ECE2049 E22: Homework 1 Solutions

Problem 2

Part a

First, convert 0x4048 from hex to binary: 0100 0000 0100 1000b

Convert to unsigned int:

$(1 * 2^{14}) + (1 * 2^{6}) + (1 * 2^{3}) + = 16456$

Convert to sign magnitude int:
The most significant bit (MSB) is 0, so we know this number is positive and thus has the same representation as above:

$(1 * 2^{14}) + (1 * 2^{6}) + (1 * 2^{3}) + = 16456$

Convert to two's complement int:
Again, the MSB is zero, so this number is positive. Therefore, we can just write out the number as if it were unsigned.

$(1 * 2^{14}) + (1 * 2^{6}) + (1 * 2^{3}) + = 16456$

Part b

First, convert 0x448C to binary: 0100 0100 1000 1100b

Convert to unsigned int:

$(1 * 2^{14}) + (1 * 2^{10}) + (1 * 2^{7}) + (1 * 2^{3}) + (1 * 2^{2}) = 17548$

Convert to sign magnitude int: MSB is 0, so result is positive:
$(1 * 2^{14}) + (1 * 2^{10}) + (1 * 2^{7}) + (1 * 2^{3}) + (1 * 2^{2}) = 17548$

Convert to two's complement int: MSB is 0, so result is positive:
$(1 * 2^{14}) + (1 * 2^{10}) + (1 * 2^{7}) + (1 * 2^{3}) + (1 * 2^{2}) = 17548$

Part c

First, convert 0xDEED to binary: 1101 1110 1110 1101b

Convert to unsigned int:

$(1*2^{15})+(1*2^{14})+(1*2^{12})+(1*2^{11})+(1*2^{10})+(1*2^{9})+(1*2^{7})+(1*2^{6})+(1*2^{5})+ (1*2^{3}+(1*2^{2})+(1*2^{0}) = 57069$

Convert to sign magnitude int: MSB is 1, so result is negative.

$(1 * 2^{14}) + (1 * 2^{12}) + (1 * 2^{11}) + (1 * 2^{10}) + (1 * 2^{9}) + (1 * 2^{7}) + (1 * 2^{6}) + (1 * 2^{5}) + (1 * 2^{3} + (1 * 2^{2}) + (1 * 2^{0}) = -24301$

Convert to two's complement int: MSB is 1, so result is negative—therefore we must use the two's complement procedure to find the magnitude of the number.

Original		1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	1
Complement		0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0
Add 1	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Magnitude		0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	1

$(1 * 2^{13}) + (1 * 2^{8}) + (1 * 2^{4}) + (1 * 2^{1}) = -8,467$

Problem 2

The description gives us a way to interpret an 8-bit binary number: we can use this information to infer the state of the "relays" described by the problem.

According to the description, the most significant bit of the output value v corresponds to relay R7, and the least significant bit corresponds to R0. Writing the output value (0x5B) as a binary number we can see the state of each relay:

Relay	R7	R6	R5	R4	R3	R2	R1	R0
v	0	1	0	1	1	0	1	1

Let us assume that a state of 1 means the relay is on, and 0 indicates the relay is off. Based on this assumption, relays R6, R4, R3, R1, and R0 have a state of 1, meaning they are on. The other relays are off.