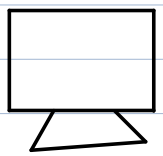
Maths :

- Welcome to the world of mathematics.

Today's session is independent of previous sessions.

=> Decimal number system
=> Binary number system
=> Binary to decimal
=> Decimal to Binary
=> abs, min, max, sum
=> Range
=> Log function.

=> 

=> Computer understands 0 & 1

=> 550 + 40 => 590

=> Binary → This number system

Decimal number system.

★ Decimal Number System :

⇒ 49025381 : 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

total 10

$(450)_{10}$ ⇒ Decimal Number System

450 ⇒ 0 ⟷ 9

⇒ 9876 ⇒ $9 \times 1000 + 8 \times 100 + 7 \times 10 + 6 \times 1$

⇒ $9 \times 10^3 + 8 \times 10^2 + 7 \times 10^1 + 6 \times 10^0$

$1 \Rightarrow 10^0$

10	9876
10	987
10	98
10	9

6
7
8
9

9876

10 | 9876 | 987
90
67
80
76
76
6

⇒ $6 \times 10^0 + 7 \times 10^1 + 8 \times 10^2 + 9 \times 10^3$

⇒ $6 + 70 + 800 + 9000$

⇒ **Binary no. system :** (means two 0,1)

⇒ Base 2

Binary

i) ⇒ $(101)_2$

dir ←

Decimal

⇒ $1 \times 2^0 + 0 \times 2^1 + 1 \times 2^2$

⇒ $1 \times 1 + 0 + 1 \times 4$

$= 1 + 4$ ⇒ 5

ii) $(1100)_2$ ⇒ $0 \times 2^0 + 0 \times 2^1 + 1 \times 2^2 + 1 \times 2^3$

⇒ $0 + 0 + 4 + 8$ ⇒ 12

Quiz :

1111

1×2^0

1×2^1

1×2^2

1×2^3

⇒ 1

+

⇒ 2

+

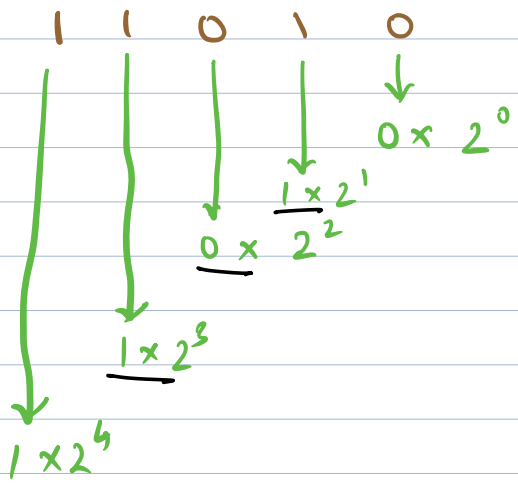
⇒ 4

+

⇒ 8

15

Quiz:



$2 \times 2 \times 2 \times 2$

$\Rightarrow 16 + 8 + 0 + 2 + 0$

$\Rightarrow 26$

★ Decimal to Binary:

⇒ Convert 25 to Binary ?

$\frac{25}{2} \Rightarrow 12$

2	25
2	12
2	6
2	3
2	1
	0

1
0
0
1
1

$\Rightarrow (11001)_2$

⇒ 1 1 0 0 1 ⇒ $1 \times 2^0 + 0 \times 2^1 + 0 \times 2^2 + 1 \times 2^3 + 1 \times 2^4$

⇒ 1 + 0 + 0 + 8 + 16

⇒ 25

⇒ Quiz 26 → (Binary)$_2$

2	26
2	13
2	6
2	3
2	1
	0

0
1
0
1
1

⇒ $(11010)_2$

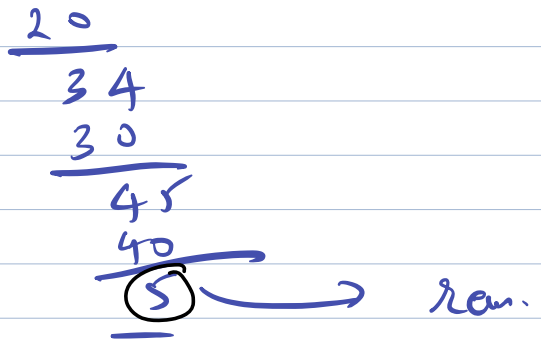
⇒ Quiz : y = 12345 % 10

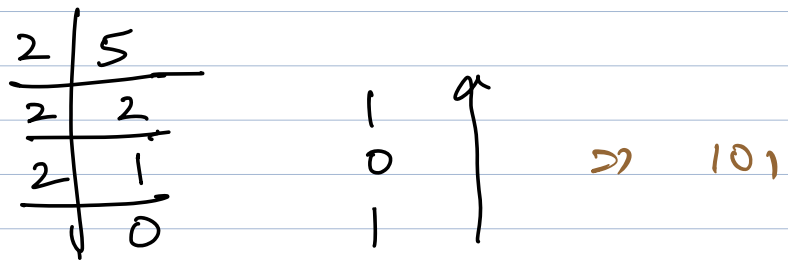
↳ rem.

$$10 \overline{)\,12345\,} \; 1234$$

10

23





$\Rightarrow x = (111)_2$

print(min (x, 10)) ⇒ 7

print (max (4, x)) ⇒ 7

$x \Rightarrow 1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 \Rightarrow$

$1 + 2 + 4 \Rightarrow 7$

=> Sum all numbers from 1 — 100.

Gauss's

$$S = 1 + 2 + 3 + \cdots + 99 + 100$$
$$S = 100 + 99 + 98 + \cdots + 2 + 1$$
$$\Downarrow \quad 101 + 101 + 101 + \cdots + 101 + 101$$

$2S \Rightarrow 100\,(101)$

$2S \Rightarrow 100\,(101)$

$$S = \frac{\overset{(n)}{100} \times \overset{(n+1)}{101}}{2} \Rightarrow 50 \times 101$$

$\Rightarrow$ 5050

$$S = \frac{n(n+1)}{2}$$

=> Sum => sum (range (1, 101))

range (1, 101)
(1 ... 100)

=> **Range:**

[ ] → inclusive

( ) → exclusive

i) [1, 10] => Both ends includes

ii) [1, 10) => 1 included but 10 is excluded

iii) (1, 10) => Both are excluded

ii) [start, end)

range [1, 10) => 1, 2, 3, 4, 5, 6, 7, 8, 9

=> range(start, end) => start, end-1

python works for this range bracket only.

⇒ n % 2 == 0 (even)

else :

odd.

ii) find last digit of 8592

$$10 \overline{)8592} \; 859$$

80

59

50

92

90

2 → rem.

n % 10 ⇒ last digit

Challenge: Given a number n. How many times you divide it by 2 to reach 1. (integer div.)

- $5 \xrightarrow{1/2} 2 \xrightarrow{1/2} 1$ — 2 times
- $8 \xrightarrow{1/2} 4 \xrightarrow{1/2} 2 \xrightarrow{1/2} 1$ — 3 times
- $15 \xrightarrow{1/2} 7 \xrightarrow{1/2} 3 \xrightarrow{1/2} 1$ — 3 times
- $16 \xrightarrow{1/2} 8 \xrightarrow{1/2} 4 \xrightarrow{1/2} 2 \xrightarrow{1/2} 1$ — 4 times

A gems of power of 2

$2^4 \Rightarrow 16$

$2^3 \Rightarrow 8$

Logarithmic function:

$\Rightarrow \log_b(x) = y \Rightarrow b^y = x$

$\Rightarrow \log_2^{(x)} = 2 \Rightarrow b^y = x$

$\Rightarrow 2^2 \Rightarrow 4$

$x = 4$

$\Rightarrow \log_{10}^{(10)} = y \quad \Rightarrow 10^y = 10$

$\Rightarrow y = 1$

$\Rightarrow \log_2^1 = 0 \quad \Rightarrow 2^0 = 1$

$\Rightarrow 2^0 = x$

$\Rightarrow \log_2^2 = 1 \quad \Rightarrow 2^1 \Rightarrow x$

$\Rightarrow \log_2^4 = 2 \quad \Rightarrow 2^2 \Rightarrow x$

$\Rightarrow \log_2^8 = 3 \quad \Rightarrow 2^3 \Rightarrow x$

$\Rightarrow \log_2^{16} = 4 \quad \Rightarrow 2^4 = x$

$\Rightarrow 1054 \Rightarrow 10$

$1054 \xrightarrow{1/2} 527 \xrightarrow{1/2} 263 \xrightarrow{1/2} 131 \xrightarrow{1/2} 65 \xrightarrow{1/2} 32 \xleftarrow{1/2} 16 \xleftarrow{1/2} 8 \xleftarrow{1/2} 4 \xleftarrow{1/2} 2 \xleftarrow{1/2} 1$

Recap: Decimal, Binary

abs, sum, min, max

log

Range

=>

```
import math.
```

$\log_3(x) = y$

$\log_{10}(x) = y$

$\log_e(x) = y$

$e = 2.71$

```
dir(math)
```

$\log(x)$ => $\log_e(x)$ => ln

$\log_2(x)$ => $\log_2(x)$

>> import math