CSCI 200: Elements of Computing **Fall 2010**

LAB 1

name:_____

INTRODUCTION: This lab is practice with *binary* and *two's complement* arithmetic. Do your work with a pencil. We will work a few of each type during today's lab. Work in pairs where possible.

TURN IN:

1. **This document with the answers for each problem. Show your work. Answers without showing calculations will not receive credit.**

Task 1: Convert the following 2's complement binary numbers to their decimal (base 10) equivalent. Those with a 1 in the leftmost bit are negative: *first* complement the bits, *then* add 1.

0 0 1 0 1 0 0 1	1 1 0 1 1 1 0 0
0 1 1 1 0 1 1 0	1 1 1 0 1 1 0 1
0 0 1 1 0 0 1 0	1 1 0 1 1 0 1 0
0 0 0 0 1 1 1 0	1 0 0 0 1 1 1 0
0 1 0 0 1 0 1 1	1 1 0 0 1 0 1 1

Task 2: What are the binary results of the following arithmetic operations? For subtraction, first convert the *subtrahend* subtracted to its two's complement representation, then add it to the minuend.

`  0 1 1 1 1 0 1 0` `+ 1 0 1 0 1 1 0 1`	`  1 0 1 1 1 0 0 0` `- 0 1 1 0 1 0 1 1`
`  1 0 1 0 1 0 0 0` `+ 0 1 1 1 1 0 1 1`	`  1 1 0 1 1 1 0 0` `- 0 1 0 0 1 1 1 1`
`  1 0 1 0 1 1 0 0` `+ 0 1 0 1 1 0 1 1`	`  1 1 0 1 0 1 0 0` `- 0 1 1 0 1 1 0 1`

Task 3: What is the result of the following arithmetic operations? Use repeated subtraction for division and take advantage of shifts for multiplication. Show the calculation.

$\begin{array}{r} 1\ 0\ 1\ 1\ 1\ 0\ 1\ 0 \\ \times\quad\quad\quad 1\ 0\ 1\ 1 \\ \hline \end{array}$	$\begin{array}{r} 1\ 0\ 1\ 0 \\ \div\ 0\ 1\ 0\ 1 \\ \hline \end{array}$
$\begin{array}{r} 1\ 0\ 1\ 1\ 1\ 1\ 1\ 0 \\ \times\quad\quad\quad 1\ 1\ 0\ 1 \\ \hline \end{array}$	$\begin{array}{r} 1\ 0\ 0\ 1\ 0\ 1\ 1\ 0 \\ \div\quad\quad\quad 1\ 1\ 1\ 1 \\ \hline \end{array}$
$\begin{array}{r} 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1 \\ \times\quad\quad\quad 1\ 0\ 1\ 0 \\ \hline \end{array}$	$\begin{array}{r} 0\ 0\ 1\ 1\ 1\ 1\ 0\ 0 \\ \div\quad\quad\quad 0\ 1\ 0\ 1 \\ \hline \end{array}$

Task 4: Convert the following decimal (base ten) values to the binary (base two equivalent).

12	15
60	150
349	672
573	981