

# NUMBER SYSTEMS

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ICS<sub>3</sub>U  
Mr. Emmell

## What is a number system?

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How do we define it?

# Examples

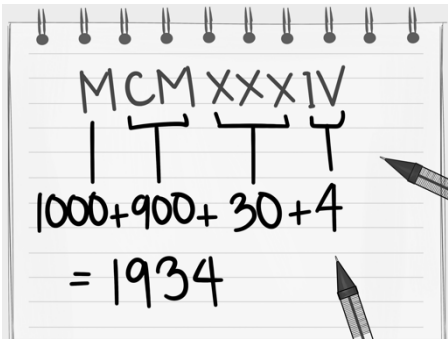
- Tally
- One digit

1	I	6	I
2	II	7	II
3	III	8	III
4	IIII	9	IIII
5		10	

# Examples

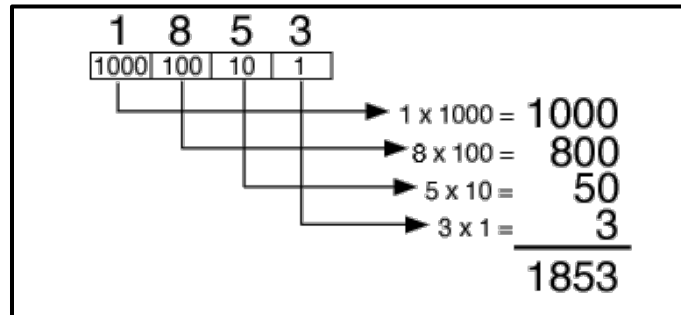
- Roman Numerals
- 7 Digits

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



## 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 }

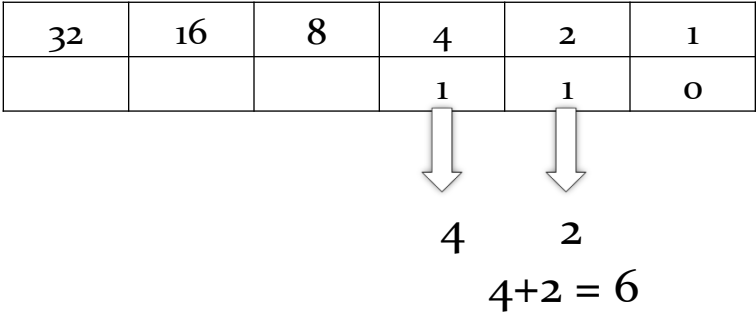
# Binary

- Examples

Binary	Decimal
0	0
1	1
10	2
11	3

# Convert from Binary

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



## Convert from Binary

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

32	16	8	4	2	1
	1	0	1	0	1

$16 + 4 + 1 = 21$

## Convert from Binary

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

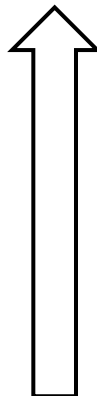
32	16	8	4	2	1
	1	0	1	0	1

$16 + 4 + 1 = 21$

## 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

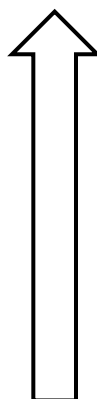


$$= 1001000_2$$

## Convert TO Binary

- What is the number 68 in binary?

Divisor	Value	Remainder
2	68	
2	34	0
2	17	0
2	8	1
2	4	0
2	2	0
2	1	0
	0	1



$$= 1000100_2$$

**Exercises:**

1. Convert each of the binary values below to decimal. (Note the base 2 is left out)  
a) 11010          b) 10001          c) 11111          d) 100010
  
1. Convert each of the decimal values below to binary.  
a) 44              b) 75              c) 135              d) 111
  
2. Convert each binary value below to decimal. Can you find a shortcut?  
a) 1111            b) 11111            c) 111111            d) 11111111
  
4. Convert each of the following to binary. What is the pattern?  
a) 6                b) 12                c) 24                d) 48
  
5. The maximum size of a 2 byte integer is 32768, while it can only be as small as negative 32767. Explain by considering how many numbers this range represents.
  
6. In defining a colour in html, the component colours are given as a value from 0 to 255 for each of Red/Green/Blue. How many bytes of data does this take per pixel?