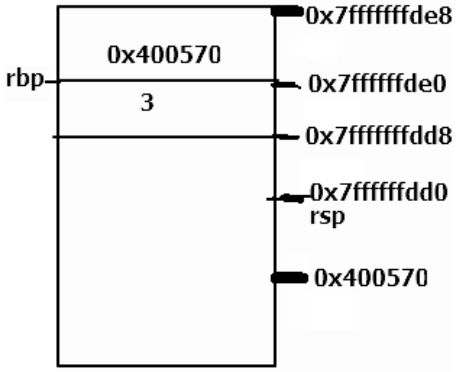
```
End of assembler dump.
(gdb) p/x $rbp
$5 = 0x7fffffffdce0
(gdb) si

Breakpoint 1, main () at func1.c:11
11              int num1 = 3, res;
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
=> 0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $rsp
$6 = 0x7fffffffdcd0
(gdb)
```



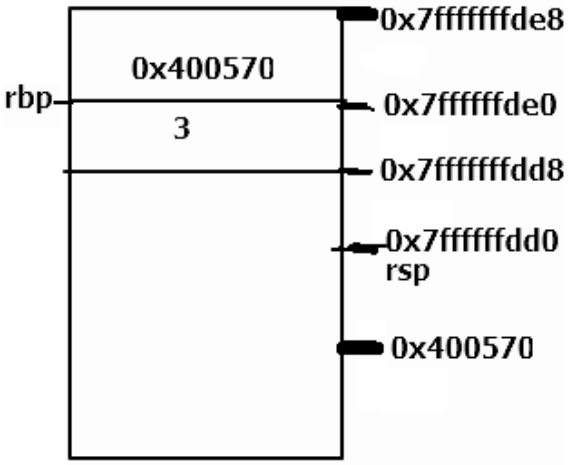
기계어 분석

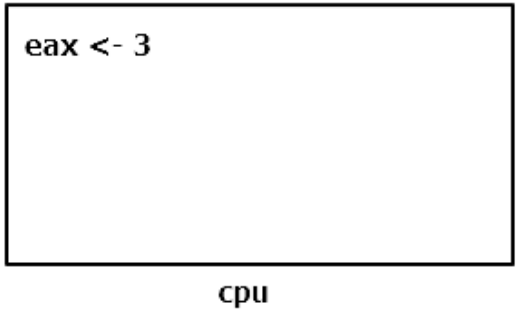

Terminal
6:55 AM
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
0x000000000040056a <+53>: leaveq
0x000000000040056b <+54>: retq
End of assembler dump.
(gdb) p/x $rsp
$6 = 0x7fffffffdcd0
(gdb) si
12 res = myfunc(num1);
(gdb) disas
Dump of assembler code for function main:
0x0000000000400535 <+0>: push %rbp
0x0000000000400536 <+1>: mov %rsp,%rbp
0x0000000000400539 <+4>: sub $0x10,%rsp
0x000000000040053d <+8>: movl $0x3,-0x8(%rbp)
=> 0x0000000000400544 <+15>: mov -0x8(%rbp),%eax
0x0000000000400547 <+18>: mov %eax,%edi
0x0000000000400549 <+20>: callq 0x400526 <myfunc>
0x000000000040054e <+25>: mov %eax,-0x4(%rbp)
0x0000000000400551 <+28>: mov -0x4(%rbp),%eax
0x0000000000400554 <+31>: mov %eax,%esi
0x0000000000400556 <+33>: mov $0x4005f4,%edi
0x000000000040055b <+38>: mov $0x0,%eax
0x0000000000400560 <+43>: callq 0x400400 <printf@plt>
0x0000000000400565 <+48>: mov $0x0,%eax
0x000000000040056a <+53>: leaveq
0x000000000040056b <+54>: retq
End of assembler dump.
(gdb) x $rbp-8
0x7fffffffdcd8: 0x00000003
(gdb)


0x7fffffffde8
0x400570
rbp
0x7fffffffde0
3
0x7fffffffdd8
0x7fffffffdd0
rsp
0x400570

기계어 분석

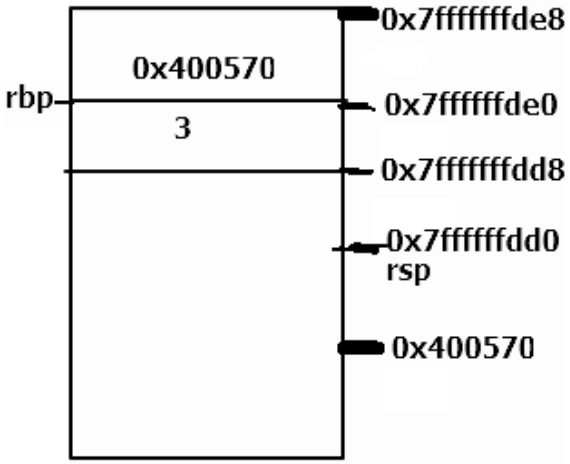
```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) x $rbp-8
0x7fffffffdcd8: 0x00000003
(gdb) si
0x0000000000400547      12              res = myfunc(num1);
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
=> 0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $eax
$7 = 0x3
(gdb)
```





기계어 분석

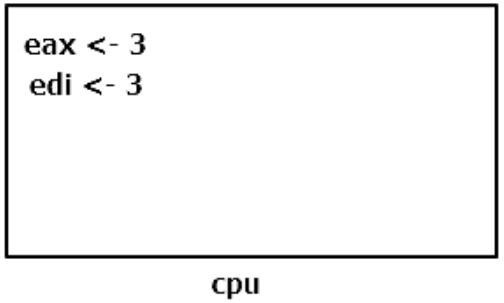
```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $eax
$7 = 0x3
(gdb) si
0x0000000000400549      12              res = myfunc(num1);
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
=> 0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb)
```



기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

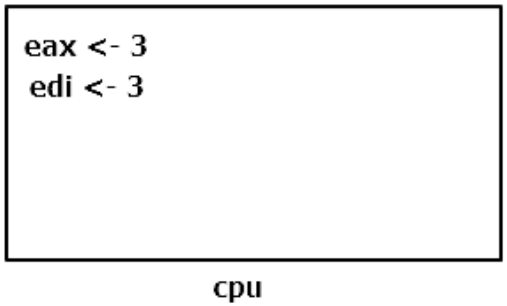
```
=> 0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) si
myfunc (num=0) at func1.c:4
4       {
(gdb) disas
Dump of assembler code for function myfunc:
=> 0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rsp
$8 = 0x7fffffffdcc8
(gdb) x $rsp
0x7fffffffdcc8: 0x0040054e
(gdb)
```



기계어 분석

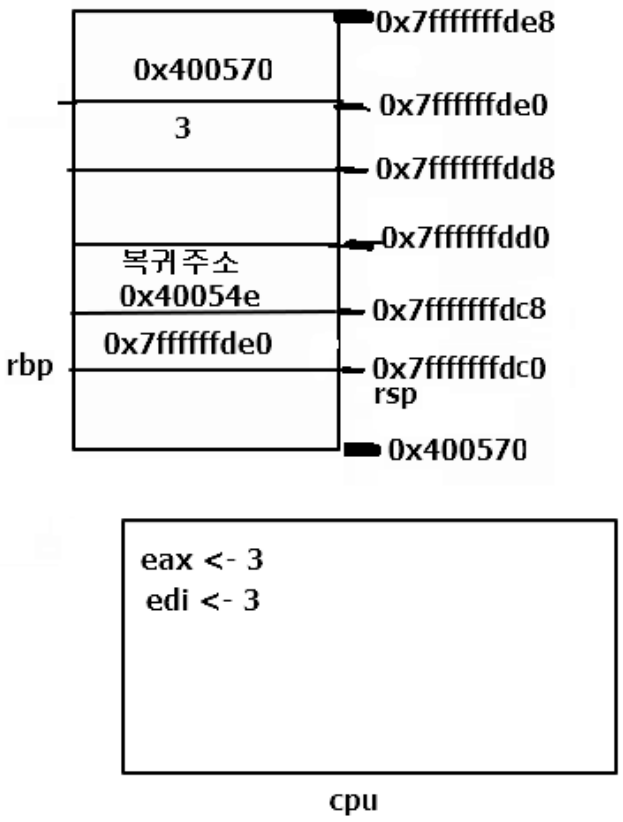
howard@ubuntu: ~/my_proj/Homework/sanghoonlee

```
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rsp
$8 = 0x7fffffffdcc8
(gdb) x $rsp
0x7fffffffdcc8: 0x0040054e
(gdb) si
0x0000000000400527      4       {
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
=> 0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rsp
$9 = 0x7fffffffdcc0
(gdb) p/x rsp
No symbol "rsp" in current context.
(gdb) x $rsp
0x7fffffffdcc0: 0xffffdce0
(gdb)
```



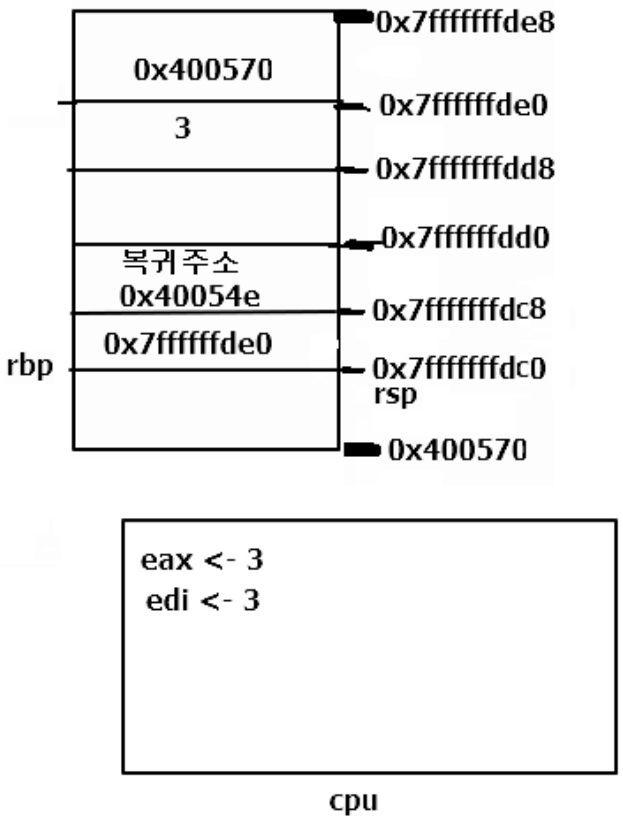
기계어 분석

```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
   0x0000000000400526 <+0>:     push   %rbp
=> 0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rsp
$9 = 0x7fffffffdcc0
(gdb) p/x rsp
No symbol "rsp" in current context.
(gdb) x $rsp
0x7fffffffdcc0: 0xffffdce0
(gdb) si
0x000000000040052a      4       {
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
=> 0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rbp
$10 = 0x7fffffffdcc0
(gdb)
```



기계어 분석

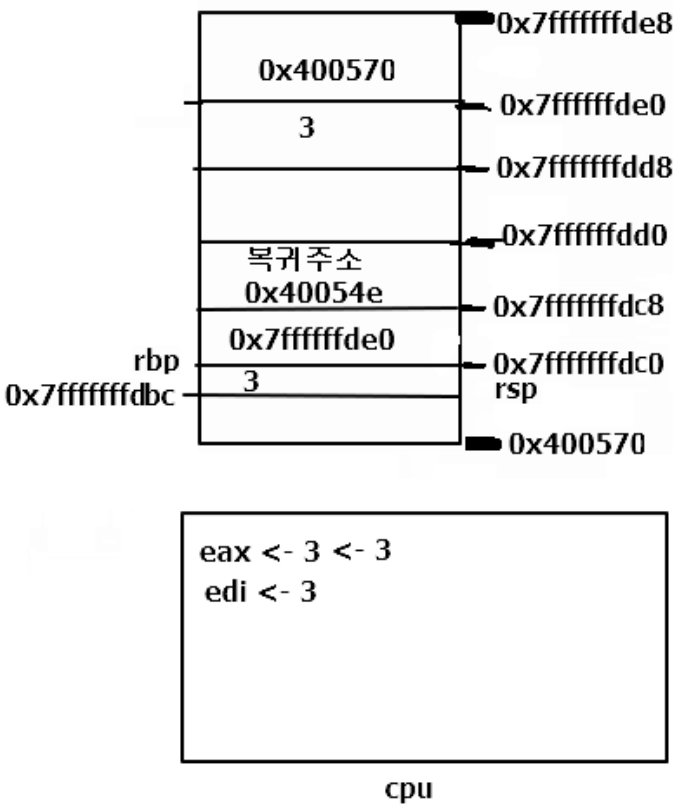
```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
   0x0000000000400526 <+0>:     push   %rbp
=> 0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rsp
$9 = 0x7fffffffdcc0
(gdb) p/x rsp
No symbol "rsp" in current context.
(gdb) x $rsp
0x7fffffffdcc0: 0xffffdce0
(gdb) si
0x000000000040052a      4       {
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
=> 0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rbp
$10 = 0x7fffffffdcc0
(gdb)
```



기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

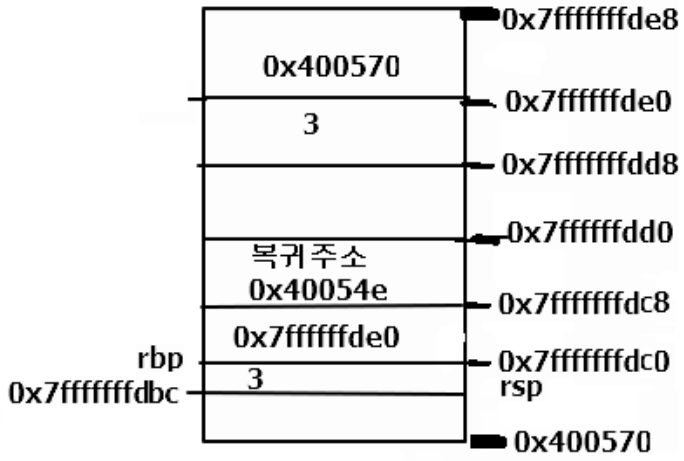
```
(gdb) si
6               return num + 3;
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
=> 0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) x $rbp-4
0x7fffffffdcbc: 0x00000003
(gdb) si
0x0000000000400530      6               return num + 3;
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
=> 0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $eax
$11 = 0x3
(gdb)
```



기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

```
(gdb) si
0x0000000000400530      6               return num + 3;
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
=> 0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $eax
$11 = 0x3
(gdb) si
8       }
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
=> 0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $eax
$12 = 0x6
(gdb)
```

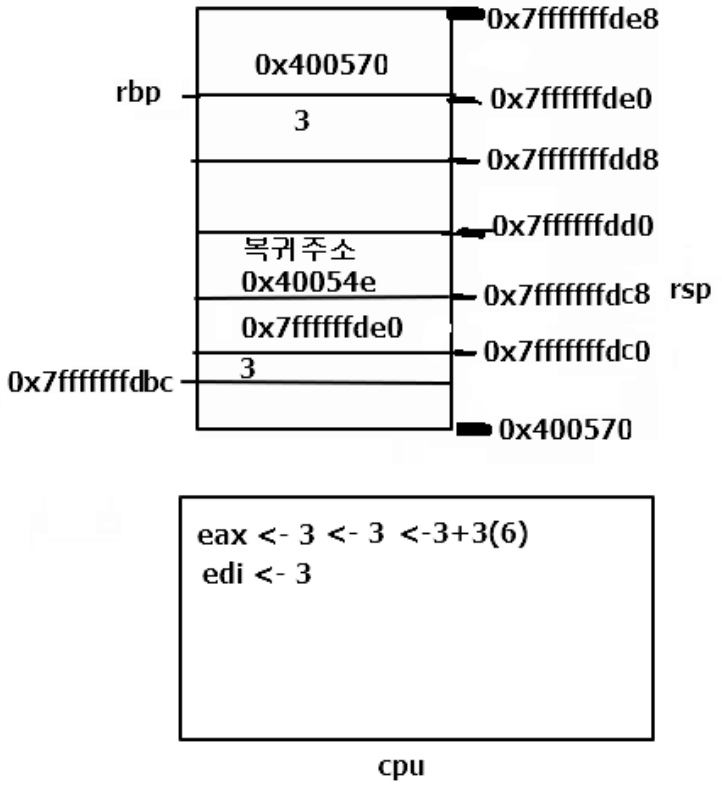


eax <- 3 <- 3 <-3+3(6)
edi <- 3

cpu

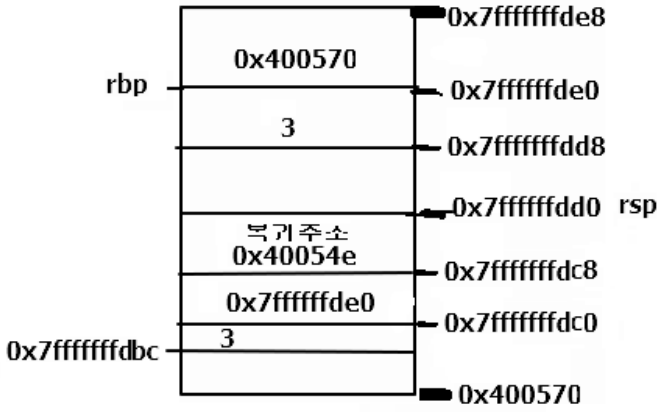
기계어 분석

```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
(gdb) si
8       }
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
=> 0x0000000000400533 <+13>:    pop    %rbp
   0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $eax
$12 = 0x6
(gdb) si
0x0000000000400534      8       }
(gdb) disas
Dump of assembler code for function myfunc:
   0x0000000000400526 <+0>:     push   %rbp
   0x0000000000400527 <+1>:     mov    %rsp,%rbp
   0x000000000040052a <+4>:     mov    %edi,-0x4(%rbp)
   0x000000000040052d <+7>:     mov    -0x4(%rbp),%eax
   0x0000000000400530 <+10>:    add    $0x3,%eax
   0x0000000000400533 <+13>:    pop    %rbp
=> 0x0000000000400534 <+14>:    retq
End of assembler dump.
(gdb) p/x $rbp
$13 = 0x7fffffffdce0
(gdb)
```



기계어 분석

```
(gdb) p/x $rsp
$14 = 0x7fffffffdcc8
(gdb) si
0x000000000040054e in main () at func1.c:12
12              res = myfunc(num1);
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
=> 0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x $rip
$15 = 0x40054e
(gdb) p/x $rsp
$16 = 0x7fffffffdcd0
(gdb)
```

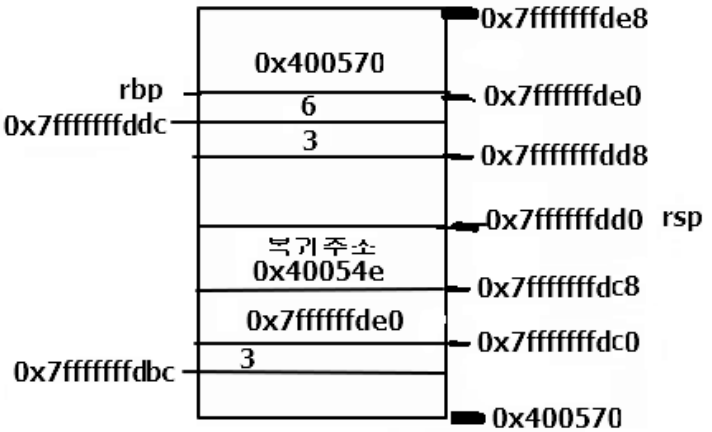


eax <- 3 <- 3 <-3+3(6)
edi <- 3
rip <- 0x40054e 복귀주소

cpu

기계어 분석

```
howard@ubuntu: ~/my_proj/Homework/sanghoonlee
0x7fffffffdcc8: 0x0040054e
(gdb) si
13              printf("res = %d\n", res);
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
=> 0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
   0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) x $rbp - 8
0x7fffffffdcd8: 0x00000003
(gdb) x %rpb - 4
A syntax error in expression, near `%rpb - 4'.
(gdb) x $rbp - 4
0x7fffffffdcdc: 0x00000006
(gdb)
```



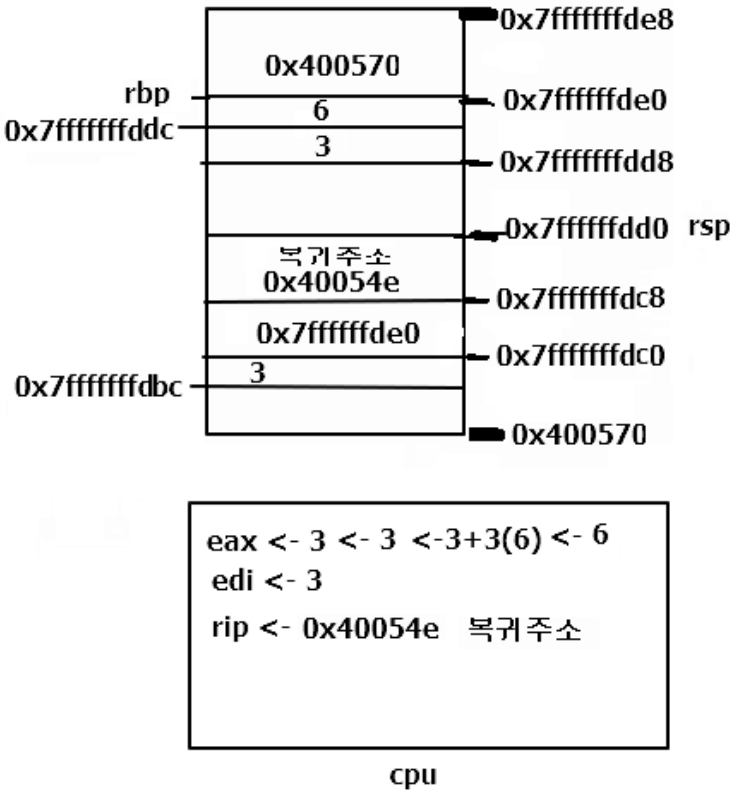
eax <- 3 <- 3 <-3+3(6)
edi <- 3
rip <- 0x40054e 복귀주소

cpu

기계어 분석

howard@ubuntu: ~/my_proj/Homework/sanghoonlee

```
A syntax error in expression, near `%rpb - 4'.
(gdb) x $rbp - 4
0x7fffffffdcdc: 0x00000006
(gdb) si
0x0000000000400554      13              printf("res = %d\n", r
(gdb) disas
Dump of assembler code for function main:
   0x0000000000400535 <+0>:     push   %rbp
   0x0000000000400536 <+1>:     mov    %rsp,%rbp
   0x0000000000400539 <+4>:     sub    $0x10,%rsp
   0x000000000040053d <+8>:     movl   $0x3,-0x8(%rbp)
   0x0000000000400544 <+15>:    mov    -0x8(%rbp),%eax
   0x0000000000400547 <+18>:    mov    %eax,%edi
   0x0000000000400549 <+20>:    callq  0x400526 <myfunc>
   0x000000000040054e <+25>:    mov    %eax,-0x4(%rbp)
   0x0000000000400551 <+28>:    mov    -0x4(%rbp),%eax
=> 0x0000000000400554 <+31>:    mov    %eax,%esi
   0x0000000000400556 <+33>:    mov    $0x4005f4,%edi
   0x000000000040055b <+38>:    mov    $0x0,%eax
   0x0000000000400560 <+43>:    callq  0x400400 <printf@plt>
   0x0000000000400565 <+48>:    mov    $0x0,%eax
   0x000000000040056a <+53>:    leaveq
   0x000000000040056b <+54>:    retq
End of assembler dump.
(gdb) p/x %eax
A syntax error in expression, near `%eax'.
(gdb) p/x $eax
$19 = 0x6
(gdb)
```



포인터 크기

- 포인터란 주소를 저장하는 변수로 그 크기는 자료형과 관계가 없고, os(system)의 비트수에 따라 결정된다.
- 8bit : 1 byte
- 16bit : 2byte
- 32bit : 4byte
- 64bit : 8byte
- Sizeof(int*) 등을 통해 확인해볼것

2진수,16진수 변환

- 2진수란 0,1로 이루어진 숫자로, 비트를 표현할 때 사용한다.
- 제일 작은 수부터, 2^0,2^1,2^2, ... 을 나타낸다.
- 예) 1101(2)는 2^3+2^2+2^0=13(10)을 나타낸다.
- 16진수란 0~15로 이루어진 숫자로, 10부터는 알파벳을 통해 표현한다.
- 0,1,2,3,4,5,6,7,8,9,a,b,c,d,e,f
- 2진수 -> 16진수 변환 시, 4bit씩 끊어서 변환한다.
- 예)1101 1001 0001 0010 0001 0001(2)
- -> d a 1 2 1 1 = 0xda1211