# Comp 3350: Computer Organization & Assembly Language

# HW # 1: Theme: Binary Number Representations (Review of prerequisites)

*All main questions are of equal weight.*

*(Credit awarded to only those answers that show work)*

1. What is the decimal representation of each of the ***unsigned*** binary integers?

1. 1101 0101

(1 \* 27) + (1 \* 26) + (1 \* 24) + (1 \* 22) + (1 \* 20) = 213

1. 1010 1100

(1 \* 27) + (1 \* 25) + (1 \* 23) + (1 \* 22) = 172

1. 0101 1000

(1 \* 26) + (1 \* 24) + (1 \* 23) = 88

2. What is the minimum number of binary bits needed to represent each of the following ***unsigned*** decimal numbers?

1. 19567

215 = 32768, which corresponds to 16 bits necessary to represent the given decimal number.

1. 254

28 = 256, which corresponds to 9 bits necessary to represent the given decimal number.

1. 5437

213 = 8192, which corresponds to 14 bits necessary to represent the given decimal number.

3. What is the hexadecimal representation of each of the following binary numbers in signed 2’s complement?

1. 0010 0101 0100 0011

(1 \* 213) + (1 \* 210) + (1 \* 28) + (1 \* 26) + (1 \* 21) + (1 \* 20) = 9539

9539 / 16 = 596, remainder 3

596 / 16 = 37, remainder 4

37 / 16 = 2, remainder 5

2 / 16 = 0, remainder 2

So, the hexadecimal equivalent to the given binary number is 2543.

1. 0001 1011 0010 0100

(1 \* 212) + (1 \* 211) + (1 \* 29) + (1 \* 28) + (1 \* 25) + (1 \* 22) = 6948

6948 / 16 = 434, remainder 4

434 / 16 = 27, remainder 2

27 / 16 = 1, remainder B

1 / 16 = 0, remainder 1

So, the hexadecimal equivalent to the given binary number is 1B24.

1. 1111 0110 1101 1001

In unsigned form: 0000100100100111

(1 \* 211) + (1 \* 28) + (1 \* 25) + (1 \* 22) + (1 \* 21) + (1 \* 20) = 2343

The signed equivalent of this is -2343.

2343 / 16 = 146, remainder 7

146 / 16 = 9, remainder 2

9 / 16 = 0, remainder 9

So, the hexadecimal equivalent to the unsigned binary number is 927.

The hexadecimal equivalent to the signed 2’s complement binary number is F6D9. <<<<

1. What is the decimal value of the following representation of each hex integer below—assume they use unsigned notation?

a. 591

(5 \* 162) + (9 \* 161) + (1 \* 160) = 1280 + 144 + 1 = 1425

b. C07

(12 \* 162) + (7 \* 160) = 3079

c. 387E

(3 \* 163) + (8 \* 162) + (7 \* 161) + (14 \* 160) = 12288 + 2048 + 112 + 14 = 14462

5. What is the 16-bit hexadecimal representation of each ***signed*** decimal integer?

1. –45

For the purpose of the first part, we will convert the decimal integer from signed to unsigned.

45 / 16 = 2, remainder D

2 / 16 = 0, remainder 2

So, the unsigned 16-bit hexadecimal equivalent is 000000000000002D. The signed 16-bit hexadecimal equivalent is FFFFFFFFFFFFFFD3.

1. –208

For the purpose of the first part, we will convert the decimal integer from signed to unsigned.

208 / 16 = 13, remainder 0

13 / 16 = 0, remainder D

So, the unsigned 16-bit hexadecimal equivalent is 00000000000000D0. The signed 16-bit hexadecimal equivalent is FFFFFFFFFFFFFF30.

1. +2796

This decimal integer is signed, but because it’s positive, we treat it like it is unsigned.

2796 / 16 = 174, remainder C

174 / 16 = 10, remainder E

10 / 16 = 0, remainder A

So, the unsigned/signed 16-bit hexadecimal equivalent is 0000000000000AEC.

6. What is the 8-bit binary (2’s complement) representation of each of the ***signed*** decimal integers?

1. –22

For the purpose of the first part, we will convert the decimal integer from signed to unsigned.

22 / 2 = 11, remainder 0

11 / 2 = 5, remainder 1

5 / 2 = 2, remainder 1

2 / 2 = 1, remainder 0

1 / 2 = 0, remainder 1

So, the unsigned 8-bit binary equivalent is 00010110. The signed 8-bit binary equivalent is 11101010.

1. +114

This decimal integer is signed, but because it’s positive, we treat it like it is unsigned.

114 / 2 = 57, remainder 0

57 / 2 = 28, remainder 1

28 / 2 = 14, remainder 0

14 / 2 = 7, remainder 0

7 / 2 = 3, remainder 1

3 / 2 = 1, remainder 1

1 / 2 = 0, remainder 1

So, the unsigned/signed 8-bit binary integer equivalent is 01110010.

1. –8

For the purpose of the first part, we will convert the decimal integer from signed to unsigned.

8 / 2 = 4, remainder 0

4 / 2 = 2, remainder 0

2 / 2 = 1, remainder 0

1 / 2 = 0, remainder 1

So, the unsigned 8-bit binary equivalent is 00001000. The signed 8-bit binary equivalent is 11111000.

7. Write the ASCII code for the string “Auburn Tigers”. The answer would provide ASCII (in hexadecimal) corresponding to each letter in the string. The ASCII values can be found on the inner cover of the book.

65 117 98 117 114 110 32 84 105 103 101 114 115

8. What is the range of decimal values that can be represented by:

a) 6-bit unsigned integer? A 6-bit unsigned integer can represent the decimal values from 0 to 63.

b) 6-bit signed integer? A 6-bit signed integer can represent the decimal values -32 to 31.