

6.823 Computer System Architecture  
CISC ISA – x86jr

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x86 has a CISC-style instruction set with variable-length instructions. In the x86 architecture, each instruction is capable of performing one or more simpler instructions called micro-operations ( $\mu$ ops). It also supports several complex addressing modes.

We introduce a (very small) subset of the x86 instruction set in the following table. (Interested readers are referred to the [Intel's website](#) for full details.)

Instruction	Operation	OF	SF	Length
add $R_{DEST}, R_{SRC}$	$R_{DEST} \leftarrow R_{SRC} + R_{DEST}$	M	M	2 bytes
cmp imm32, $R_{SRC2}$	Temp $\leftarrow R_{SRC2} - \text{MEM}[\text{imm32}]$	M	M	6 bytes
inc $R_{DEST}$	$R_{DEST} \leftarrow R_{DEST} + 1$	M	M	1 byte
jmp label	jump to the address specified by label			2 bytes
j1 label	if (SF $\neq$ OF) jump to the address specified by label	T	T	2 bytes
xor $R_{DEST}, R_{SRC}$	$R_{DEST} \leftarrow R_{DEST} \text{ XOR } R_{SRC}$	O	M	2 bytes

Table H2-1: Simple x86 instruction set (x86jr)

Notice that the jump instruction `j1` (jump if less than) depends on SF and OF, which are status flags. Each instruction affects them in different ways based on the result of its computation: “M” indicates the instruction modifying (writing) the status flag, “T” the instruction testing (reading but not writing) it, and “O” the instruction resetting it. A blank (as in `jmp` instruction) means that the instruction does not affect the status flag. Some instructions, like the `cmp` instruction, perform a computation and set status flags, but do not return any result.

The meanings of the status flags are given in the following table:

Name	Purpose	Condition Reported
OF	Overflow	Result exceeds positive or negative limit of number range
SF	Sign	Result is negative (less than zero)

Table H2-2: Status flags

The following table shows how different values in the operands of `cmp` influence those status flags in a 32-bit machine:

<b>R<sub>SRC2</sub></b>	<b>MEM[imm32]</b>	<b>OF</b>	<b>SF</b>
0x00000001	0x00000000	0	0
0x00000000	0x00000001	0	1
0x7FFFFFFF (positive limit)	0xFFFFFFFF (-1)	1	0
0x80000000 (negative limit)	0x00000001	1	1

Table H2-3: Operands vs Status flags