Agenda ⇒ Introduction to Binary Number System

⇒ Write initial series

⇒ Derive patterns in the Binary

⇒ Interconversion

⇒ Puzzles

⇒ Quiz

human understandable → Decimal System

Not understood by machines (Circuit)

2 states

ON → OFF

With only 2 symbols

(Binary No. System)

Base 2

2

"There are 10 types of people in the world, those who can understand this & those who can't"

(Number System → {0, 1})

0 → 0

1 → 1

2 → 10 (zero repeated once)

3 → 11 (one repeated once)

100 (zero repeated twice)

101 (one repeated twice)

110 (0 " thrice)

111 (1 " thrice)

⋮

→ Try to write first 35 binary numbers

0	0	10	1010	20	10100	30	11110
1	1	11	1011	21	10101	31	11111
2	10	12	1100	22	10110	32	100000
3	11	13	1101	23	10111	33	100001
4	100	14	1110	24	11000	34	100010
5	101	15	1111	25	11001	35	100011
6	110	16	10000	26	11010		
7	111	17	10001	27	11011		
8	1000	18	10010	28	11100		
9	1001	19	10011	29	11101		

(1) That for every Even number the last bit to the right is always 0.

1010110 → Even

That for every Odd number, the last bit to the right is always 1

1010111 → odd

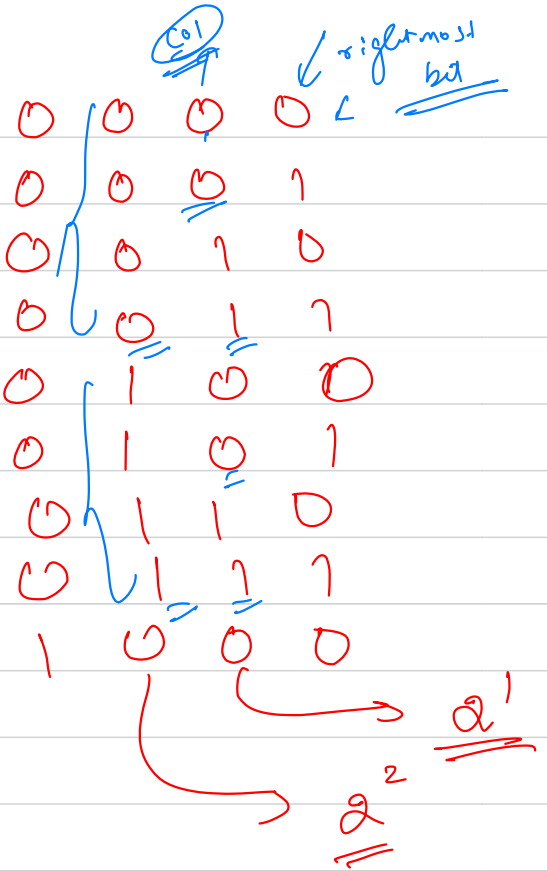
(2) For every number that can be represented as a power of 2 (2^n) will have n zeroes appended after a one.

$8 \rightarrow 2^3 \longrightarrow 1000$

$32 \rightarrow 2^5 \longrightarrow 100000$

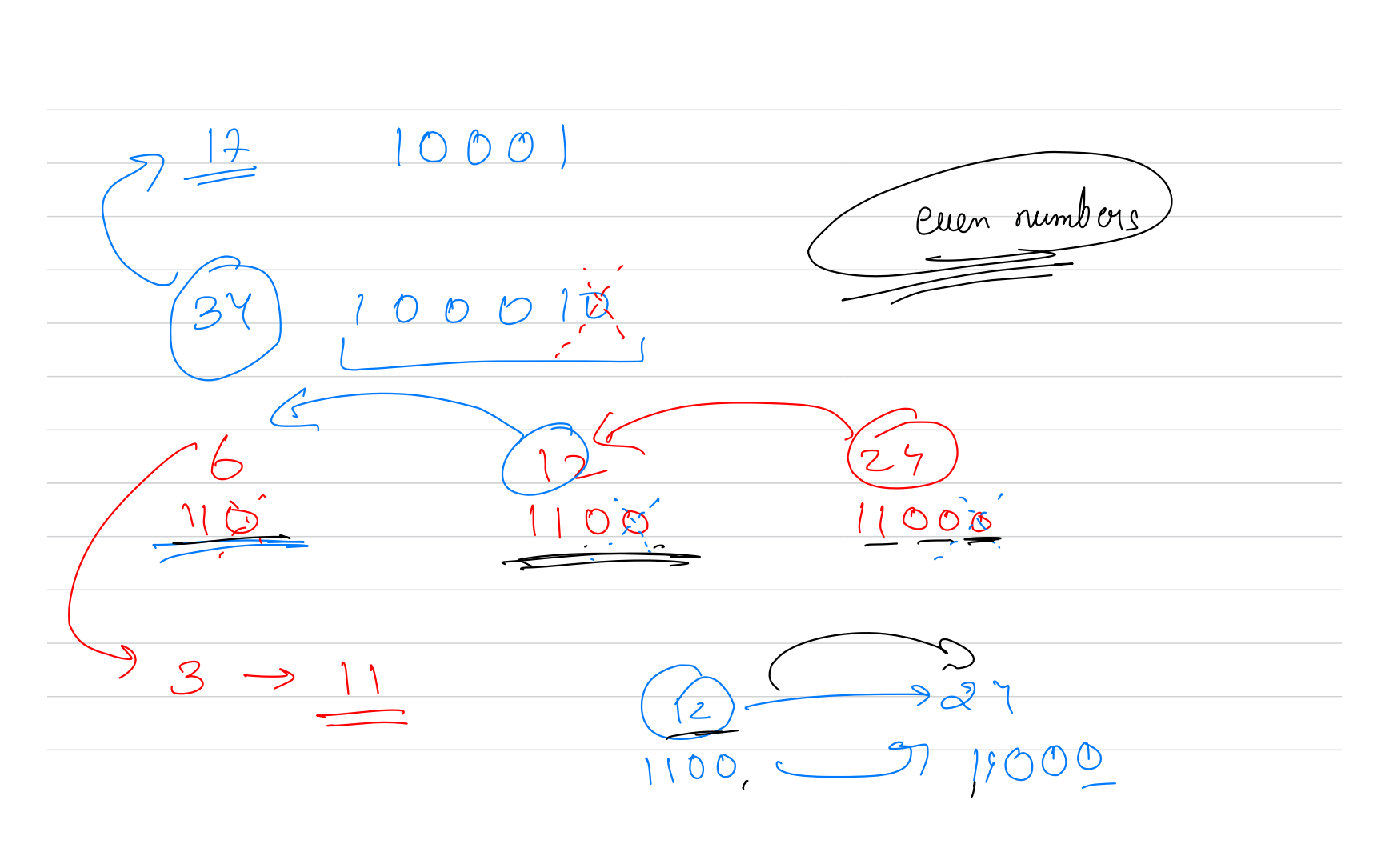
(3) For every number that can be represented as $2^n - 1$ will just have n '1's in the binary

$7 \rightarrow 2^3 - 1 \rightarrow 111$



Every digit from right changes every consecutive number.
Second digit from right changes after every 2^1 numbers

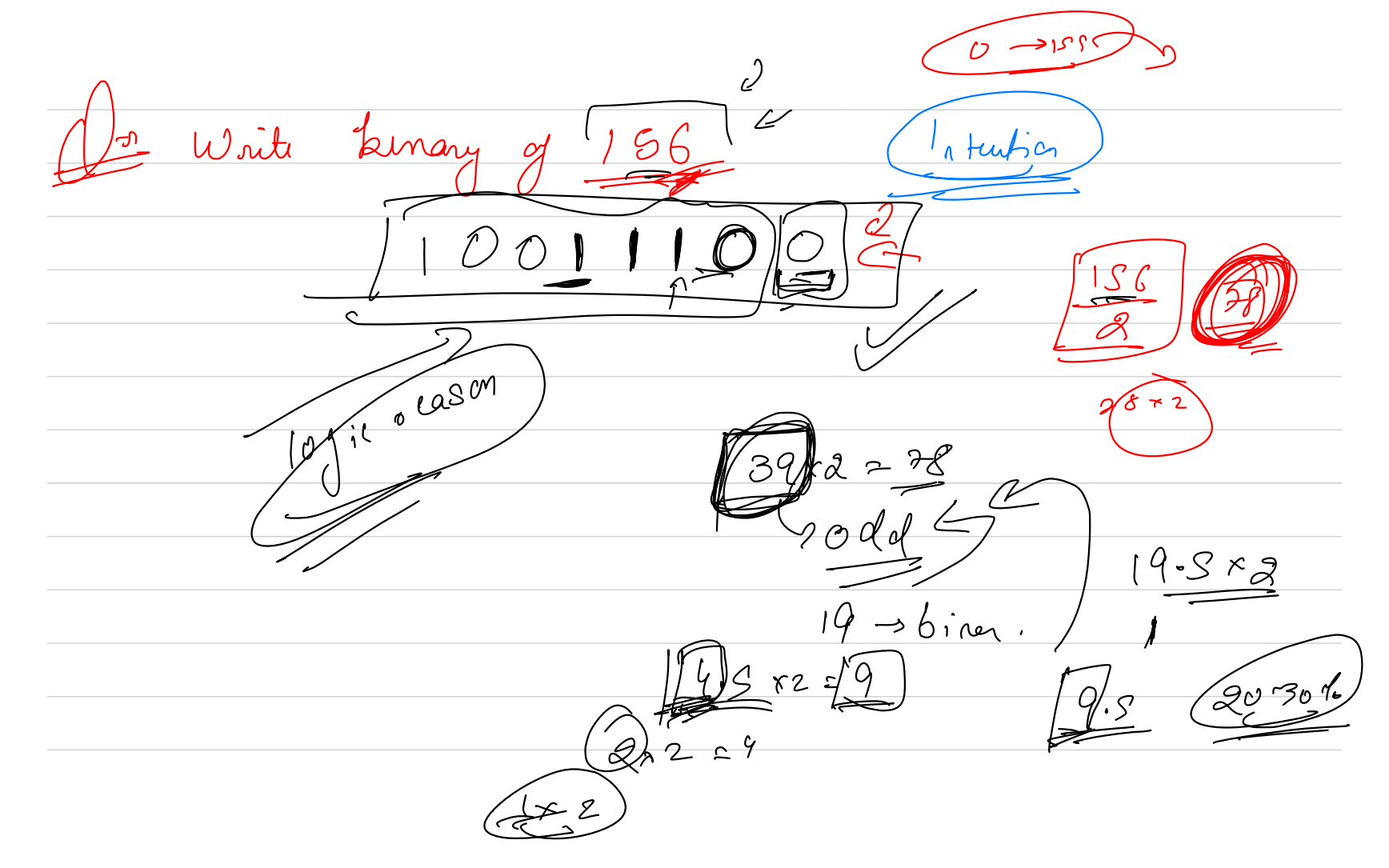
So any i^{th} bit will change upto 2^i numbers


17
10001
even numbers
34
100010
6
110
12
1100
24
11000
3 → 11
12
24
1100
11000

* for any even number, you get half of that number, if you remove the last bit

Also to double the number, you can just append a 0 but to the last.

for odd numbers, the above observation is slightly tweaked. By removing the last bit, we get integer part of it's half value.


0 → 155
Write binary of 156
Intuition
1 0 0 1 1 1 0 0
2
156
2
78
78 × 2
Logic + reason
39 × 2 = 78
odd
19 → binary
19.5 × 2
4 × 2 = 8
2 × 2 = 4
1 × 2
9.5
20 - 30%

Q:- Write the binary of 66 → even

1000010

33 × 2 = odd

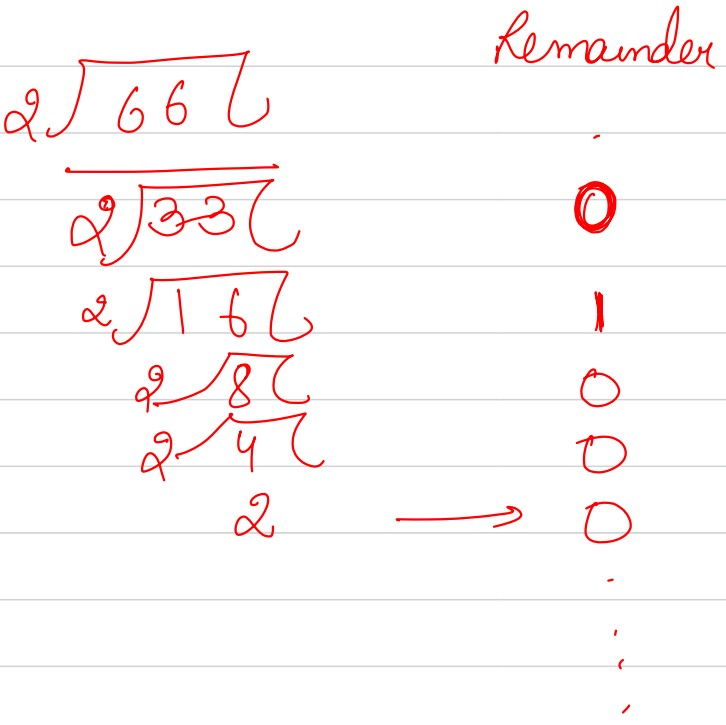
16.5 × 2 = 33

8 × 2 = 16 even

4 × 2 = 8

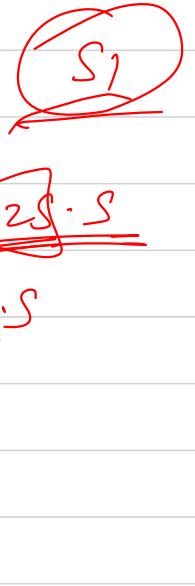
2 × 2 = 4

1 × 2 = 2


Remainder
2 | 66
2 | 33
0
2 | 16
1
2 | 8
0
2 | 4
0
2
0

Write binary of 102

1 1 0 0 1 1 0



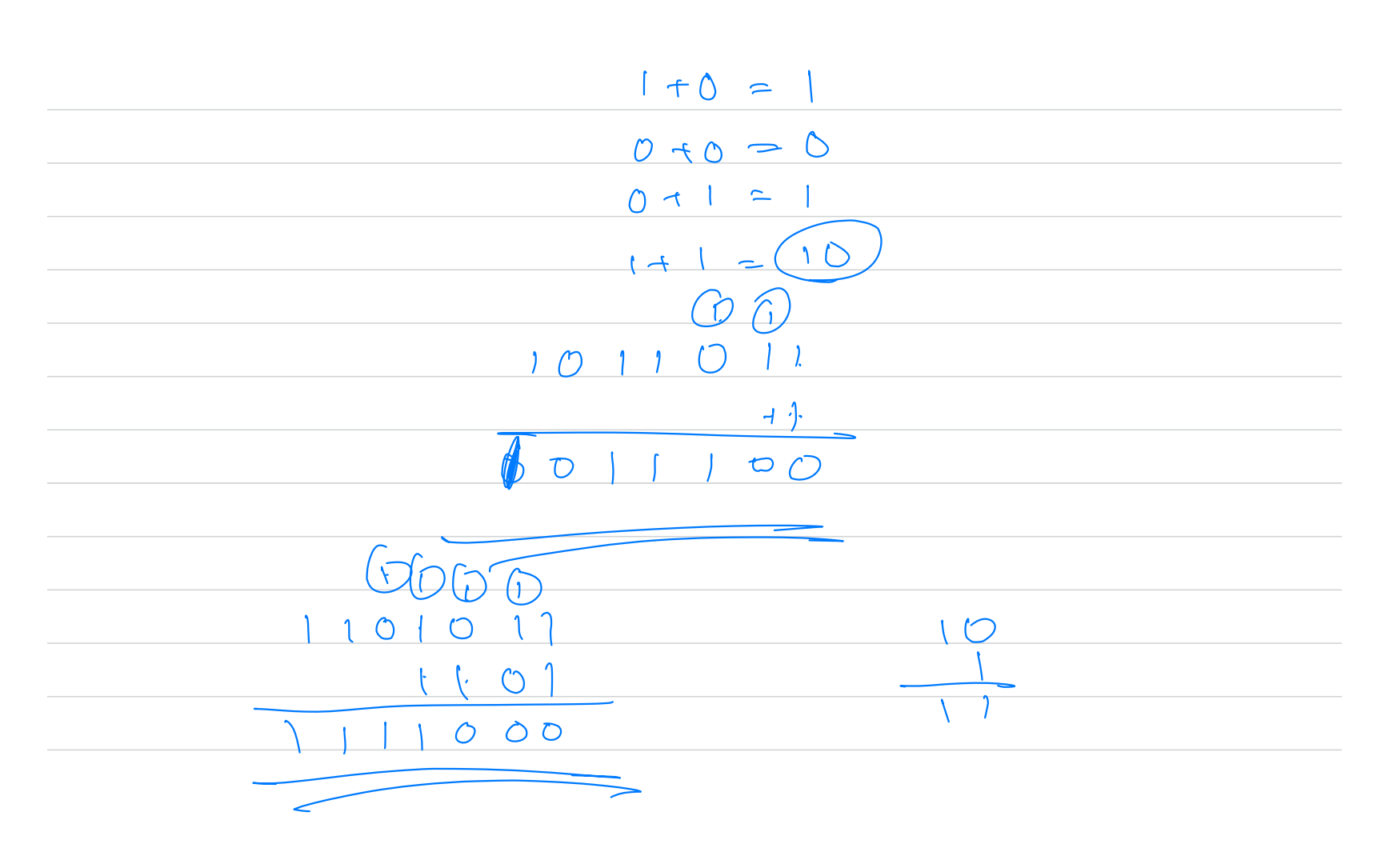
1) 99 ⟶ 1100011

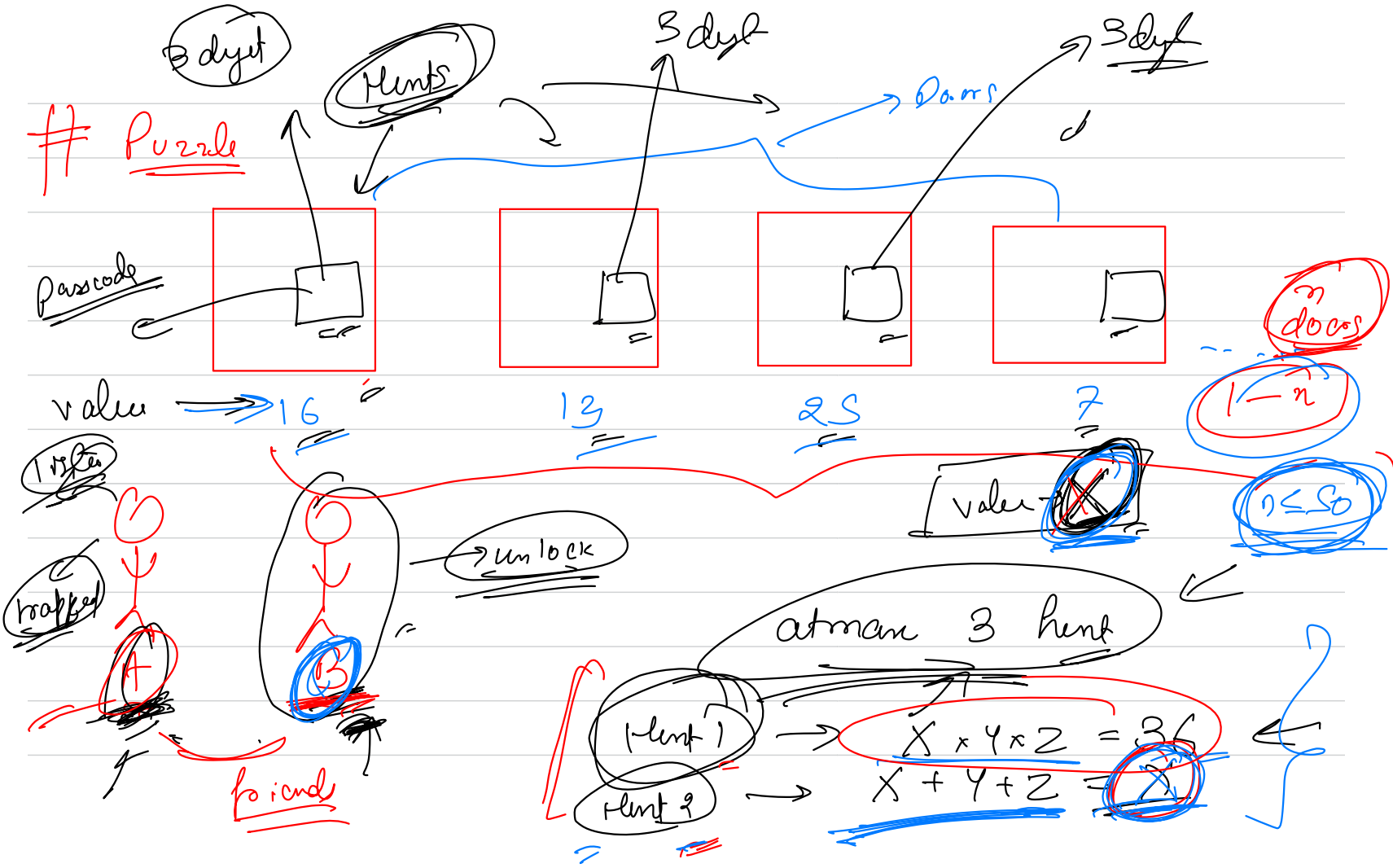
2) 123 ⟶ 1111011

3) 1343 ⟶ 10100111111

4) 1000 ⟶ 1111101000

5) 666 ⟶ 1010011010


1 + 0 = 1
0 + 0 = 0
0 + 1 = 1
1 + 1 = 10
1 0 1 1 0 1 1
+ 1 1
0 0 1 1 1 0 0
1 1 0 1 0 1 1
+ 1 0 1
1 1 1 0 0 0
10
1
11


3 digit
Hints
3 digit
Doors
3 digit
Puzzle
Passcode
value
16
13
25
7
n doors
1 — n
n ≤ 50
value
trapped
friend
unlock
atman 3 hint
Hint 1
Hint 2
X × Y × Z = 36
X + Y + Z =

Hint 3 → Largest no appear only once (of periods) ✗

→ factorize

$x + y + z = X$

50

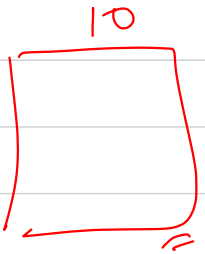
$X \times Y \times Z = 36$

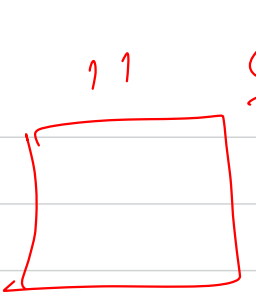
$3 \times 3 \times 4 \Rightarrow 10$ | $2 \times 3 \times 6 = 11$

$1 \times 6 \times 6$ → 13 ⟷ $2 \times 2 \times 9 = 13$

$1 \times 4 \times 9$ → 14 | $1 \times 3 \times 12 = 16$

$1 \times 2 \times 18$ → 21 | $1 \times 1 \times 36 = 38$





B

B

B

$3 \times 3 \times 6 = 36$

$1 \times 6 \times 6 = 36$

$2 \times 2 \times 4 = 36$

$2 \times 3 \times 6 = 36$

7 Candidates

Hint 2

Hint 3

$x + y + z =$ Door value

10