CS/COE 0447 Fall 2009
Homework 2
Due Date: October 26, 2009

You should turn in a hard copy of this assignment at the beginning of class on Monday, October 26, 2009.

Show all your work. Answers with only numbers will not get full credit.

1. (5 pts) Add the following unsigned binary numbers (show the carry and overflow bits)

```
  0111 1000 0100
+ 1001 1100 1101
  --------------
```

2. (5 pts) Subtract the following unsigned binary numbers (show the borrow and underflow bits)

```
  0101 0100 0101
- 1101 1011 1011
  --------------
```

3. (5 pts) Convert the following decimal numbers to binary numbers:

   2640, 4021, 1362

4. (5 pts) Convert the following unsigned binary numbers to decimal numbers:

   100010001000, 111010111100, 111100001010

5. (5 pts) Convert the following decimal numbers into 9-bit binary numbers (with sign-magnitude):

   11, -175, -47

6. (5 pts) Convert the following 8-bit binary numbers (with sign-magnitude) to decimal numbers:

   00110010, 10001110, 11010111

7. (5 pts) Convert the following decimal numbers into 9-bit binary numbers in 1's complement form:

   11, -175, -47

8. (5 pts) Convert the following 8-bit binary numbers in 1's complement to decimal numbers:

00110010, 10001110, 11010111

9. (5 pts) Convert the following decimal numbers into 9-bit binary numbers in 2's complement form:

11, -175, -47

10. (5 pts) Convert the following 8-bit binary numbers in 2's complement to decimal numbers:

00110010, 10001110, 11010111

11. (10 pts) For each of the following decimal expressions, show the converted binary numbers in 2's complement form and calculate the result using the binary numbers. Convert the result back to decimal.

a. 58 - 97 = ?

b. 86 + 57 = ?

c. -93 + (-55) = ?

12. (10 pts) Show the steps for the multiplication of 01101101b and 11011010b (unsigned) using Hardware Design 2 (available here: http://www.cs.pitt.edu/~childers/CS0447/lectures/numbers3.pdf). Draw a table similar to the following one and fill up the columns:

Iteration	Step	Multiplier (8 bits)	Multiplicand (8 bits)	Product (16 bits)
...	...	...	...	...

13. (10 pts) Show the steps for the multiplication of 01101101b and 11011010b (unsigned) using Hardware Design 3 (available here: http://www.cs.pitt.edu/~childers/CS0447/lectures/numbers3.pdf). Draw a table similar to the following one and fill up the columns:

Iteration	Step	Multiplier (8 bits)	Multiplicand (8 bits)	Product (16 bits)
...	...	...	...	...

14. (5 pts) Convert the following decimal numbers into 9-bit binary numbers in Booth's encoding form:

11, -175, -47

15. (5 pts) Convert the following 8-bit binary numbers into Booth's encoding form:

00110010, 10001110, 11010111

16. (10 pts) Show the steps for the multiplication of 01101101b and 11011010b (signed) using Booth's algorithm (available here: http://www.cs.pitt.edu/~childers/CS0447/lectures/numbers3.pdf). Draw a table similar to the following one and fill up the columns:

Iteration	Step	Multiplier (8 bits)	Multiplicand (8 bits)	Product (17 bits)
...	...	...	...	...