Due Date: August 30, 2016 Points: 12

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ECE 241

\*\*\*Answers are in bold with the type of number (base 1010, base 22/binary)\*\*\*

This assignment will have to be done as a pdf document and uploaded to the course webpage. The document has been uploaded as a .doc file to facilitate you editing it and converting it to a pdf.

1) Write the 8-bit-binary two's-complement representation of the following numbers. Show the steps of converting the number. (4)

A) 6410 64/2 = 32 (remainder of 0), 32/2 = 16 (r of 0), 16/2 = 8 (r of 0), 8/2 = 4(r of 0), 4/2 = 2 (r of 0), 2/2 = 1 (r of 0), 1/2 = 0 (r of .5), 0/2 = 0

**Therefore, the 8-bit representation of 64 is 0100 00002**

B) -12810  First, we find the binary representation of 128:

128/2 = 64 (remainder of 0), 64/2 = 32 (r of 0), 32/2 = 16 (r of 0), 16/2 = 8 (r of 0), 8/2 = 4(r of 0), 4/2 = 2 (r of 0), 2/2 = 1 (r of 0), 1/2 = 0 (r of .5), 0/2 = 0

Therefore, the 8-bit representation of 128 is…

1000 00002

Now, we can take the 8-bit representation and flip it, then add one to find the negative value:

First: 1000 00002 becomes 0111 11112

Secondly: we add 1 like so

0111 1111

+ 1

1000 00002

**Therefore, -12810 is equivalent to 1000 00002**

C) 210 256/2 = 128, 128/2 = 64, 64/2 = 36, 32/2 = 16, 16/2 = 8, 8/2 = 4, 4/2 = 2, 2/2 = 1, 1/2 = .5 (1 in binary), 0/2 = 0

**Therefore, 210 is equivalent to 0000 00102**

D) 12810 **Not Possible for 128 to be represented in Binary**

2) Convert the following 16-bit Hexadecimal number to decimal, assuming they are signed numbers. I recommend converting them to binary and then converting the signed binary to decimal. (4)

1. 0xffff First covert to binary:

(from course notes) we know that F = 11112 so, we would then have a 16-bit binary number like so: 1111 1111 1111 11112 or 0b1111111111111111

Finally, convert from binary to decimal:

**1x215 + 1x214 + 1x213 + … + 1x20 = 65,53510**

1. 125016 First convert to binary:

116 = 00012, 216 = 00102, 516 = 01012, 016 = 00002

So, 125016 is equal to the 16-bit binary number “0001 0010 0101 00002”

Finally, convert from binary to decimal:

0x215 ­+ 0x214 + 0x213 + 1x212 +… + 1x20

Because we know anything multiplied to 0 = 0, we can isolate and find:

**1x212 + 1x29 + 1x26 + 1x24 = 4,68810**

1. 0x0011 First convert to binary:

Its positive because of the “0” in front. And we know that 016 = 00002, and

116 = 00012. So the 16-bit binary representation of this is:

0000 0000 0001 00012

Finally, we convert to decimal by using a polynomial concatenation of powers of 2 multiplied by the 0 or 1, and since we know 0x(anything) = 0, we can isolate and find:

**1x24 + 1x20 = 16+1 = 1710**

1. 55AA16 First convert to binary:

We know from the course notes that 516 = 01012, as well as A16 = 10102

So, the 16 bit binary representation is:

0101 0101 1010 10102

Finally, we convert to decimal by using polynomial concatenation of powers of 2 multiplied by 0 or 1. We can ignore the numbers multiplied to 0, isolate and find:

**1x214+ 1x212 + 1x210 + 1x28 + 1x27 + 1x25 + 1x23 + 1x21 = 21,93010**

3) Write out the results of the following logical operations, assuming the variables are all int's (16-bit integers). Also assume that the variable "Port" is equal to 0x0055 at the start of each line. (4)

1. Port &= 0xfff0; 0000 0000 0101 0101

&1111 1111 1111 0000

**0000 0000 0101 00002**

**Or**

**26+24 = 64+16 = 7010**

1. Port |= 15; // 15 is decimal.

0000 0000 0101 0101

| 0000 0000 0000 1111

**0000 0000 0101 11112**

**Or 20 + 21 + 22 + 23 + 24 + 26 = 9510**

1. Port = Port ^ 0x0005;

0000 0000 0101 0101

^ 0000 0000 0000 0101

**0000 0000 0101 00002**

**Or**

**26 + 24 = 64 + 16 = 7010**

1. Port = (( Port & ~(0x000f) ) | 0x0020 );

0000 0000 0101 0101

&1111 111 1 1111 0000

0000 0000 0101 0000

| 0000 0000 0010 0000

**0000 0000 0111 00002**

**Or**

**26 + 25 + 24 = 64 + 32 + 16= 11210**