Name _____

Lab Day _____

1) Perform the following operations in binary and give the 8-bit binary result. (Ignore any carries.) Convert each number (including the 8-bit result) to decimal assuming both unsigned and signed. Circle each decimal result that is incorrect. The first is done as an example.

(a)

```
unsigned              signed    unsigned              signed    unsigned              signed
  254    11111110     -2                01111110                         01111111
  255  + 11111111     -1              + 10000000                       + 01111100
 (253)   11111101     -3
```

(c)   (d)   (e)

```
unsigned              signed    unsigned              signed    unsigned              signed
         11111000                       10111000                         00011101
       + 00000011                     + 01011101                       + 01101011
```

(f)   (g)   (h)

```
unsigned              signed    unsigned              signed    unsigned              signed
         11110011                       10101010                         11100110
       - 10101010                     - 11110011                       - 01110101
```

2) Perform the following 8-bit by 8-bit multiplications in binary and give the 16-bit result. Assume the numbers are unsigned. The first answer is given so you can check your method.

(a)   (b)

```
         00110011                       01110111                         11001010
       × 01010101                     × 01010101                       × 01101010
         00110011
        00000000
       00110011
      00000000
     00110011
    00000000
   00110011
  00000000
  0001000011101111
```

3) on back side

3) Given the following

```
x = 0b00111101;                    // assumed signed values
y = 0b10001110;
```

perform each operation and give the 8-bit binary result to the left of each problem. The first is already done as an example. Multiplication, division and modulo can be converted to decimal before performing, but all other operations should be done in binary. Show any work required.

00111110   x + 1
           x + y
           y - x
           x - y
           x * 2
           x / 8
           x % 8
           x / 10
           x % 10
           +x
           -x
           -y
           ~x
           ~y
           !x
           x << 2
           y << 2
           x >> 2
           y >> 2
           x & y
           x | y
           x ^ y
           1 && 0
           x && 0
           x && 1
           x && y
           x || 1
           x || y
           1 == 0
           x == 61
           x == y
           x != 12
           x != y
           x < y
           x <= y
           x > y
           x >= y