

**ILOC Reference**  
**CS 432 - Fall 2019**

| Form                      | Op1          | Op2       | Op3         | Comment                             |
|---------------------------|--------------|-----------|-------------|-------------------------------------|
| <b>Integer Arithmetic</b> |              |           |             |                                     |
| add                       | op1, op2 =>  | op3       | reg reg reg | addition                            |
| sub                       | op1, op2 =>  | op3       | reg reg reg | subtraction                         |
| mult                      | op1, op2 =>  | op3       | reg reg reg | multiplication                      |
| div                       | op1, op2 =>  | op3       | reg reg reg | division                            |
| addI                      | op1, op2 =>  | op3       | reg imm reg | addition w/ constant                |
| multI                     | op1, op2 =>  | op3       | reg imm reg | multiplication w/ constant          |
| neg                       | op1 =>       | op2       | reg reg     | arithmetic negation                 |
| <b>Boolean Arithmetic</b> |              |           |             |                                     |
| and                       | op1, op2 =>  | op3       | reg reg reg | boolean AND                         |
| or                        | op1, op2 =>  | op3       | reg reg reg | boolean OR                          |
| not                       | op1 =>       | op2       | reg reg     | boolean NOT                         |
| <b>Data Movement</b>      |              |           |             |                                     |
| i2i                       | op1 =>       | op2       | reg reg     | register copy                       |
| loadI                     | op1 =>       | op2       | imm reg     | load integer constant               |
| load                      | [op1] =>     | op2       | reg reg     | load from address                   |
| loadAI                    | [op1+op2] => | op3       | reg imm reg | load from base + immediate          |
| loadAO                    | [op1+op2] => | op3       | reg reg reg | load from base + offset             |
| store                     | op1 =>       | [op2]     | reg reg     | store to address                    |
| storeAI                   | op1 =>       | [op2+op3] | reg reg imm | store to base + immediate           |
| storeAO                   | op1 =>       | [op2+op3] | reg reg reg | store to base + offset              |
| push                      | op1          |           | reg         | push onto stack                     |
| pop                       | op1          |           | reg         | pop from stack                      |
| <b>Comparison</b>         |              |           |             |                                     |
| cmp_LT                    | op1, op2 =>  | op3       | reg reg reg | less-than comparison                |
| cmp_LE                    | op1, op2 =>  | op3       | reg reg reg | less-than-or-equal-to comparison    |
| cmp_EQ                    | op1, op2 =>  | op3       | reg reg reg | equality comparison                 |
| cmp_GE                    | op1, op2 =>  | op3       | reg reg reg | greater-than-or-equal-to comparison |
| cmp_GT                    | op1, op2 =>  | op3       | reg reg reg | greater-than comparison             |
| cmp_NE                    | op1, op2 =>  | op3       | reg reg reg | inequality comparison               |
| <b>Control Flow</b>       |              |           |             |                                     |
| label                     | ("op1:")     |           | lbl         | control flow label                  |
| jump                      | op1          |           | lbl         | unconditional branch                |
| cbr                       | op1 =>       | op2, op3  | reg lbl lbl | conditional branch                  |
| call                      |              |           | fun         | call function                       |
| return                    |              |           |             | return to caller                    |
| <b>Miscellaneous</b>      |              |           |             |                                     |
| print                     |              |           | reg         | print integer to standard out       |
| print                     |              |           | str         | print string to standard out        |
| nop                       |              |           |             | no-op (do nothing)                  |
| phi                       |              |           | reg reg reg | φ-function (for SSA only)           |

| Op  | Meaning                  |
|-----|--------------------------|
| reg | register (int or bool)   |
| imm | immediate (int constant) |
| lbl | jump label               |
| fun | call label               |
| str | string                   |