COSC 290.002

Class Exercises #3

1. Given a tiny computer that has a word size of 6 bits, what the smallest negative numbers and the largest positive numbers that this computer can represent in each of the following representations?

Smallest negative no. Largest positive no.

(In binary) (in decimal) (in binary) (in decimal)

* 1. Singed magnitude 1111112 = -3110 0111112 = 3110
  2. One’s complement 1000002 = -3110  0111112 = 3110
  3. Two’s complement 1000012 = -3210 0111112 = 3110
  4. Excess—31 0000002 = -3110 1111112 = 3210

1. Add the following signed binary numbers as shown using one’s complement arithmetic and two’s complement arithmetic
   1. 0 1 1 0 1 1 1 1 b. 1 1 1 0 1 1 0 1 c. 1 1 1 1 1 1 1 0

+ 1 1 0 1 1 0 0 1 + 1 1 0 1 0 0 0 1 + 1 0 1 1 0 1 0 1

OC 01001001 10111111 10110100

TC 01001001 11000000 10110101

1. 0 1 1 0 1 1 1 1 e. 1 1 1 0 1 1 0 1 f. 1 0 0 1 1 1 1 0

- 1 1 1 0 0 0 1 1 - 1 1 1 1 0 1 0 1 - 0 0 0 1 0 1 1 1

OC 10001011 (overflow) 11110111 10000111

TC 10001100 (overflow) 11111000 10001000

1. Using arithmetic shifting as shown in 8 bits storage using one’s and two’s complement, perform the following:

OC TC

* 1. 0 0 0 0 1 1 0 1 X 22  00110100 00110100
  2. 0 0 1 1 1 1 0 1 X 2 01111010 01111010
  3. 1 1 1 1 0 1 1 0 X 23 10110111 10110000
  4. 0 0 1 0 1 0 1 1 / 22  00001010 00001010

1. Perform the following binary multiplications using Booth’s algorithm, assuming signed two’s complement integers:
   1. 01110 b. 10100010

X 01111 x 11000000

0011010010 0001011110000000