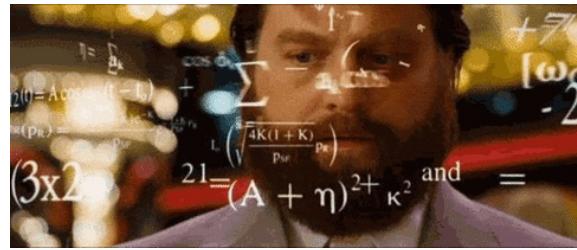


Maths



Agenda

- Number Systems
- Binary to Decimal
- Decimal to Binary
- Logarithm
- Sum 1 to 100
- Ranges - Loops

} Bit Manipulation

} Time & Space

Transition Test

Syllabus - till

first 2 classes
of loops

- 50% score
- or
- PSC - 70%
↓ + Attendance

problem

Solving
%

Repeater Batch

formal announcement
on slack

Number Systems

0 9 5

Thousands	Hundreds	Tens	Ones / Units
7	3	9	2
↓	↓	↓	↓
1000	100	10	1

$$= 7 \times 1000 + 3 \times 100 +$$

$$= 7 \times 10^3 + 3 \times 10^2 +$$

$$9 \times 10^1 + 2 \times 10^0$$

$$24 = 2 \times 10^1 + 4 \times 10^0$$

Number System = Decimal Number System

(Base = 10)

Digit = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 - 10 digits

Other Number Systems

→ Octal → Base = 8

→ Hexadecimal → Base = 16

→ **Binary** → Base = 2

Binary

base 2
2 digit

Digits = 0 and 1

Electronic devices

Binary to Decimal



Example

Convert 100110 to decimal

$$\begin{array}{ccccccc} & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\ & \underline{1} & \underline{0} & \underline{0} & \underline{1} & \underline{1} & \underline{0} \\ = & 1 \times 2^5 & + & \underline{0 \times 2^4} & + & \underline{0 \times 2^3} & + 1 \times 2^2 \\ & + & 1 \times 2^1 & + & \underline{0 \times 2^0} & & \\ = & 1 \times 32 & + & 0 & + 0 & + 1 \times 4 & + 1 \times 2 + 0 \\ = & 32 & + & 4 & + 2 & = & 38 \end{array}$$

$$(100110)_2 = (38)_{10}$$

Quiz 1

Convert this number to decimal: 1111

$$\begin{array}{cccc}
 2^3 & 2^2 & 2^1 & 2^0 \\
 | & | & | & |
 \\
 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\
 = 8 + 4 + 2 + 1 \\
 = 15
 \end{array}$$

$$(1111)_2 = (15)_{10}$$

Quiz 2

Decimal value of: 11010

$$\begin{array}{ccccc}
 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \\
 | & | & 0 & | & 0 \\
 \\
 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\
 = 16 + 8 + 0 + 2 + 0 \\
 = 26
 \end{array}$$

$$(11010)_2 = (26)_{10}$$

Decimal to Binary



- 1) Divide the number by 2 till you get 0.
- 2) Note down the remainders while dividing.
- 3) Final answer is the remainders in reverse order

Example

Convert 35 to binary

$$\begin{array}{r} 35 \\ \hline 2 | 17 \\ 2 | 8 \\ 2 | 4 \\ 2 | 2 \\ 2 | 1 \\ \hline & 0 \end{array}$$

↑
1
0
0
0
1

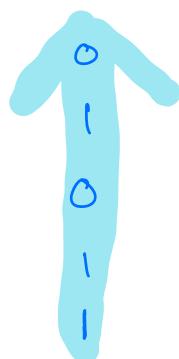
$$\begin{array}{r} 17 \\ 2 | 35 \\ -34 \\ \hline 1 \end{array}$$

$$(100011)_2 = (35)_{10}$$

Quiz 3

Convert 26 to binary

$$\begin{array}{r} 2 | 26 \\ 2 | 13 \\ \hline 2 | 6 \\ 2 | 3 \\ \hline 2 | 1 \\ \hline 0 \end{array}$$



$$(11010)_2 = (26)_{10}$$

$$\begin{array}{r} 2 | 0 \\ 2 | 1 \\ - 0 \\ \hline 1 \end{array}$$

Quiz 4

$$y = 12345 \% 10$$



$$y = 5$$

(Last digit)

Convert y to binary

$$\begin{array}{r} 2 | 5 \\ 2 | 2 \\ \hline 2 | 1 \\ \hline 0 \end{array}$$



$$(101)_2 = (5)_{10}$$

Quiz 5

Convert 111 to decimal, now use this number x in the following:

```
print(min(x, 10))  
print(max(4, x))
```

min(7, 10) → 7
max(4, 7) → 7

$$\begin{array}{ccc} 2^2 & 2^1 & 2^0 \\ | & | & | \end{array}$$

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

$$= 4 + 2 + 1$$

$$= \underline{7} \quad \leftarrow x$$

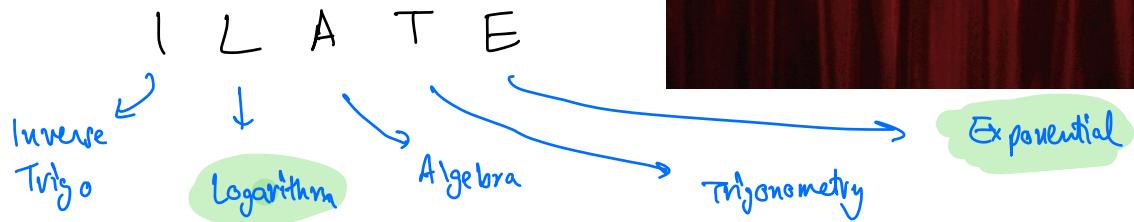
Break

fill

10:05 PM

Logarithm

$$\log_{10} 10,000 = ?$$



$$5^2 = 25 \Rightarrow \log_5 25 = 2$$

Base Power / Exponent
 Value

value
+
Base Power

Example

$$\log_2 64 =$$

To what power should I raise 5 to get the result as 25?

$$2^? = 64$$

$$\Rightarrow 2^x = 64$$

$$\Rightarrow 2^x = 2^6$$

$$\Rightarrow x = 6$$

To what power should I raise 2 to get the result as 64?

$$\log_2 64 = 6$$

Quiz 6

$$\log_3 81 =$$

$$\begin{aligned} 3^x &= 81 \\ \Rightarrow 3^x &= 3^4 \\ \Rightarrow x &= 4 \end{aligned}$$

$$\log_3 81 = 4$$

Quiz 7

$$\log_5 125 =$$

$$\begin{aligned} 5^x &= 125 \\ \Rightarrow 5^x &= 5^3 \\ \Rightarrow x &= 3 \end{aligned}$$

$$\log_5 125 = 3$$

Quiz 8

$N=15$

How many times we need to divide 15 by 2 till reaches 1 ?

$$15 \xrightarrow{1/2} 7 \xrightarrow{1/2} 3 \xrightarrow{1/2} 1$$

3 steps

$$\log_2 15 = \text{3.906} \dots$$

Quiz 9

$N=9$

How many times we need to divide 9 by 2 till reaches 1 ?

$$9 \rightarrow 4 \rightarrow 2 \rightarrow 1$$

3 steps

$$\log_2 9 = \text{3.1699} \dots$$

Question $N = 35 \rightarrow 1$

35 → 17 → 8 → 4 → 2 → 1
↓ ↓ ↓ ↓ ↓
5 steps

$$\log_2 35 = 5.129 \dots$$

Question $N \div 2 \rightarrow 1$

$$\text{Steps} = \text{floor}(\log_2 N)$$

$$\log_2 16 = 4$$

Inbuilt function

$\log 2()$, $\log 10()$

$$\log(x) \rightarrow \log_e x$$

*Natural
logarithm*

$$\log(9, 3) = \log_3 9$$

Base

Sum 1 to 100

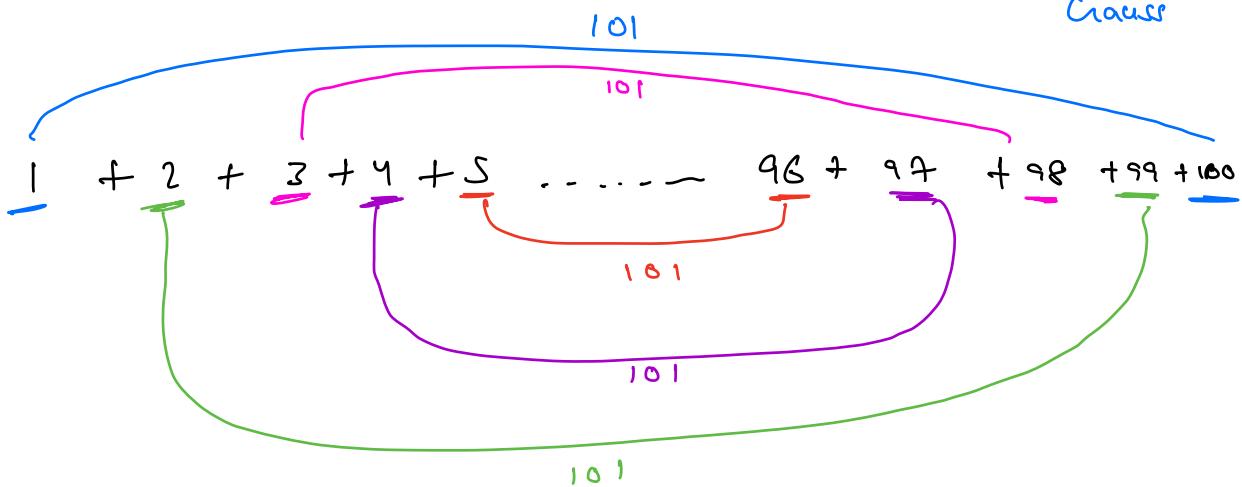
Quiz 10

Add all the integer numbers
from 1 to 100.



4th

Gauss



$$\text{Sum of each pair} = 101$$

$$\text{No of pairs} = \times 50$$

$$\text{Total sum} = \underline{\underline{5050}}$$

Direct formula

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

→ Derived from
AD

Ranges

5 to 10 - 5, 6, 7, 8, 9, 10

[] Square brackets
 Corners are included

() Round brackets
 Corners are excluded

Example

$$[1, 8] = 1, 2, 3, 4, 5, 6, 7, 8$$

$$[10, 13] = 10, 11, 12, 13$$

Example

$$(1, 8) = 2, 3, 4, 5, 6, 7$$

X X

$$(10, 13) = 11, 12$$

Example

$$\begin{matrix} [5, 9) \\ \checkmark \quad \times \end{matrix} = 5, 6, 7, 8$$

$$\begin{matrix} [1, 6) \\ \checkmark \quad \times \end{matrix} = 1, 2, 3, 4, 5$$

Example

$$\begin{matrix} (4, 10] \\ \times \quad \checkmark \end{matrix} = 5, 6, 7, 8, 9, 10$$

$$\begin{matrix} (1, 4] \\ \times \quad \checkmark \end{matrix} = 2, 3, 4$$

Quiz 11

How many numbers are there in the range $[2, 10]$?

$$[2, 10] = 2, 3, 4, 5, 6, 7, 8, 9, 10$$

9 numbers

Python Ranges

- For loop

$\text{range}(a, b)$ = $[a, b)$

\uparrow
Included \nwarrow
Excluded

$\text{range}(1, 6)$ = $[1, 6)$

= 1, 2, 3, 4, 5

$\text{range}(3, 10)$ = $[3, 10)$

= 3, 4, 5, 6, 7, 8, 9

Quiz 12

What numbers will the following python range contain ?

`range(10, 15)`

$\text{range}(10, 15)$ = $[10, 15)$

= 10, 11, 12, 13, 14

5 numbers

Doubts

Thank
You

$$\begin{array}{r} 0 \\ \swarrow \quad \leftarrow \text{quotient} \\ 2) 1 \\ - 0 \\ \hline 1 \quad \leftarrow \text{remainder} \end{array}$$

Attendance — 80% or more

Recording

Indentations — Use Tab

Use a good editor — VS Code
By charm

MCQ — Only the score of first
submission is taken

Ideal Solution

After solving the problem, go to Hint Tab



Complete Solution

Crood
Night

Thank
You

Friday

