IOTA TUTORIAL 2.1

Decimal To Balanced Ternary

1 4 2
7 8 6
3
5 0 9

10 → 3

1 0
1
-1

INTRO

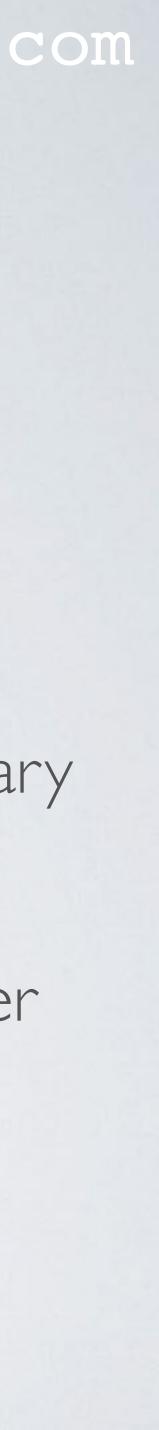- In Tutorial 2: Trit & Tryte the trinary numeral system has been discussed.

- In this video I will explain how to convert a decimal value into a balanced ternary value.
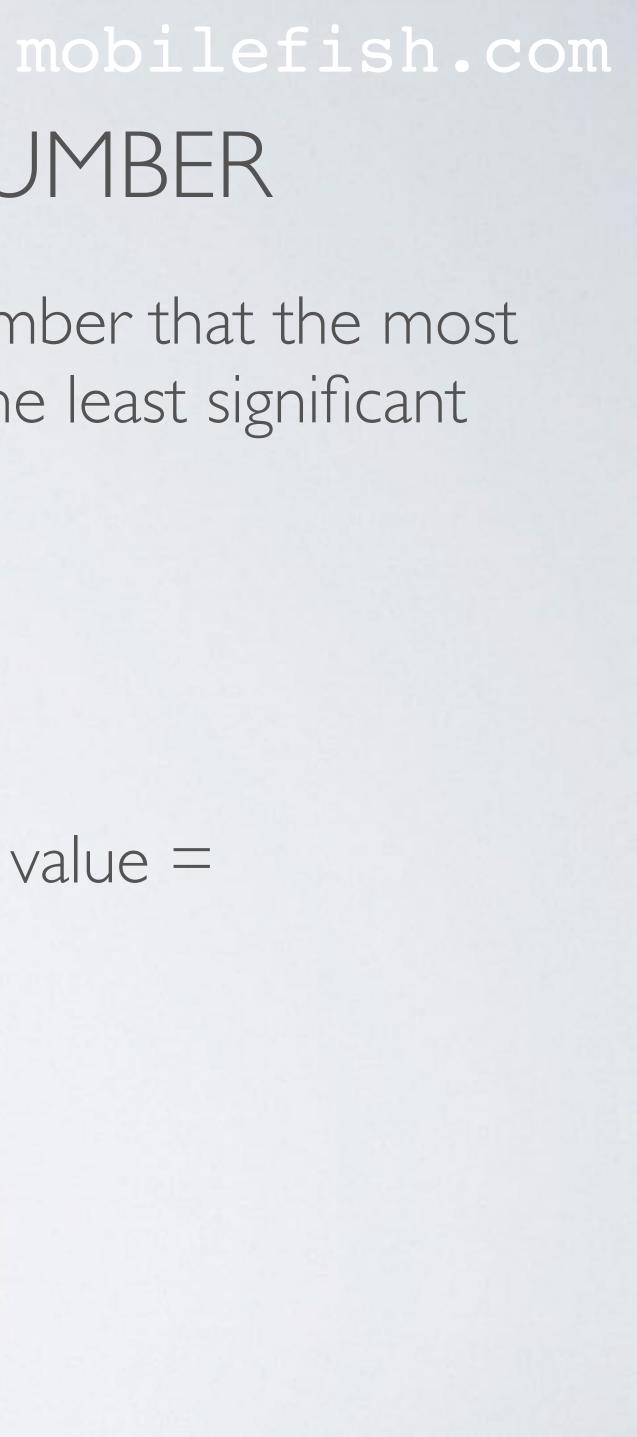
TERNARY NUMERAL SYSTEM

- The trinary numeral system is often referred to as the ternary numeral system.

- The ternary (or trinary) numeral system has two types:
  The balanced ternary system in which a trit has the values: -1, 0 and 1.
  The unbalanced ternary system in which a trit has the values: 0, 1 and 2.

- When we speak of a base-3 numeral system we often refer to the unbalanced ternary system and not the balanced ternary system.

- In a balanced ternary system, instead of using the values -1, 0 and 1 we can use other symbols, such as the letter T, 0 and 1 or the minus sign (-), 0 and the plus sign (+).

- For example a balanced ternary value can be written as:
  1-110-1 = 1T10T = +-+0-

CONVERT BASE-N NUMBER TO DECIMAL NUMBER

- When converting any base-N number to a decimal number, remember that the most left value is the most significant value and the most right value is the least significant value.

- Convert a **base-2** value (binary value) to a decimal value =
$1101_{bin} = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 13_{dec}$

- Convert a **base-3** value (unbalanced ternary value) to a decimal value =
$2101_{ternary} = 2 \times 3^3 + 1 \times 3^2 + 0 \times 3^1 + 1 \times 3^0 = 64_{dec}$

- Convert a **base-10** value (decimal value) to a decimal value =
$6389_{dec} = 6 \times 10^3 + 3 \times 10^2 + 8 \times 10^1 + 9 \times 10^0 = 6389_{dec}$

CONVERT DECIMAL TO BALANCED TERNARY

- To convert a decimal value to a balanced ternary value is a two step process:

- Step 1: Convert the decimal value to a base-3 or unbalanced ternary value.

  - convert_decimal_to_base3_example1.txt

  - convert_decimal_to_base3_example2.txt

- Step 2: Convert the base-3 value to a balanced ternary value.

  - convert_base3_to_balanced_ternary.txt

LETS PLAY A SILLY GAME?

Game rule: When the number 9 appears in the decimal number sequence add 1. If the result value is 10 write 0 and add 1 to the next column.

Decimal values: 0,1,2,3,4,5,6,7,8,9

Number: 45890193
00010010 +
46000203

ADD A 1 FOR EACH TRIT VALUE 2

Rule: When the number 2 appears in the number sequence add 1. If the result value is 3 write T and add 1 to the next column.

Unbalanced ternary values: 0,1,2
Balanced ternary values : T,0,1

Number: 012011
001000
——————+
01T111

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ADD A 1 FOR EACH TRIT VALUE 2

Rule: When the number 2 appears in the number sequence add 1. If the result value is 3 write T and add 1 to the next column.

Unbalanced ternary values: 0,1,2
Balanced ternary values   : T,0,1

Number: 12021
          01010
        ———————+
        1T1TT1