

CSC 215

Math and Computer Science



Binary Numbering (base 2)

- 1 byte has 8 bits
- Each bit can contain a 0 or 1

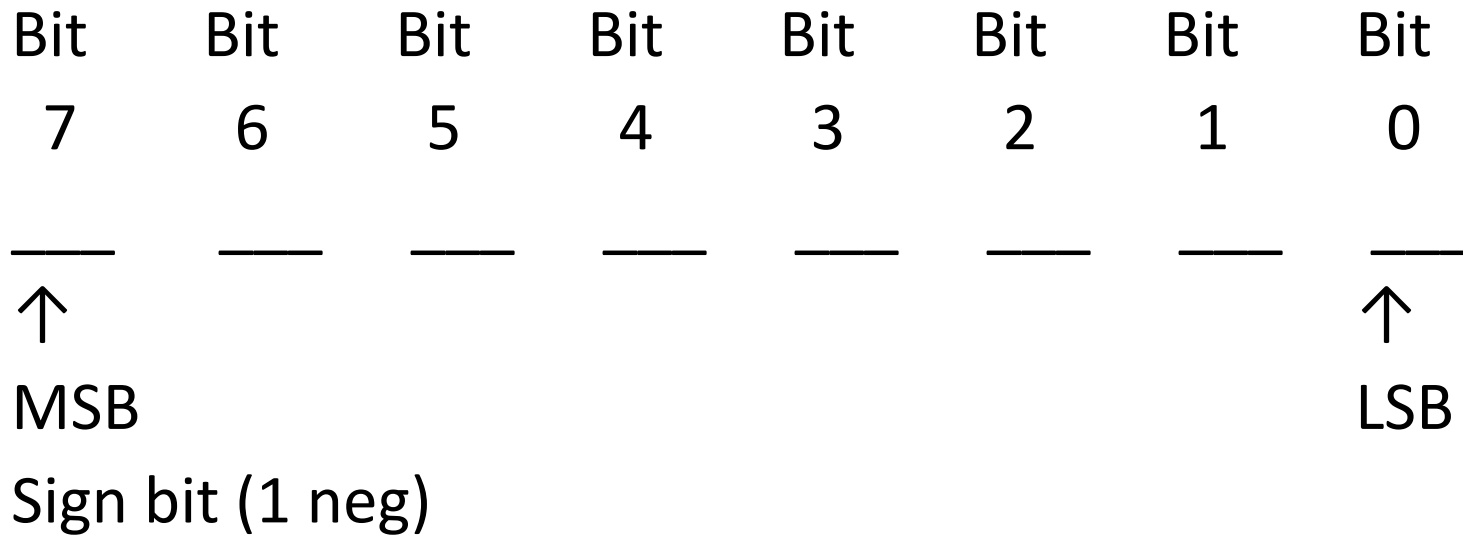
00100100 (char)

10101101 11001110 (short integer)

10001101 11001110 10001101 11001110 (long integer)

00010101 11101110 00001101 11000110 10111101 11010000 11111111 11000000
(long long integer)

Determining The Value



MSB = Most significant bit

LSB = Least significant bit

Determining The Value (Positive)

0	0	1	1	0	0	1	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Sum up the locations that have a 1

$$2^5 + 2^4 + 2^1 + 2^0 =$$

$$32 + 16 + 2 + 1 = 51$$

Determining the value (Negative)

1 0 1 1 0 0 1 1

Take the complement

0 1 0 0 1 1 0 0

Add one

0 1 0 0 1 1 0 1

2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

Then sum the values

$$2^6 + 2^3 + 2^2 + 2^0 = 64 + 8 + 4 + 1 = -77$$

Converting to binary (positive)

- char x = 79;

79 / 2 = 39 R 1 <- Least significant bit

39 / 2 = 19 R 1

19 / 2 = 9 R 1

9 / 2 = 4 R 1

4 / 2 = 2 R 0

2 / 2 = 1 R 0

1 / 2 = 0 R 1 <- high order bit (must pad with zeros)

01001111

Converting to binary (Negative)

- char x = -79; // first convert absolute value of -79 to binary
01001111 // see previous slide
10110000 // take complement
10110001 // add 000000001 to the complement value

Converting Binary to Hex and Back

- A hex digit is comprised of 4 bit
- Use the digits (0-9) and the letters (a-f)
- A = 10, b=11, c=12, d=13, e=14, f=15

Chart for conversion

Bit Pattern	Hex Value	Decimal Value		Bit Pattern	Hex Value	Decimal Value
0000	0	0		1000	8	8
0001	1	1		1001	9	9
0010	2	2		1010	A	10
0011	3	3		1011	B	11
0100	4	4		1100	C	12
0101	5	5		1101	D	13
0110	6	6		1110	E	14
0111	7	7		1111	F	15

Examples

- 79
- 01001111
- 0100 1111 separate into groups of 4
- 4 F
- Final hex value is 0x4F // 0x denotes base 16(hex)

Examples

- 14868 (short int)
- 0011101000010100
- 0011 1010 0001 0100
- 3 a 1 4
- 0x3a14

Examples

-9854

0010011001111110

// convert absolute of -9854

1101100110000001

// take complement

1101100110000010

// add one

1101 1001 1000 0010

// split into groups of four

D 9 8 2

// substitute values

0xD982

Assigning Hex Values

```
short int x = 0xD982;  
short int y = 0x7FFF;    // assign maximum signed short int  
short int a = 9845;  
short int b = 98;
```