

4CS 4341: Digital Logic and Computer Architecture

Homework 5 Guide for Section 501

Question 1

Represent **(a)** A= -83, **(b)** B= 15 **(c)** C= 41 and **(d)** D= -37 each in 2's complement notation using 8 bits (including the sign bit, of course).

- For each number, first convert from decimal to binary ignoring sign.
 - This can be accomplished by successive subtraction of powers of 2.
- If the sign of the number is negative, flip all the bits of the number, then add 1.
 - Alternatively, for speed of manual conversion, beginning with the least significant bit and proceeding toward the most significant bit, copy each 0 bit and the first 1 bit, then flip all the remaining bits.

Part A

83 can be converted to binary by successive subtractions of powers of 2. Start with the number represented by the most significant (highest) bit and proceed toward the least significant bit. If the bit's value is greater than the number being converted, then that bit is zero. If not, the bit is 1. Subtract the amount it represents from the number being converted and continue the process using the remainder.

Bit Position	7	6	5	4	3	2	1	0
Number Being Converted	83	83	19	19	3	3	3	1
Value of Bit Position	128	64	32	16	8	4	2	1
Remainder	<0	19	<0	3	<0	<0	1	0
Result	0	1	0	1	0	0	1	1

To make the result negative in 2's complement notation, flip all the bits, then add 1

Positive Number	0	1	0	1	0	0	1	1
1's complement	1	0	1	0	1	1	0	0
2's complement	1	0	1	0	1	1	0	1

-83 = 0b10101101

Part B

15 = 0b0001111

Part C

41 = 0b00101001

