* Chapter 1
  + The signals have two discrete values: are called binary
    - Binary system consists of two values: 0 or 1 (bits)
  + Binary system
    - Decimal system
      * 0,1,2,3,4,5,6,7,8,9
      * N digits
      * A(n-1), a(n-2),…...A(1), A(0)
      * A(n-1)x10^(n-1), A(n-2)x10^(n-2), …. , a(1)x10^1, a(0)x10^0 (converted to decimal number)
      * EX:
        + 7392
        + 7x10^3 + 3x10^2 + 9x10^1 + 2 x10^0
      * N+m digits
        + A(n-1), a(n-2),….,A(1)A(0) \*A(-1)A(-2), ….. a(-m)
        + To convert to decimal just multiply each term by ten raised to the power of the term
    - Binary System (base 2)
      * Binary number system has 2 symbols 0 and 1
      * Any n digit binary number can be represented as:
        + A(N-1)A(n-2)...A(1)A(0); a(I) = 0 or 1
        + A(n-1)x2^(n-1)+a(n-2)x2^(n-2)+….+A(1)x2^1+a(0)x2^0
      * Any n+m binary number can be represented:
        + A(n-1)A(n-2)….A(1)A(0)\*a(-1)a(-2)…..a(-m); a(I) = 0 or 1
        + A(n-1)x2^(n-1)+A(n-2)x2^(n-2)+….A(1)x2^1+A(0)x2^0+\*a(-1)x2^-1+a(-2)x2^-2+…..a(-m)x2^-m; a(I) = 0 or 1
      * EX:
        + 11010.11
        + 1x2^4+1x2^3+0x2^2+1x2^1+0x2^0+1x2^-1+1x2^-2
        + 16 + 8 + 0 + 2 + 0 + ½ + ¼
        + (26.75)(base 10)
      * EX: (base 5 number)
        + (4021.2)base 5 convert to decimal (base 10)
        + 4x5^3 + 0x5^2 + 2x5^1 + 1x5^0 + 2x5^-1
        + 500 + 0 + 10 + 1 + 2/5
        + (511.4) base 10
      * Ex (base 8 to base 10) octal to deciman
        + (127.4)Base 8
        + 1x8^2 + 2x8^1 + 7x8^0 + 4x8^-1
        + 64 + 16 + 7 + 0.5
        + (87.5)base 10
    - Hexadecimal numbers(base 16)
      * 0,1,2,3,4,5,6,7,8,9,a,b,c,d,e,f
      * (B65F)base 16 convert to decimal
        + 11x16^3 + 6x16^2 + 5x16^1 + 15x16^0
        + 45056 + 1536 + 80 + 15
        + (46,687) base 10
  + Arithmetic operations
    - Addition:
      * 101101 + 100111 = 1010100

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| Decimal | Binary |
| 0 | 00 |
| 1 | 01 |
| 2  3 | 10  11 |
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* + - Subtraction
      * 101101 – 100111 = 000110
    - Multiplication
      * 1011x101 = 110111
  + Number base conversion
    - Ex: convert 41 to binary(base2)
      * 41/2 = 20 + 1
      * 20/2 = 10 + 0
      * 10/2 = 5 + 0
      * 5/2 = 2 + 1
      * 2/2 = 1 + 0
      * ½ = 0 +1
      * 41 -> 101001 (Note take the remainders from bottom up to get the binary number
    - Ex: convert 153 to octal (base 8)
      * 153/8 = 19 +1
      * 19/8 = 2 + 3
      * 2/8 = 0 + 2
      * (153) base 10 -> (231)base 8
  + Convert if you have a decimal fraction
    - Ex: convert .6875 to binary
      * .6875 x 2 = 1 . 375 ( take the number after the . And multiply the base)
      * .375 x 2 = 0.75
      * .75 x 2 = 1.5
      * .5 x 2 = 1.0
      * .0 x 2 = 0.0
      * .6875 -> 0.10110 (note take the whole number parts of the answer from top to bottom)
    - Ex : convert (0.513)base 10 to octal
      * .513 x 8 = 4.104
      * .104 x 8 = 0 .832
      * .832 x 8 = 6.656
      * .656 x 8 = 5. 248
      * .248 x 8 = 1. 984
      * .984 x 8 = 7.872
      * 0.513 -> 0.406517
  + Convert an integer and fraction to binary
    - Ex: (25.25)base 10 to binary
      * Whole:
        + 25/2 = 12 + 1
        + 12/2 = 6 + 0
        + 6/2 = 2 + 0
        + 3/2 = 1 + 1
        + ½ = 0 + 1
        + 25 -> 11001
      * Fractional:
        + 25x2 = 0.5
        + 0.5 x2 = 1.0
        + 0 x 2 = 0
        + .25 -> .01
      * Answer: (11001.01)base 2
  + Octal and Hexadecimal numbers
    - Each octal number corresponds to 3 binary digits
    - Each hex number corresponds to 4 binary digits

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| Decimal | Binary | Octal | Hex |
| 00 | 0000 | 0 | 0 |
| 01 | 0001 | 1 | 1 |
| 02 | 0010 | 2 | 2 |
| 03 | 0011 | 3 | 3 |
| 04 | 0100 | 4 | 4 |
| 05 | 0101 | 5 | 5 |
| 06 | 0110 | 6 | 6 |
| 07 | 0111 | 7 | 7 |
| 08 | 1000 | 10 | 8 |
| 09 | 1001 | 11 | 9 |
| 10 | 1010 | 12 | a |
| 11 | 1011 | 13 | b |
| 12 | 1100 | 14 | c |
| 13 | 1101 | 15 | d |
| 14 | 1110 | 16 | e |
| 15 | 1111 | 17 | f |

* + - Convert from binary to octal
      * 10110001101011.111100000110 (group from decimal into groups of 3)
      * ->(26153.7406)base 8
    - Convert from binary to hex
      * 10110001101011.11110010(group from decimal into groups of 4)
      * ->(2c6b.f2)base 16
    - Convert from octal to binary
      * (673.124)base 8
      * 110111011.001010100
    - Convert hex to binary
      * (306.d)base16
      * 001100000110.1101
  + Compliments
    - Binary numbers
      * 1's compliment -> 10110000 Find 1s compliment
        + Flip your bits
        + 01001111
    - Decimal Numbers
      * 9s compliment (subtract each number by 9)
      * 546700 -> 453299
  + Compliments (more details)
    - 2 types of compliments
    - Base\_r system
      * Radix compliment (r's compl)
        + Binary(r=2) – 2s compliment
        + Decimal(r=10) – 10s compliment
      * Diminished radix compliment (r-1's compliment)
        + Binary = 1s compliment
        + Decimal = 9s compliment
  + Diminished radix compliment
    - Decimal
    - Given number N
      * Base r
      * N\_digits
    - (r-1s) compliment of N = (r^n-1)-N
    - Example Decimal – r = 10 – n digits – N
      * (r-1)'s compl of N = (10^n-1)-N
    - Ex: 9s compliment of 546700
      * 999999-546700 = 453299
    - Binary
      * R = 2 -> (r-1) = 1s compliment
      * N
      * N\_digits
      * 1s compl of N ( 2^n-1) - N