

## Activity: LC-3 Control Instructions

### A. Why?

Instruction set architectures (and the LC-3 in particular) provide control instructions so we can write code that makes decisions

### B. Outcomes

By the end of the activity you should

- Be able to inspect an LC-3 program and determine whether or not it will take a conditional branch.
- Know the difference between branch and jump instructions on the LC-3.

### C. Questions

1. What does the following instruction sequence do? (It depends on what's in R1.)

Addr	OpC	Instruction	Comments
x3000	AND	0101 011 001 1 11111	??? <b>Group 1: Copy R3 ← R1</b>
x3001	BR	0000 011 000000111	If ???, go to location ??? <b>Group 1</b>
x3002	BR	0000 100 000000010	Else ??? <b>Group 2</b>
x3003	EEK!	Horrible error in pgm?	This should never happen?

2. **Group 3** The LC-3 branch instruction doesn't have a base+offset addressing mode; the jump instruction is unconditional. Say R7 contains an address you want to go to, but only if the condition code is  $\leq 0$ . Write an instruction sequence to carry this out.

3. **Group 4** Suppose you're at x4000 and you want to go to the location pointed to by x40A0. Write an instruction sequence to carry this out. (Use a temporary register if you want.)

x4000 BR 0000 111 010011111 = (offset = 159 = x9F)

unconditional branch to x4001+x9F = x40A0

No, this jumps to x40A0 (PC ← x40A0)

want PC ← M[x40A0]