Homework 1

Binary Numbers

1. Convert the following binary numbers to decimal:

a. 1110 = 2^3 + 2^2 + 2^1 = 8 + 4 + 2 + 0 = **14**
b. 11100 = 2^4 + 2^3 + 2^2 = 16 + 8 + 4 = **28**

2. Convert each binary number to decimal:

a. 110011.11 = 2^5 + 2^4 + 2^1+ 2^0 + 2^-1 + 2^-2 = **51.75**
b. 1000001.111 = 2^6 + 2^0 + 2^-1 + 2^-2 + 2^-3 = **65.875**

Decimal-to-Binary conversion

3. Convert each decimal number to binary using sum-of-weights method:

a. 48 = 32+16 = (2^5) + (2^4) = **110000**
b. 61 = 32+16+8+4+1 = (2^5) + (2^4) + (2^3) + (2^2) + (2^0) = **111101**

4. Convert each decimal number to binary using repeated division by 2:

a. 34 = **100010**
b. 40 = **101000**

Binary Arithmetic

5. Add the binary numbers:

a. 101 + 11 = **1000**
b. 111 + 110 = **1101**

6. Use direct subtraction on the following binary numbers:

a. 110 - 101 = **001**
b. 1110 - 11 = **1011**

Complements of Binary Numbers

7. Determine 1's complement of the following binary numbers:

a. 110 = 001
b. 1110101 = **0001010**

8. Determine 2's complement of the following binary numbers:

a. 10011 = **01101**
b. 1011000 = **0101000**

Signed Numbers

9. Express each decimal number as an 8-bit number in the 2's complement form:

a. -68 = 11001000, 1's: 00110111, 2's: **00111000**
b. +101 = 01100101, 1's: 10011010, 2's: **10011011**

10. Determine the decimal value of each signed binary number in the 2's complement form:

a. 10011001 = **-25**
b. 01110100 = **+116**