Computer Architecture
Spring 2019
Homework No. 4
(Due on May 8)

1.

Iteration	Step	Multiplicand	Product
0	Initial	0110	0000 101**1**
1	Add multiplicand at front 4 bit (Last bit : 1)	0110	0110 1011
1	Shift right	0110	0011 010**1**
2	Add multiplicand at front 4 bit (Last bit : 1)	0110	1001 0101
2	Shift right	0110	0100 101**0**
3	Add nothing (Last bit : 0)	0110	0100 1010
3	Shift right	0110	0010 010**1**
4	Add multiplicand at front 4 bit (Last bit : 1)	0110	1000 0101
4	Shift right	0110	0100 0010

2.

Iteration	Step	Divisor	Remainder
0	Initial	0110	0000 1101
1	Shift left	0110	0001 101-
1	Subtract divisor	0110	1011 101-
1	Negative: restore the front 4 bit, set last bit = 0	0110	0001 1010
2	Shift left	0110	0011 010-
2	Subtract divisor	0110	1101 010-
2	Negative: restore the front 4 bit, set last bit = 0	0110	0011 0100
3	Shift left	0110	0110 100-
3	Subtract divisor	0110	0000 100-
3	Positive: do nothing, set last bit = 1	0110	0000 1001
4	Shift left	0110	0001 001-
4	Subtract divisor	0110	1011 001-
4	Negative: restore the front 4 bit, set last bit = 0	0110	0001 0010

Remainder: 0001
Quotient: 0010

3.

Iteration	Step	Divisor	Remainder
0	Initialize	0110	0000 1101
1	Positive value, shift left	0110	0001 101-
1	Positive: subtract divisor	0110	1011 101-
1	Negative: Last bit = 0	0110	1011 1010
2	Negative value, shift left	0110	0111 010-
2	Negative: Add divisor	0110	1101 010-
2	Negative: Last bit = 0	0110	1101 0100
3	Negative value, shift left	0110	1010 100-
3	Negative: Add divisor	0110	0000 100-
3	Positive: Last bit = 1	0110	0000 1001
4	Positive value, shift left	0110	0001 001-
4	Positive: subtract divisor	0110	1011 001-
4	Negative: Set last bit = 0	0110	1011 0010
4	Finally, Add Divisor	0110	0001 0010

Remainder: 0001
Quotient: 0010

4.

Rewriting C3F00000 as binary, it is 1 10000111 11100000000000000000000. Therefore,

$$-1 * 2^{8} * 1.111_{2} = -(111100000)_{2} = -(32 + 64 + 128 + 256) = -480$$