


Agenda → Beginner → Number system
✓ ✓

flowcharts
logic building

How??
Why??
✓ ✓

Basics of python
Problem solving with py ma

Online Judges

Search & Sorting
⋮

Agenda for today's class → Brief history of numbers & number systems

→ Basic properties of few types of number systems

→ Puzzles

→ Poll or h w exercises

→ Quiz

Number Systems

It is the system or way of naming & representing number.

History

Ancient

P_1

→

P_2

three rocks

The most convenient way is finger

Lines

↔

→

Very big number (large magnitude?)

Greeks system

→

New symbols

→

higher magnitude values

new symbol

Roman Number System → Higher magnitude values have special symbols. If we prepend a symbol it will be considered as a subtraction.

1992 → (MCMXCII) ←

what if we have to subtract 2 roman numbers

Positional Notation → To represent no. of higher

magnitude we can use symbols

★ Babylonians } → Base

★ Ancient Chinese

★ Astecs → 20

★ Indian → decimal system

Set of symbols → use the no form greater no.

→ (Base) 10 } → we will define 10 unique symbols
→ zero }
(Decimal System)

12 → Clock
→ Dozens

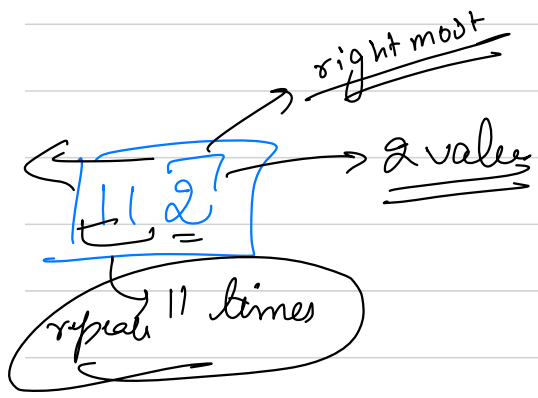
120
102

216 ^{2 place} \rightarrow $(2 \times 10^2) + (1 \times 10^1) + (6 \times 10^0)$ ^{10 symbols}
 Decimal \rightarrow Rational Number $\rightarrow \left[\frac{p}{q} \right]$ $q \neq 0$

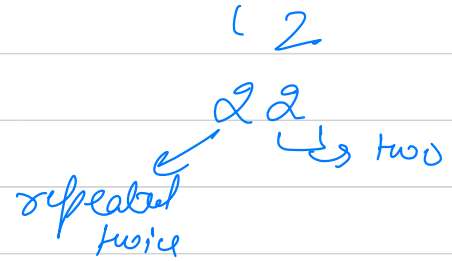
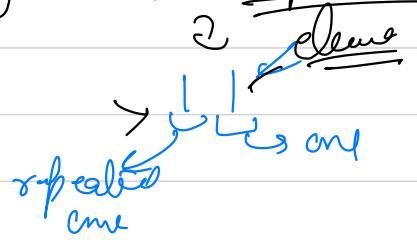
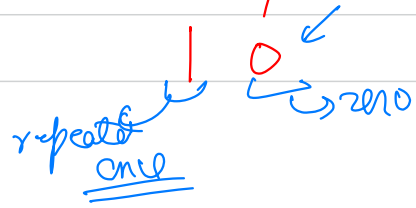
$(1, 2, 3, 4)$ \leftarrow
Hindu-Arabic System \rightarrow Modern symbols for base 10
12.00513

↳ Modern No. System → X no. of symbols, repeat

11



- 00
- 01
- 02
- 03
- 04
- 05
- 06
- 07
- 08
- 09



Rightmost symbol
↓
value

0 1 2 3 4 5 6 7 8 9

new
repeat ← 0 → zero
new
repeat ← 1 → one

2

3

14

→ 4

24

5

6

7

8

9

3 4 → 4 repeats thrice

119 → nine repeated
11 times

1 0 (repeat 0 for first time)
1 1 (repeat 1 for first time)
1 9 (repeat 9 for first time)
2 0 (repeat 0 twice)

Q miss

Special Symbols & we repeat them

S symbols (0, 1, 2, 3, 4)

first 20 numbers in this new S symbol system ✓

→ How we will write 6 in the sys

a) 12

b) 6

c) 11

d) None

S → symbol

Symbols → (0, 1, 2, 3, 4) ←

- a) 25
- b) 100
- c) 112
- d) None

0 → 0
1 → 1
2 → 2
3 → 3
4 → 4
5 → 10
6 → 11
7 → 12
8 → 13
9 → 14
10 → 20
11 → 21
12 → 22
13 → 23

14 → 24
15 → 30
16 → 31
17 → 32
18 → 33
19 → 34
20 → 40
21 → 41
22 → 42
23 → 43
24 → 44
25 → 100
26 → 101
27 → 102

(0 repeated 5 times)
(1 repeated 5 times)

→ Modern No. system → In these systems, the ^(Rightmost) last digit represent the symbol that is repeated and the no. excluding the last digit represents that how many times the digit is repeated

a) 122

b) 12 (1) //

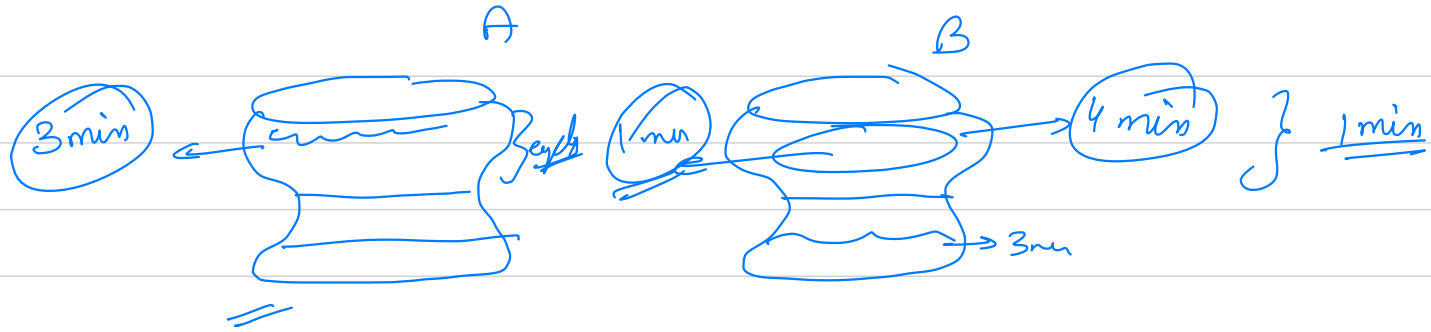
c) 112

d) none

Decimal

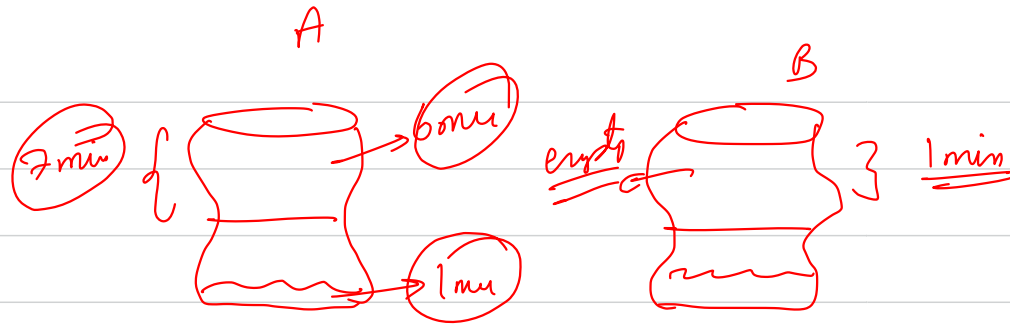
Puzzle 1 \Rightarrow Can you measure exactly 9 minutes using
an hour glass of 7 min & ^{an} hour of 4
minute

You start both the hour glass together



→ Now hourglass A will exhaust first at end of
7th min

Now flip the hourglass A.



→ Now again B will exhaust at the 8th min

→ flip again



Now wait for A to exhaust that will be the 9th min

Let's come back to No. System

Symbol (0, 1, 2, 3, 4, A, B, C, D, E)

decide

AO (??)

0
1
2
3
4
A
B
C
D
E
0
1
2
3
4
A

2 min

Q Let's say we have system of 5 symbols (A, B, C, D, E)

→ what is the decimal equivalent of DC?

0	A	$10 \rightarrow C A$
1	B	$11 \rightarrow C B$
2	C	$12 \rightarrow C C \rightarrow$
3	D	$13 \rightarrow C D$
4	E	$14 \rightarrow C E$
5	BA ←	$15 \rightarrow D A$
6	BB	$16 \rightarrow D B$
7	BC	$17 \rightarrow D C$
8	BD	
9	BE	

→ Series → BA, BB, BC, BD, BE, —

a) AC

b) CA

c) EA

d) None



Q₂ We have a system with symbols as (0, B)

Write the first 15 no.

0 → 0

1 → B

2 B 0

3 B B

4 B 0 0 =

5 B 0 B

6 B B 0

7 B B B

8 B 0 0 0

←

(0, 1)
binary number
system

→ Binary → Indepth → computers understand Binary

→ hexadecimal (16 symbols) → Memory locations

→ Octal (8 symbol) → file permissions

→ Very large no → 1000
→ 10000

Decimal → 15
16

1 Byte → 8 bits

3

fact \rightarrow The no. of unique symbol, that may single digit
equivalents



QW \rightarrow How to measure exactly 15 mins using 2 hourglasses
one of 7 min & one of 11 min ??

Quiz

$$\begin{array}{r} 000001 \\ 0101111 \\ \hline +1 \\ \hline \hline 01100000 \end{array}$$

22
(Binary addition)

$$1+0 \rightarrow 1$$

$$0+0 \rightarrow 0$$

$$0+1 \rightarrow 1$$

$$1+1 \rightarrow 10$$