❖ Problem Set 1: Number Systems

Number System Conversions

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Problem Set due May 6, 2023 10:37 PDT Completed

Decimal to Binary

1/1 point (graded)

Express the decimal number 1000_{10} as a binary number. Only use the exact number of bits required (i.e., no leading zeros). Do the math with paper and pencil to get used to your powers of 2.

1111101000 ✔

Submit Try again (1 attempt remaining) Show answer

Decimal to Hexadecimal

1/1 point (graded)

Express the decimal number 1000_{10} as a 3-digit hexadecimal number. This should be straightforward by referring to the previous question.

3E8 ✔

Submit Try again (1 attempt remaining) Hint Show answer

Hexadecimal to Binary

1/1 point (graded)

Express the hexadecimal number $BEEF_{16}$ as a binary number. Do not use a calculator; this problem should be easy if done properly.

1011111011101111 ✔

1011111011101111

Submit Try again (1 attempt remaining) Show answer

Hexadecimal to Decimal

1/1 point (graded)

Express the hexadecimal number $BB8_{16}$ as a decimal number. Do the math with pencil and paper to get used to your powers of 2.

3000 ✔

3000

Submit Try again (1 attempt remaining) Show answer

Binary to Decimal

1/1 point (graded)

Express the binary number 1100101_2 as a decimal number. Do the math with pencil and paper to get used to your powers of 2.

101 ✔

101

Submit Try again (1 attempt remaining) Show answer

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Unsigned Number

1/1 point (graded)

What is the decimal value of 11111100_2 interpreted as an 8-bit unsigned number?

252 ✔

252

Submit Try again (1 attempt remaining) Show answer

Sign-Magnitude

1/1 point (graded)

What is the decimal value of 11111100_2 interpreted as an 8-bit sign-magnitude number?

-124 ✔

-124

Submit Try again (1 attempt remaining) Show answer

Two's Complement

1/1 point (graded)

What is the decimal value of 11111100_2 interpreted as an 8-bit 2's complement number?

-4 ✔

-4

Submit Try again (1 attempt remaining) Show answer

Range of Numbers

1/1 point (graded)

What are the most positive values that can be represented with 16-bit unsigned, sign-magnitude, and 2's complement numbers, respectively.

- ○ {32768, 32768, 32768}
- ◉ {65535, 32767, 32767}
- ○ {65535, 32767, 32768}
- ○ {65536, 32768, 32768}
- ○ {65535, 65535, 65535}

✔

Submit | Try again (1 attempt remaining) | Show answer

Range of Numbers

1/1 point (graded)

What are the most negative values that can be represented with 16-bit unsigned, sign-magnitude, and 2's complement numbers, respectively.

- ○ {0, -0, -32768}
- ○ {0, -32767, -32767}
- ◉ {0, -32767, -32768}
- ○ {0, -65535, -65535}
- ○ {-32767, -32767, -32767}

✔

Submit | Try again (1 attempt remaining) | Show answer

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Addition

1/1 point (graded)

Compute $1010_2 + 0111_2$ and write your result as a 5-bit binary number.

10001 ✔

10001

Submit Try again (1 attempt remaining) Hint | Show answer

Unsigned Interpretation

1/1 point (graded)

If the numbers in the addition problem above are unsigned, interpret the addition in decimal.

- ○ -2 + 7 = 5
- ○ -6 + 7 = -15
- ○ -6 + 7 = 1
- ○ 10 + 7 = 1
- ◉ 10 + 7 = 17 ✔

Submit Try again (1 attempt remaining) Show answer

Two's Complement Interpretation

1/1 point (graded)

If the numbers in the addition problem above are signed 2's complement (4-bit for the addends and 5-bits for the sum), write an expression for the addition in decimal.

- ○ -2 + 7 = 5
- ○ -6 + 7 = -15
- ◉ -6 + 7 = 1
- ○ 10 + 7 = 1
- ○ 10 + 7 = 17

✔

Submit | Try again (1 attempt remaining) | Show answer

Carry out

1/1 point (graded)

Interpreting the numbers as 2's complement, how can you recast the addition problem above to give a sensible result?

Check all that apply.

- ☑ Truncate the 5 bit output to 4 bits like the inputs: 1010 + 0111 = 0001 (-6 + 7 = 1)
- ☑ Sign-extend the inputs to 5 bits and interpret the output as 5 bits: 11010 + 00111 = 00001 (-6 + 7 = 1)
- ☐ Sign-extend the inputs to 5 bits and interpret the output as 6 bits: 11010 + 00111 = 100001 (-6 + 7 = 1)
- ☐ Because of overflow, information is lost and the answer cannot be made sensible.
- ☐ Addition of 2's complement numbers never produces sensible results.

✔

Submit | Try again (1 attempt remaining) | Show answer

Overflow

1/1 point (graded)

When adding a pair of N-bit two's complement numbers to get an N-bit sum, overflow occurs if and only if:

- (●) the signs of the inputs are the same and the sign of the sum is different
- ( ) the inputs are both positive and the sum is negative
- ( ) the signs of the two inputs are different
- ( ) overflow can never occur when adding two's complement numbers

✔

Submit | Try again (1 attempt remaining) | Show answer

Subtraction

1/1 point (graded)

Using 6-bit two's complement arithmetic, compute 001000_2 - 010010_2 and express your answer as a 6-bit binary number.

110110 ✔

110110

Submit | Try again (1 attempt remaining) | Show answer

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Zero Extension

1/1 point (graded)

Extend the 6-bit unsigned binary number 101111_2 to be an 8-bit unsigned binary number.

00101111 ✔

Submit Try again (1 attempt remaining) Show answer

Sign Extension

1/1 point (graded)

Extend the 6-bit signed 2's complement binary number 101111_2 to be an 8-bit 2's complement binary number.

11101111 ✔

11101111

Submit Try again (1 attempt remaining) Show answer

Sign Extension

1/1 point (graded)

Extend the 8-bit 2's complement hexadecimal number AD_{16} to 16 bits. Express your result in hexadecimal.

FFAD ✔

Submit Try again (1 attempt remaining) Show answer