CS107 x86-64 Reference Sheet

Common instructions

`mov src, dst`	dst = src
`movsbl src, dst`	byte to int, sign-extend
`movzbl src, dst`	byte to int, zero-fill
`cmov src, reg`	reg = src when condition holds, using same condition suffixes as jmp
`lea addr, dst`	dst = addr
`add src, dst`	dst += src
`sub src, dst`	dst -= src
`imul src, dst`	dst *= src
`neg dst`	dst = -dst (arith inverse)
`imulq S`	signed full multiply R[%rdx]:R[%rax] <- S * R[%rax]
`mulq S`	unsigned full multiply same effect as **imulq**
`idivq S`	signed divide R[%rdx] <- R[%rdx]:R[%rax] mod S R[%rax] <- R[%rdx]:R[%rax] / S
`divq S`	unsigned divide - same effect as **idivq**
`cqto`	R[%rdx]:R[%rax] <- SignExtend(R[%rax])
`sal count, dst`	dst <<= count
`sar count, dst`	dst >>= count (arith shift)
`shr count, dst`	dst >>= count (logical shift)
`and src, dst`	dst &= src
`or src, dst`	dst |= src
`xor src, dst`	dst ^= src
`not dst`	dst = ~dst (bitwise inverse)
`cmp a, b`	b-a, set flags
`test a, b`	a&b, set flags
`set dst`	sets byte at dst to 1 when condition holds, 0 otherwise, using same condition suffixes as jmp
`jmp label`	jump to label (unconditional)
`je label`	jump equal ZF=1
`jne label`	jump not equal ZF=0
`js label`	jump negative SF=1
`jns label`	jump not negative SF=0
`jg label`	jump > (signed) ZF=0 and SF=OF
`jge label`	jump >= (signed) SF=OF
`jl label`	jump < (signed) SF!=OF
`jle label`	jump <= (signed) ZF=1 or SF!=OF
`ja label`	jump > (unsigned) CF=0 and ZF=0
`jae label`	jump >= (unsigned) CF=0
`jb label`	jump < (unsigned) CF=1
`jbe label`	jump <= (unsigned) CF=1 or ZF=1
`push src`	add to top of stack Mem[--%rsp] = src
`pop dst`	remove top from stack dst = Mem[%rsp++]
`call fn`	push %rip, jmp to fn
`ret`	pop %rip

Condition codes/flags

ZF Zero flag
SF Sign flag
CF Carry flag
OF Overflow flag

Addressing modes

Example source operands to **mov**

Immediate

```
mov $0x5, dst
```

`$val`
source is constant value

Register

```
mov %rax, dst
```

`%R`
R is register
source in %R register

Direct

```
mov 0x4033d0, dst
```

`0xaddr`
source read from Mem[0xaddr]

Indirect

```
mov (%rax), dst
```

`(%R)`
R is register
source read from Mem[%R]

Indirect displacement

```
mov 8(%rax), dst
```

`D(%R)`
R is register
D is displacement
source read from Mem[%R + D]

Indirect scaled-index

```
mov 8(%rsp, %rcx, 4), dst
```

`D(%RB,%RI,S)`
RB is register for base
RI is register for index (0 if empty)
D is displacement (0 if empty)
S is scale 1, 2, 4 or 8 (1 if empty)
source read from:
Mem[%RB + D + S*%RI]

CS107 x86-64 Reference Sheet

Registers

%rip	Instruction pointer
%rsp	Stack pointer
%rax	Return value
%rdi	1st argument
%rsi	2nd argument
%rdx	3rd argument
%rcx	4th argument
%r8	5th argument
%r9	6th argument
%r10,%r11	Callee-owned
%rbx,%rbp, %r12-%15	Caller-owned

Instruction suffixes

b	byte
w	word (2 bytes)
l	long /doubleword (4 bytes)
q	quadword (8 bytes)

Suffix is elided when can be inferred from operands. e.g. operand `%rax` implies `q`, `%eax` implies `l`, and so on

Register Names

64-bit register	32-bit sub-register	16-bit sub-register	8-bit sub-register
%rax	%eax	%ax	%al
%rbx	%ebx	%bx	%bl
%rcx	%ecx	%cx	%cl
%rdx	%edx	%dx	%dl
%rsi	%esi	%si	%sil
%rdi	%edi	%di	%dil
%rbp	%ebp	%bp	%bpl
%rsp	%esp	%sp	%spl
%r8	%r8d	%r8w	%r8b
%r9	%r9d	%r9w	%r9b
%r10	%r10d	%r10w	%r10b
%r11	%r11d	%r11w	%r11b
%r12	%r12d	%r12w	%r12b
%r13	%r13d	%r13w	%r13b
%r14	%r14d	%r14w	%r14b
%r15	%r15d	%r15w	%r15b