

# What is a number system?

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How do we define it?

# Examples

- One digit
- Tally

1		<del>    </del>	6
2		<del>    </del>	7
3		<del>    </del>	8
4		<del>    </del>	9
5	<del>    </del>	<del>    </del> <del>    </del>	10

# Examples

- 7 Digits
- Roman Numerals

Symbol	Value
I	1
V	5
X	10
L	50
C	100
D	500
M	1000

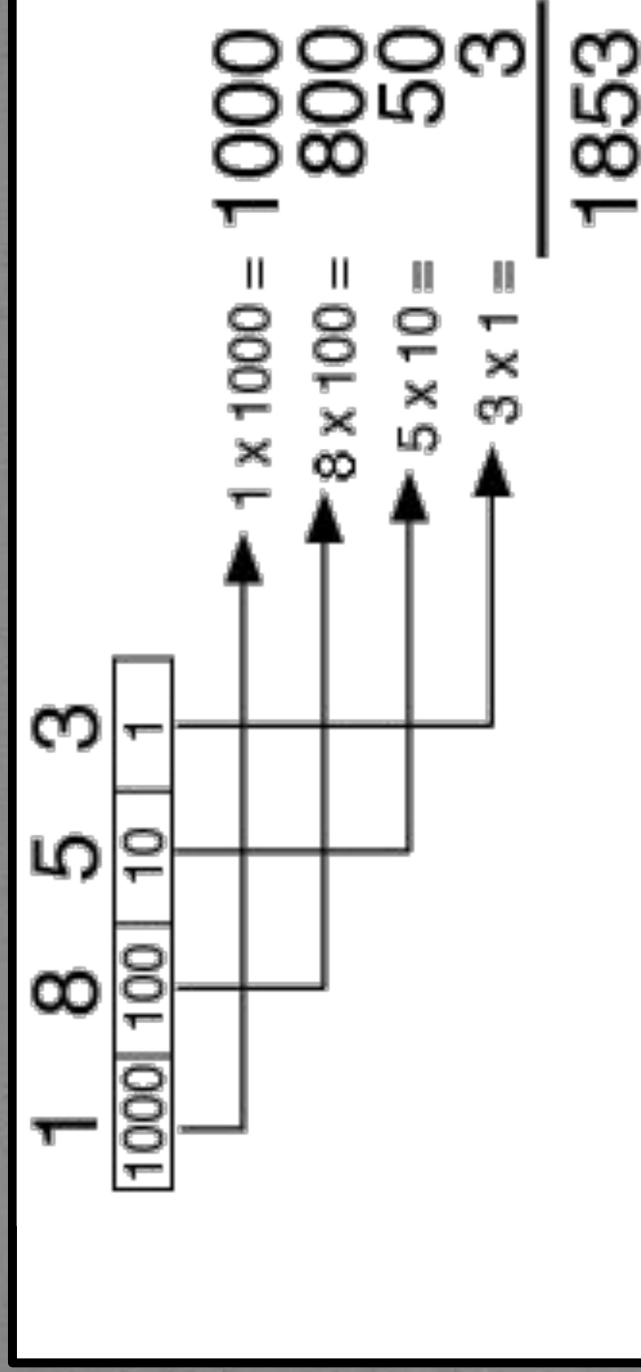
MCMXXXIV

1000 + 900 + 30 + 4

= 1934

# Examples

- Base 10 – Decimal
- 10 digits { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 }



# And a NEW ONE!

- Binary
- Important, since circuits can only differentiate between ON and OFF [one (1) and zero (0)]
- Based on only 2 digits { 0, 1 }

# How does it work?

In decimal, the columns go like this

$10^4$	$10^3$	$10^2$	$10^1$	$10^0$
10000	1000	100	10	1

Notice: Base 10 - columns are powers of 10

So in Binary....

The columns are base 2 !

$2^4$	$2^3$	$2^2$	$2^1$	$2^0$
16	8	4	2	1

# Convert from Binary

- What is the number  $110_2$  in decimal?

The subscript 2 indicates the base!

32	16	8	4	2	1				
			1	1	0				



4



2

$$4 + 2 = 6$$



# Convert from Binary

- What is the number  $10101_2$  in decimal?

32	16	8	4	2	1
	1	0	1	0	1

16      4      1

$16+4+1 = 21$

# Binary

- Examples

Binary	Decimal
0	0
1	1
10	2
11	3

# Convert TO Binary

- What is the number 71 in binary?

## Rules for conversion

- Start with number to convert at the top
- Divide by two:  
listing INTEGER result, and REMAINDER
- Keep dividing the result until you reach zero

Divisor	Value	Remainder
2	71	
2	35	1
	17	1

$$71 / 2 = 35 \text{ with } 1 \text{ remainder}$$

$$35 / 2 = 17 \text{ with } 1 \text{ remainder}$$

# Convert TO Binary

- What is the number 72 in binary?

Divisor	Value	Remainder
2	72	
2	36	0
2	18	0
2	9	0
2	4	1
2	2	0
2	1	0
	0	1



$$= 1001000_2$$