Number Systems and Conversion

When we write decimal numbers, we use a positional notation; each digit is multiplied by an appropriate power of 10 depending on its position in the number.

$$953.78_{10} = 9 \times 10^2 + 5 \times 10^1 + 3 \times 10^0 + 7 \times 10^{-1} + 8 \times 10^{-2}$$

When we write binary numbers, each digit is multiplied by an appropriate power of 2 on its position in the number.

$$1011.11_2 = 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} = 8 + 0 + 2 + 1 + \frac{1}{2} + \frac{1}{4} = 11.75_{10}$$

When we write bases greater than 10, more than 10 symbols are needed to represent the digits.

$$A2F_{16} = 10 \times 16^2 + 2 \times 16^1 + 15 \times 16^0 = 2560 + 32 + 15 = 2,607_{10}$$

$$B65F_{16} = 11 \times 16^3 + 6 \times 16^2 + 5 \times 16^1 + 15 \times 16^0 = 46,687_{10}$$

$$A = 10,\ B = 11,\ C = 12,\ D = 13,\ E = 14,\ F = 15$$