Boolean Arithmetic

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Chapter 2, Slides

- Slide 4: An n-place radix r number can represent how many values?

  What is the decimal value of these unsigned binary numbers: 1111, 111111?

- Slide 5: Convert `0x6A` to binary. Convert 1011110_2 to hexadecimal and to decimal. Convert the decimal number 11 to binary.

- Slide 6: How is overflow indicated when performing unsigned binary addition?

- Slide 7: Using 8-bit numbers, what is the bit pattern of the most negative number? The most positive number? The numbers 1 and -1?

  What are the weights of the bits in a signed binary number?

- Slide 8: Is it possible to have overflow when adding two signed numbers of opposite signs? Give a reason.

- Slide 9: How is overflow indicated when adding two signed binary numbers?

- Slide 11: The truth table for the sum output is exactly the same as that for what basic logic gate?

  The truth table for the carry output is exactly the same as that for what basic logic gate?

- Slide 15: The result of applying the bit-wise Not operation to a binary number `n` has the value `-(n + 1)`. (For example, `00111011 = 59`. `!00111011 = 11000100 = -60`. This is known as the *one's complement* of `n`. Adding `1` to the one's complement results in the two's complement.) Explain why the control bit settings for the `x + 1`, `x - 1`, and `x - y` rows compute each of these results.

General Binary Number Questions

Assume that "signed number" means a number in two's complement format.

1. Convert the following decimal values to eight bit two's complement binary values: 120 and -63. Express each value in both binary and hexadecimal representations.

2. The following hexadecimal numbers represent two's complement binary numbers. Convert each to decimal. 0xAB and 0x42.

3. Write the entire set of three bit unsigned binary numbers in order, from least to greatest. Include each number's decimal value.

4. Write the entire set of three bit two's complement numbers in order, from least to greatest. Include each number's decimal value.

5. Add the following two binary numbers, interpreting them as unsigned numbers (a) and as two's complement numbers (b). For each of the two cases, indicate the eight-bit sum and whether or not overflow has occurred. 00110111 and 01011011.

6. Add the following two binary numbers, interpreting them as unsigned numbers (a) and as two's complement numbers (b). For each of the two cases, indicate the eight-bit sum and whether or not overflow has occurred. 01001000 and 11100100.