Basic Concepts

Base 2 integer encoding

• base 2 to base 10: 2 ways
  - Way 1: 1101 is really 1000 + 100 + 1 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^0 = 13
  - Way 2:

• base 10 to base 2: 2 ways
  - Way 1: 55 = 32 + 16 + 4 + 2 + 1 = 110111
  - Way 2: Divide the decimal by 2, write down the remainders, continue till the quotient reaches to 0. The binary is the remainders read from bottom up.

• range of positive values represented by N bits
  - 0 \sim 2^{N-1}

• binary arithmetic: addition, subtraction
  - 10111 + 1101 = 100100
  - 10100 - 1101 = 111

• 2’s complement

• Convert negative values to binary strings: 2 ways
  - Way 1: -126 = -128 + 2 = 1000 0000 + 0000 0010 = 1000 0010
  - Way 2: invert each bit and add one to the result

• range of values represented by N bits in 2’s complement:
  - -2^{(N-1)} \sim 2^{(N-1)} -1

• overflow