COMP 122/L Lecture 10

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Outline

- Translating complex `if` statements
    - Complex conditions
- Translating `while` loops

Translating complex `if` statements

Branch (b) Instruction

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        mov r0, #1
        b other
        mov r0, #5
other:
        mov r1, r0
```

Branch (b) Instruction

Branch (b) can be used to jump to code with a label.

Code can be given labels, just as with data.

r0:1

```
mov r0, #1
b other
  mov r0, #5
other:
  mov r1, r0
```

-Start at first instruction, as usual

Branch (b) Instruction

Branch (b) can be used to jump to code with a label.

Code can be given labels, just as with data.

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        mov r0, #1
        b other
        mov r0, #5
other:
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-Execution of b other causes execution to jump to other

Branch (b) Instruction

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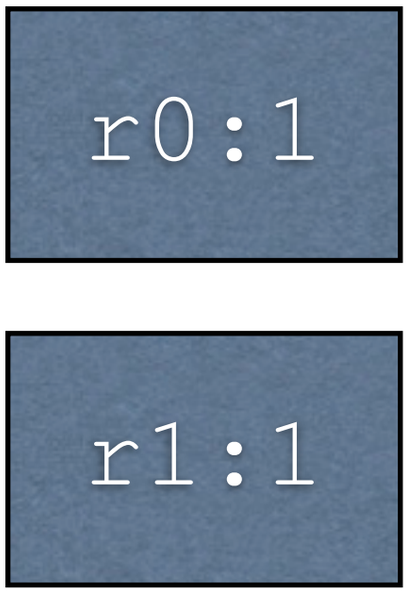
Code can be given labels, just as with data.




```
    mov r0, #1
    b other
    mov r0, #5
other:
    mov r1, r0
```

-Execution of b other causes execution to jump to other
-The mov r0, #5 instruction is never touched

Translating `if`

Key point: the `b` instruction can be conditionally executed.

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```
        mov r0, #0
        mov r1, #5
        cmp r1, #5
        beq elsewhere
        mov r0, #25
elsewhere:
        mov r2, r0
```

Translating `if`

Key point: the `b` instruction can be conditionally executed.

`r0:0`

```
    mov r0, #0
    mov r1, #5
    cmp r1, #5
    beq elsewhere
    mov r0, #25
elsewhere:
    mov r2, r0
```

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        mov r0, #0
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        cmp r1, #5
        beq elsewhere
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    elsewhere:
        mov r2, r0
```

-Does 5 - 5, sets the zero bit

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`r0:0`

`r1:5`

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        mov r0, #0
        mov r1, #5
        cmp r1, #5
→       beq elsewhere
        mov r0, #25
elsewhere:
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```

-Because the zero bit is set, the jump occurs

Translating `if`

Key point: the `b` instruction can be conditionally executed.

r0:0

r1:5

r2:0

```
        mov r0, #0
        mov r1, #5
        cmp r1, #5
        beq elsewhere
        mov r0, #25
elsewhere:
→       mov r2, r0
```

-Because the zero bit is set, the jump occurs
-The mov r0, #25 instruction is never executed

Utility for `if`

- More convenient to translate long `if`s with labeled branches
- Basically required for nested `if` or complex conditions
- Conditionally-executed instructions are most useful for short `if`s
    - Arguably the common case

Example:

absolute_value_label.s

Nested `if`

- Can be handled with multiple comparisons and branches
- Tricky part: assembly is written in a linear way, but branches are inherently non-linear
- Example:
  - `NestedIf.java`
  - `nested_if.s`

Complex Conditions

Boolean Operations

Boolean operations (e.g., `&&`, `||`) require multiple checks.

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```
if (x == 0 || x == 5) {
   y = 0;
} else if (min <= x && x <= max) {
   y = 1;
}
```

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}
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```
    if (x == 0 || x == 5) {
       y = 0;
    } else if (min <= x && x <= max) {
       y = 1;
    }
```

```
if (x == 0) {
   y = 0;
} else {
   if (x == 5) {
      y = 0;
   } else {
      if (min <= x) {
         if (x <= max) {
            y = 1;
         }}}}
```

Example:

`BigIf.java`

`big_if.s`

Translating `while` Loops

Translating `while`

- Lot like `if`, but with jumps to the start/end
- Example:
  - `WhileLoop.java`
  - `while_loop.s`