

Activity: LC-3 Addressing Modes

A. Why?

Instruction set architectures (and the LC-3 in particular) have different ways to specify operands. Each such addressing mode has advantages and disadvantages.

B. Outcomes

By the end of the activity you should

- Be able to find what operand is specified by the different LC-3 addressing modes.
- Know what advantages and disadvantages the different addressing modes have.

C. Questions

Complete this activity for class Wed Oct 7.

1. Fill out the missing table entries below. Assume execution starts at x3000 and that all registers contain unknown values.

Notation: The left-hand side of an assignment should either be a register or M[memory location]. On the right-hand side of an assignment, use M[memory location] for the value stored at the location; just use “memory location” for the location itself. For example, $M[x1234] \leftarrow x1500$ means 1500_{16} is copied to location 1234_{16} , but $M[x1234] \leftarrow M[x1500]$ means the contents at location 1500_{16} is copied to location 1234.

Addr	OpC	Instruction	Comments
x3000	LEA	1110 010 001001111	$R2 \leftarrow PC+x4F = x???$
x3001	LD	0010 100 111111111	$R4 \leftarrow M[PC-1] = x29???$ [2 digits missing]
x3002	STR	0111 100 010 010000	???
x3003	ST	0011 100 000001101	???
x3004	STI	1011 010 000001100	???
x3005	LEA	1100 011 ???	$R3 \leftarrow PC-8 = x3006-8 = x2FFE$

2. What decimal values can a (5-bit signed) immediate operand have?
3. What decimal values can a (9-bit signed) PC offset have?
4. If we have a word of data stored at location $PC+x1000$, can we access it using a single load (LD/LEA/LDI/LDR) instruction? Or do we need to do some work first?