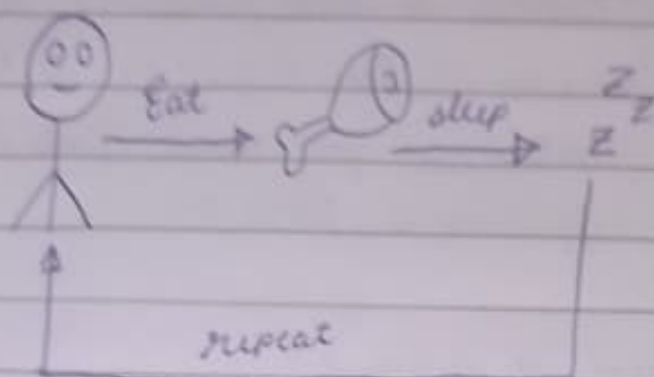


INTRODUCTION TO PROGRAMMING



↓ Evolve

• Petting Cows, dogs, goats Horse

○π ○π ○π suppose there are 5 goats, they didn't know counting.
○π ○π

• FIRST NUMBER SYSTEM : TALLY system

○ → ○π ○ → 1 ○π lost
○ → ○π ○ → 1 ○π lost
○ → ○π

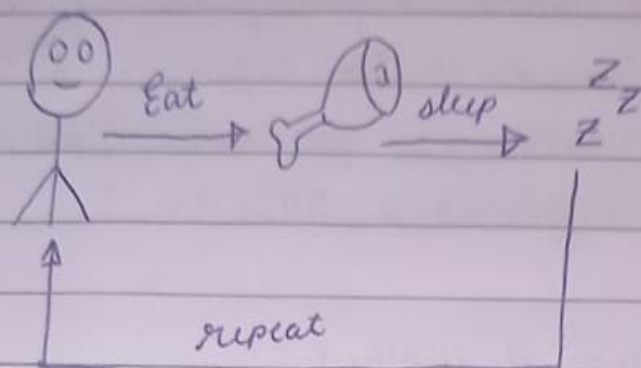
↓ Evolve

EGYPT: 1st to develop BASE 60
INDIA: developed BASE 10

• Suppose there are 500 goats then a new system was needed. Therefore COUNTING system was made

INTRODUCTION TO

PROGRAMMING



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• Petting Cows, dogs, Goats Horse

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○ → ○π

↓ Evolve

EGYPT: 1st to develop BASE 60
INDIA: developed BASE 10

• Suppose there are 500 goats then a new system was needed. Therefore COUNTING system was made

DECIMAL: {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

> why does BASE 10 famous?

- ° Humans are quite familiar with number 10. Ex. 10 fingers, 10 toes
- ° Arithmetic operations were easy & efficient in BASE-10

> How did it worked?

$8 + 5 \Rightarrow$ we go to 8

- ° 5 step from 8 repeating loop again
- ° no result is 3.
- ° as we looped 1 time therefore result will be
- ° 13

Evolve

500 PAGES

IMPORT	EXPORT
100	100
200	150
300	300
⋮	⋮

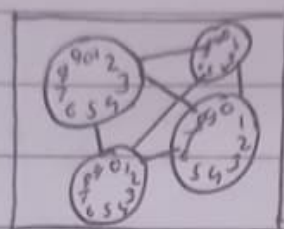
- ° chances of error in calculation
- ° we needed efficient & Fast calculations.

Evolve (1800's)

• Invention of ~~COMPUTER~~ ~~TRIE~~ IR

computer means "to calculate"

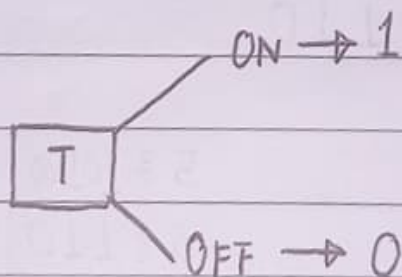
• At that time computers were as big as a building.



> mechanical computers
> accurate but slow

Evolve (1900's)

• Invention of ~~TR~~AIN \$ || \$TORS



• Development of BINARY NUMBER system

Binary No.

- BASE-2 system
- Binary: {0, 1}

$$\begin{array}{r} + 0 \\ 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 0 \\ + 1 \\ \hline 1 \end{array} \quad \begin{array}{r} 0 \\ + 0 \\ \hline 0 \end{array} \quad \begin{array}{r} 1 \\ + 1 \\ \hline 10 \end{array}$$

- from 1 we go one step to 0
- as looped 1 time so 1 at front
- result 10

$$\begin{array}{r} 10 \\ + 1 \\ \hline 11 \end{array} \quad \begin{array}{r} 11 \\ + 1 \\ \hline 100 \end{array} \quad \begin{array}{r} 100 \\ + 1 \\ \hline 101 \end{array} \quad \begin{array}{r} 101 \\ + 1 \\ \hline 110 \end{array}$$

- 0: 0 5: 101
- 1: 1 6: 110
- 2: 10
- 3: 11
- 4: 100

How to do conversion?

D	Q	R
2	27	1
2	13	1
2	6	0
2	3	0
2	1	1
	0	1

reverse order

$$(27)_{10} = (11011)_2$$

D	Q	R
2	43	X
2	21	1
2	10	1
2	5	0
2	2	1
2	1	0
	0	1

$$(43)_{10} = (101011)_2$$

D	Q	R
10	278	X
10	27	8
10	2	7
	0	2

$$(278)_{10} = (278)_{10}$$

$$\downarrow$$

$$2 \times 10^2 + 7 \times 10^1 + 8 \times 10^0$$

$$> (101)_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ = 4 + 0 + 1 = 5$$

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

$$> (110101)_2 = 2^0 \times 1 + 2^1 \times 0 + 2^2 \times 1 + 2^3 \times 0 + 2^4 \times 1 + 2^5 \times 1 \\ = 1 + 0 + 4 + 0 + 16 + 32 \\ = (53)_{10}$$

$$\Rightarrow (110101)_2 = (53)_{10}$$

Octal No.

- 8 digits
- BASE-8 System
- Octal : $\{0, 1, 2, 3, 4, 5, 6, 7\}$

$$\begin{array}{r} \cancel{45} \quad \quad \quad 1 \\ \quad \quad \quad 4 \\ + 5 \\ \hline 11 \end{array}$$

$$(9)_{10} = (11)_8$$

D	Q	R
8	23	x
8	2	7
	0	2

$$(23)_{10} = (27)_8$$

$$(27)_8 = 7 \times 8^0 + 2 \times 8^1$$

$$= 7 + 16$$

$$= 23$$

$$\Rightarrow (27)_8 = (23)_{10}$$

Hexadecimal

> BASE-16 System

> Hexa : {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F}

- we are not using numbers after 9, so that there are unique characters & there is no confusion between characters.

16	11	x
	0	11 \Rightarrow B
D	Q	R \Rightarrow H

$$(B)_{16} = B \times 16^0$$

$$= 11 \times 16^0$$

$$= 11$$

$$\Rightarrow (B)_{16} = (11)_{10}$$

D	Q	R → H
16	25	X
16	1	9
	0	1

$$(25)_{10} = (19)_6$$

$$\begin{aligned}
 AC2 &= 2 \times 16^0 + \cancel{A} \times 16^1 + A \times 16^2 \\
 &= 2 \times 1 + 12 \times 16 + 10 \times 256 \\
 &= 2 + 192 + 2560 = 2754
 \end{aligned}$$

Computer System

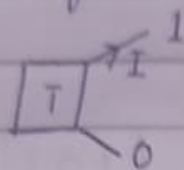
0	Σ
1	Σ
2	Σ
3	Σ
4	Σ
5	Σ
6	Σ
7	Σ
8	Σ
9	Σ

BIN	13
Σ	1 Σ
Σ	1 Σ
Σ	0 Σ
Σ	1 Σ
Σ	0 Σ

we couldn't use it
but it was confusing.

we can use binary
to have better efficiency

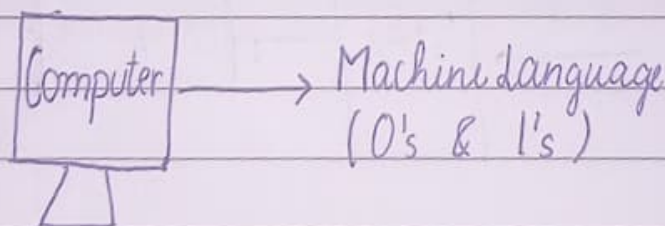
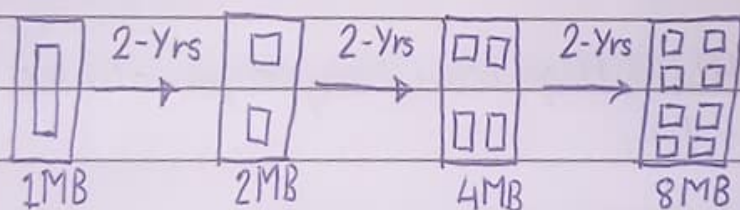
• use of TRANSISTORS



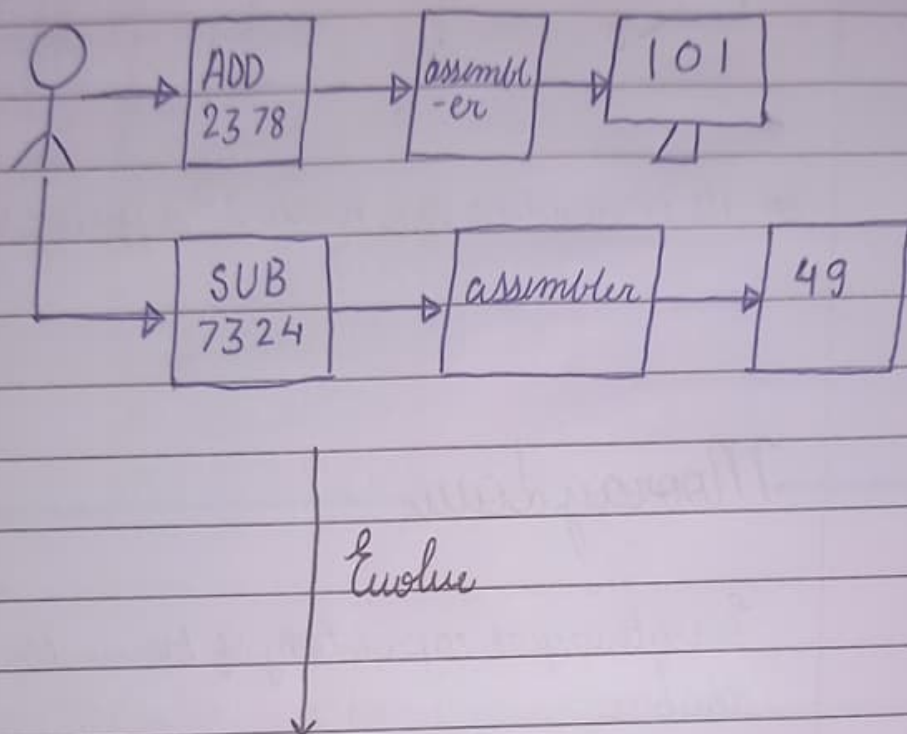
so 10 transistors can have 2^{10} different orientations

Mooray Law

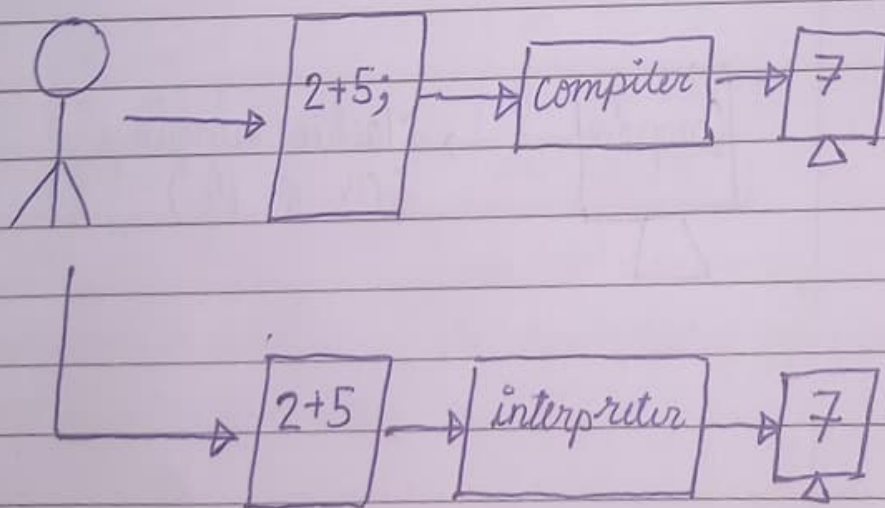
Every two year capacity of transistor doubles.



Programming

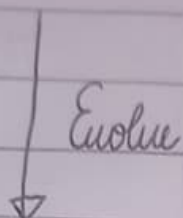


- HLL : High Level Language, almost English Like.



- In terms of speed

MACHINE LEVEL > ASSEMBLY > HIGH LEVEL



- Introduction of Internet
- And There was too much data being transferred from one place to another.
- If I want to store data
 - want it to have lowest space
 - want to fetch in lowest time



proper arrangement of goods
proper sorting of data / goods

13, 17, 14, 18 (hard to search)
13, 14, 17, 18 (easy to search)

GUDDU BHAIYA	BABLU BHAIYA
<ul style="list-style-type: none"> ° sum of 100 natural numbers 	<ul style="list-style-type: none"> ° sum of 100 numbers
<ul style="list-style-type: none"> ° $1+2+3+4+\dots+100$ $= 5050$ \Downarrow 20 min 	<ul style="list-style-type: none"> ° $\frac{n \times (n+1)}{2}$ $= \frac{100 \times (100+1)}{2}$ $= 5050$ \Downarrow 10s
<ul style="list-style-type: none"> ° slow, inefficient, inaccurate method. 	<ul style="list-style-type: none"> * better time complexity ° fast solving of problem

Homework

Q. Convert Decimal to binary?

- ° 37
- ° 92
- ° 128
- ° 243

D	Q	R
2	37	x
2	18	1
2	9	0
2	4	1
2	2	0
2	1	0
	0	1

$$(37)_{10} = (100101)_2$$

D	Q	R
2	92	x
2	46	0
2	23	0
2	11	1
2	5	1
2	2	1
2	1	0
	0	1

$$(92)_{10} = (1011100)_2$$

D	Q	R
2	128	x
2	64	0
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0

D	Q	R
2	1	0
	0	1

$$(128)_{10} = (10000000)_2$$

//_

D	Q	R
2	243	x
2	121	1
2	60	1
2	30	0
2	15	0
2	7	1
2	3	1
2	1	1
	0	1

$$(243)_{10} = (11110011)_2$$

Q. Convert Binary to Decimal.

- 1011
- 111001
- 10011011
- 10100100

° 1011

$$\begin{aligned} & 2^3 \times 1 + 2^2 \times 0 + 2^1 \times 1 + 2^0 \times 1 \\ &= 8 \times 1 + 4 \times 0 + 2 \times 1 + 1 \times 1 \\ &= 8 + 0 + 2 + 1 \\ &= 11 \end{aligned}$$

° 111001

$$\begin{aligned} &= 2^5 \times 1 + 2^4 \times 1 + 2^3 \times 1 + 2^2 \times 0 + 2^1 \times 0 + 2^0 \times 1 \\ &= 32 \times 1 + 16 \times 1 + 8 \times 1 + 1 \times 1 \\ &= 32 + 16 + 8 + 1 \\ &= 57 \end{aligned}$$

° 10011011

$$\begin{aligned} &= 2^7 \times 1 + 2^4 \times 1 + 2^3 \times 1 + 2^1 \times 1 + 2^0 \times 1 \\ &= 128 + 16 + 8 + 2 + 1 \\ &= 155 \end{aligned}$$

° 10100100

$$\begin{aligned} &= 2^7 \times 1 + 2^5 \times 1 + 2^2 \times 1 \\ &= 128 + 32 + 4 \\ &= 164 \end{aligned}$$

Q. Convert Decimal to Octal

- o 28
- o 47
- o 928
- o 1243

o

D	Q	R
8	28	x
8	3	4
	0	3

$$(28)_{10} = (34)_8$$

o

D	Q	R
8	47	x
8	5	7
	0	5

$$(47)_{10} = (57)_8$$

D	Q	R
8	928	x
8	116	0
8	14	4
8	1	6
	0	1

$$(928)_{10} = (1640)_8$$

D	Q	R
8	1243	x
8	155	3
8	19	3
8	2	3
	0	2

$$(1243)_{10} = (2333)_8$$

Q. Convert Octal to Decimal

o 41

o 207

o 124

o 311

o 41

$$= 4 \times 8^1 + 1 \times 8^0$$

$$= 4 \times 8 + 1$$

$$= 32 + 1$$

$$= 33$$

o 207

$$= 2 \times 8^2 + 7 \times 8^0$$

$$= 2 \times 64 + 7$$

$$= 128 + 7$$

$$= 135$$

o 124

$$= 1 \times 8^2 + 2 \times 8^1 + 4 \times 8^0$$

$$= 1 \times 64 + 2 \times 8 + 4 \times 1$$

$$= 64 + 16 + 4$$

$$= 84$$

° 311

$$= 3 \times 8^2 + 1 \times 8^1 + 1 \times 8^0$$

$$= 3 \times 64 + 1 \times 8 + 1$$

$$= 192 + 8 + 1$$

$$= \cancel{261} 201$$

Q Convert Decimal to Hexadecimal.

° 317

° 41

° 14

° 845

°

D	Q	R
16	317	x
16	19	D
16	1	3
	0	1

$$(317)_{10} = (13D)_{16}$$

°

D	Q	R
16	41	x
16	2	9
	1	2

$$(41)_{10} = (29)_{16}$$

◦

D	Q	R
16	14	x
	0	E

$$(14)_{10} = (E)_{16}$$

◦

D	Q	R
16	845	x
16	52	D
16	3	4
	0	3

$$(845)_{10} = (34D)_{16}$$

Q. Convert Hexadecimal to Decimal

◦ A11

◦ 49

◦ AE2F

◦ D97

• A11

$$\begin{aligned} &= A \times 16^2 + 1 \times 16^1 + 1 \times 16^0 \\ &= 10 \times 256 + 16 + 1 \\ &= 2560 + 16 + 1 \\ &= 2577 \end{aligned}$$

• 49

$$\begin{aligned} &= 4 \times 16^1 + 9 \times 16^0 \\ &= 4 \times 16 + 9 \\ &= 64 + 9 \\ &= 73 \end{aligned}$$

• AE2F

$$\begin{aligned} &= A \times 16^3 + E \times 16^2 + 2 \times 16^1 + F \times 16^0 \\ &= 10 \times 16^3 + 14 \times 256 + 2 \times 16 + 15 \\ &= 40960 + 3584 + 32 + 15 \\ &= 44591 \end{aligned}$$

• D97

$$\begin{aligned} &= D \times 16^2 + 9 \times 16^1 + 7 \times 16^0 \\ &= 13 \times 256 + 9 \times 16 + 7 \\ &= 3328 + 144 + 7 \\ &= 3479 \end{aligned}$$