Slide 1

Administrivia

- Reminder: Homework 3 due today.
- Reminder: Quiz 3 Monday. Likely topic is something from later sections of chapter 2.
- For Homework 3 you turn in the programming problems by e-mail. Send me source code (filename ending in `.s`) as attachment. One option is the `mail-files` script on the course "sample programs" page.

Slide 2

Signed Versus Unsigned

- If we have n bits, we can use them to represent signed values in — what range?

  Or we can use them to represent non-negative values only ("unsigned values") — then what range?
- Many MIPS instructions have "unsigned" counterparts — `addu`, `addiu`, `sltu`, etc.
- Example: Suppose we have

  0x00000000 in `$t0`

  0xfffffff2 in `$t1`

  What happens if we execute `slt $t2, $t0, $t1`?

  What happens if we execute `sltu $t2, $t0, $t1`?

  (Same bits, different interpretations!)

Slide 3

Sign Extension

- If we have a number in 16-bit two's complement notation (e.g., the constant in an I-format instruction), do we know how to "extend" it into a 32-bit number?

  For non-negative numbers, easy.

  For negative numbers, also not too hard — consider taking absolute value, extending it, then taking negative again.
- In effect — "extend" by duplicating sign bit.
- (Notice that not all instructions that include a 16-bit constant do this.)

Slide 4

Two's Complement and Addition/Subtraction

- Addition in binary works much like addition in decimal (taking into account the different bases). Notice what happens if one number is negative. (Try an example or two.)
- Subtraction could also be done the way we do in decimal. Or how else could we do it? (Again, try some examples.)
- But there is one catch, related to the fact that operands and result are all n bits. What is it?

Slide 5

Addition/Subtraction and Overflow

- If adding two n-bit numbers, result can be too big to fit in n bits — "overflow".
- For unsigned numbers, how could we tell this had happened?
- How about for signed numbers?
- (To be continued . . .)

Slide 6

Minute Essay

- What was interesting and/or difficult about Homeworks 2 and 3?
- I'm planning to use at least part of Monday for review for the midterm. Anything in particular you'd like to talk about?