

# CS 301 Assignment 3

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1. (a) Represent the following decimal numbers in twos complement using 16 bits: +512, -29.  
512  $\rightarrow$  0000001000000000  
-29  $\rightarrow$  1111111111100011
- (b) Represent the following twos complement values in decimal:  
1101011  $\rightarrow$  -21  
0101101  $\rightarrow$  45
2. (a) The  $r$ 's complement of an  $n$ -digit number  $N$  in base  $r$  is defined as  $r^n - N$  for  $N \neq 0$  and 0 for  $N = 0$ . Find the tens complement of the decimal number 13,250.

13,250's 10's complement is 86,750. This was obtained by taking the 9's complement and adding one.

- (b) Calculate (72530-13250) using tens complement arithmetic. Assume that the rules are similar to those for twos complement arithmetic.
- (c) Take 10s comp of 13250, subtract that from 72530. This gives 159280. Discard leading 1, gives 59280

3. Use the Booth's algorithm to multiply 23 (multiplicand) by 29 (multiplier), where each number is represented using 6 bits.

```
// Booth's Algorithm with M = 23, N = 29
A = 0
B = 010111 // 23
C = 011101 // 29
C_-1 = 0
n = 6

while(n > 0) {
    if (LSB(C) == 0 && C_-1 == 1)
        A = A + B
    if (LSB(C) == 1 && C_-1 == 0)
        A = A - B

    n = n - 1
    A||C||C_-1 = (A||C||C_-1) <<< 1
}
```

Table 1: Booth's Algorithm: $23 \times 29$				
n	A	C	$C_{-1}$	B
$6_{10}$	000000	011101	000000	010111
$5_{10}$	000000	111010	000000	101110
$4_{10}$	000000	111010	000000	101110

4.

5.