CONVERSIONS

Converting from decimal to other number bases

In order to convert a decimal number into its representation in a different number base, we have to be able to express the number in terms of powers of the other base. For example, if we wish to convert the decimal number **100** to base 4, we must figure out how to express **100** as the sum of powers of 4.

100 = (1 * 64) + (2 * 16) + (1 * 4) + (0 * 1)

= (1 * 4^3) + (2 * 4^2) + (1 * 4^1) + (0 * 4^0)

Then we use the coefficients of the powers of 4 to form the number as represent ted in base 4:

$(100)_{10}$ = $(1\ 2\ 1\ 0)_4$ base 4

One way to do this is to repeatedly divide the decimal number by the base in which it is to be converted, until the quotient becomes zero. As the number is divided, the remainders - in reverse order - form the digits of the number in the other base.

Example: Convert the decimal number **82** to base 6:

82/6 = 13 remainder 4

13/6 = 2 remainder 1

2/6 = 0 remainder 2

The answer is formed by taking the remainders in reverse order: 2 1 4 base 6

Another method

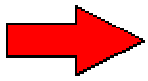
Decimal To Binary Conversion

To convert a decimal number to binary, first subtract the largest possible power of two, and keep subtracting the next largest possible power form the remainder, marking 1s in each column where this is possible and 0s where it is not.

Example 1 - (Convert Decimal 44 to Binary)

```
  44
- 32
----
  12
-  8
----
   4
-  4
----
   0
```

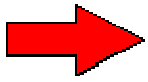
32	16	8	4	2	1
1	0	1	1	0	0



Example 2 - (Convert Decimal 15 to Binary)

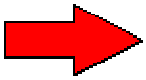
```
  15
-  8
----
   7
-  4
----
   3
-  2
----
   1
```

32	16	8	4	2	1
0	0	1	1	1	1



Example 3 - (Convert Decimal 62 to Binary)

	6	2				
-	3	2				
	3	0				
-	1	6				
	1	4				
-		8				
		6				
-		4				
		2	32	16	8	4	2	1
-		2	1	1	1	1	1	0



Binary to Octal

Example:

$$1101011.1011_2 = \underline{001}\ \underline{101}\ \underline{011}.\underline{101}\ \underline{100}_2 = 153.54_8$$

Octal to Binary

Example:

$$27.35_8 = \underline{010}\ \underline{111}.\underline{011}\ \underline{101}_2 = 10111.011101_2$$

Binary to Hexadecimal

Example:

$$1001011.1101 = \underline{0100}\ \underline{1011}.\underline{1101}_2 = 4B.D_{16}$$

- **Hexadecimal to Binary**

Example:

$$27.35_{16} = \underline{0010}\ \underline{0111}.\underline{0011}\ \underline{0101}_2$$

- **Binary-Coded-Decimal (BCD) Numbers**

Exam ple:

$$256_{10} = (0010\ 0101\ 0110)_{BCD}$$