SIC machine: (Simplified Instructional Computer)

There are two versions of the SIC machine, "simple" SIC and SIC/XE (extended environment).

For SIC, memory is organized as a sequence of 8-bit bytes, and any 3 consecutive bytes forms a word. This means that SIC is designed as a 24-bit machine. A word is addressed by is lowest numbered byte (i.e., addressing starts at byte 0).

Simple SIC:

Memory: 2^{15} (32 K) bytes

Registers:

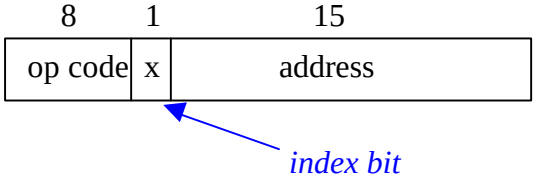
mnemonic	number	
A	0	accumulator
X	1	index register
L	2	link register
PC	8	program counter
SW	9	status word

Data formats:

Numeric - 24 bit 2's complement
Character - 8 bit ASCII

Instruction format:

one address instruction architecture, 24 bits as follows



x = 0 ⇔ direct addressing mode
x = 1 ⇔ indexed/direct addressing mode

I/O:

Each device has an 8-bit address; data is transferred in single byte quantities to or from the rightmost byte of register A.

Remark: the SIC simulator on Osprey has as installed devices the 8-bit addresses

00, 04, 05, 06, F1, F2, F3

boot output input

Extensions for SIC/XE:

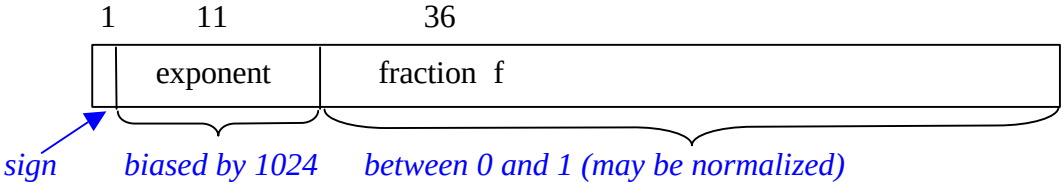
Memory: 2^{20} (1 M) bytes

Added Registers:

mnemonic	number	
B	3	base register
S	4	general working register
T	5	general working register
F	6	floating point accumulator; it uses the 24 bits that could be R7 to provide a 48 bit register

Added Data formats:

Numeric - 48 bit floating point

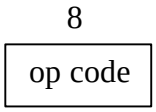


The actual exponent: exponent - 1024

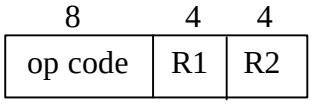
value represented = (sgn) f $\times$ $2^{(\text{exponent - 1024})}$

Instruction formats: (4 in all)

1. 1-byte format (e.g., SIO, HIO, TIO, NORM) - not used in COP 3601

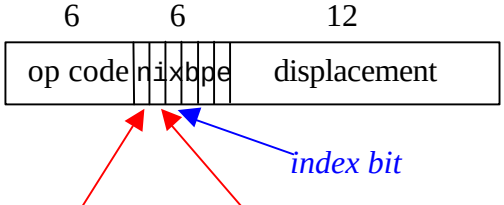


2. 2-byte format



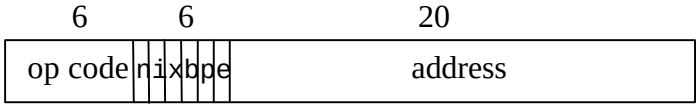
The two addresses typically represent registers, so no memory access is needed to execute these.

3. 3-byte format



If the "n-bit" and the "i-bit" are both 0 then the instruction is interpreted as a simple SIC instruction.

4. 4-byte format



n = indirect bit
i = immediate bit
x = index bit
b = base bit
p = PC relative bit
e = extended bit

These bits alone or in combination determine variations of the instruction interpretation:

e = 0 ⇒ *3 byte format*
e = 1 ⇒ *4 byte format*

x = 1 ⇒ *indexed addressing*

b = 1 and p = 0 ⇒ *base/displacement* addressing
b = 0 and p = 1 ⇒ *PC relative* addressing

n = 1 and i = 1 ⇒ *direct* addressing
n = 1 and i = 0 ⇒ *indirect* addressing
n = 0 and i = 1 ⇒ *immediate* addressing

n = 0 and i = 0 ⇒ *simple SIC* interpretation
(so the last 15 bits is treated as an address, including the *bpe* bits).

[The full collection of allowed interpretations is given in Appendix A of the course text.]