

→ Kal → 2pm

4 min

Bit Manipulation

Special class

Backtracking

→ Sunday → Kal

→ 2pm starts at

Supreme 3.0

→ Bit Manipulation:-

← 00001010
00010100

<<1

00001010 →

00000101

>>1

~		o/p
0	→	1
1	→	0

xor		o/p
0	0	→ 0
0	1	→ 1
1	0	→ 1
1	1	→ 0

Bitwise Operator

i/p	i/p	o/p
0	0	→ 0
0	1	→ 0
1	0	→ 0
1	1	→ 1

(&)

i/p	i/p	o/p
0	0	→ 0
0	1	→ 1
1	0	→ 1
1	1	→ 1

(OR)

Assume:-

- Bitwise Operators
- Binary → Decimal
- Decimal → Binary
- 1's complement/
2's complement

Sign bit

Sign bit

0 → true
1 → false

11111111 0001010000)

Set bit

→ i/p → number →

n = 19

$n \& 1 \rightarrow 1 \rightarrow \text{odd}$
 $\rightarrow 0 \rightarrow \text{even}$

Even/Odd

Even → RMB → 0

Odd → RMB → 1

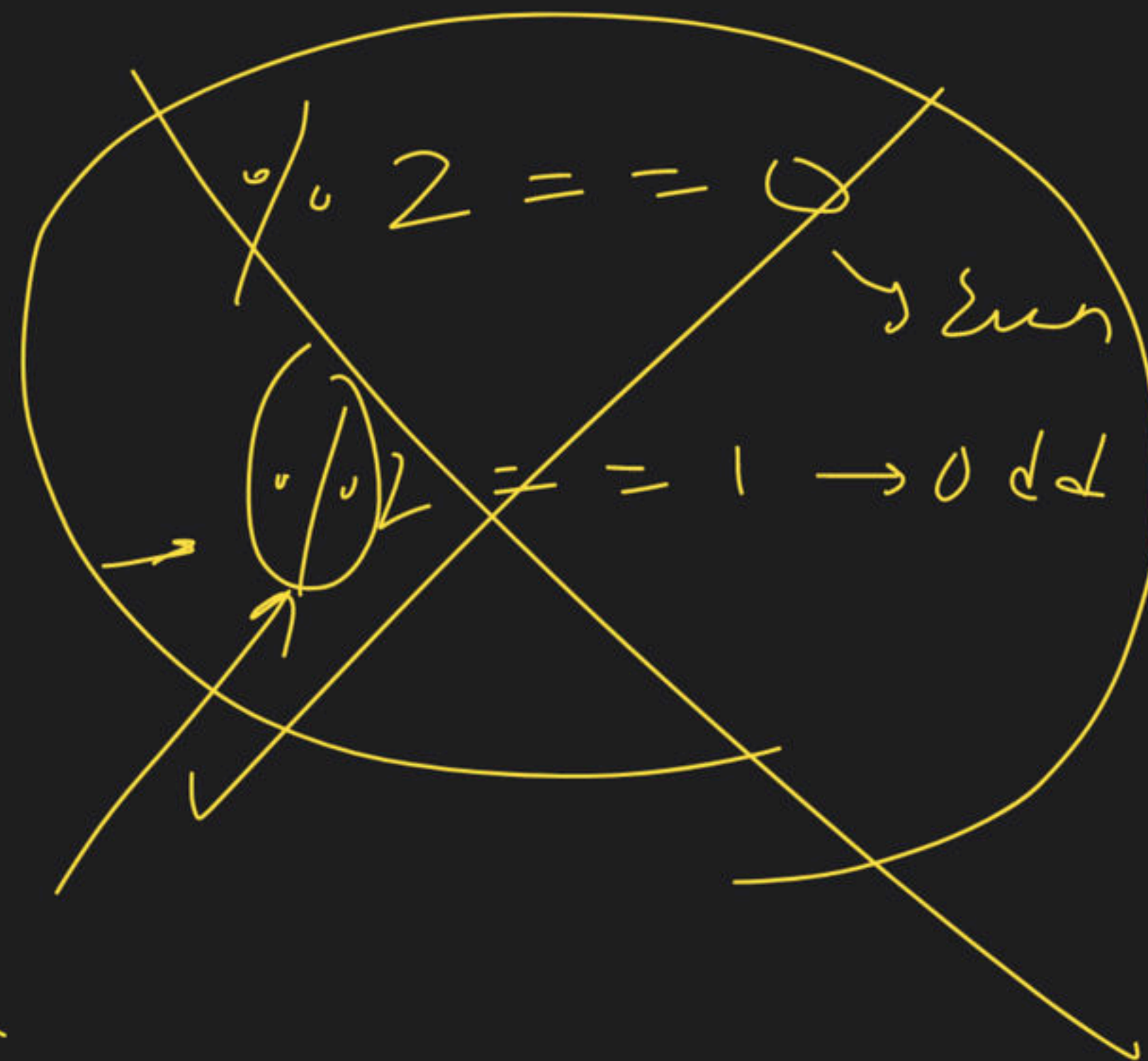
2 → 000 - - - 0010
 4 → 000 - - - 00100
 10 → 000 - - - 001010

rightmost bit = 0



odd { 3 → 000 - - - 11
 5 → 000 - - - 00101
 11 → 000 - - - 1011

R-M-B
 ↓
 1



→ Get i^{th} bit

ilp →

$n = 10$

$i = 3$

3rd 2nd 1st 0th
0000 - - - 0000 010

→ $mask = 1 \ll i$

00000 - - - 0001

$\ll 3$

0000 - - - 0001000

$n \& mask$ → 0 → 0
 → 1 → 1

$mask$ →

00000000000000000001000

Non zero

1 =

00000000000000000000000
 ↓ zero

0 =

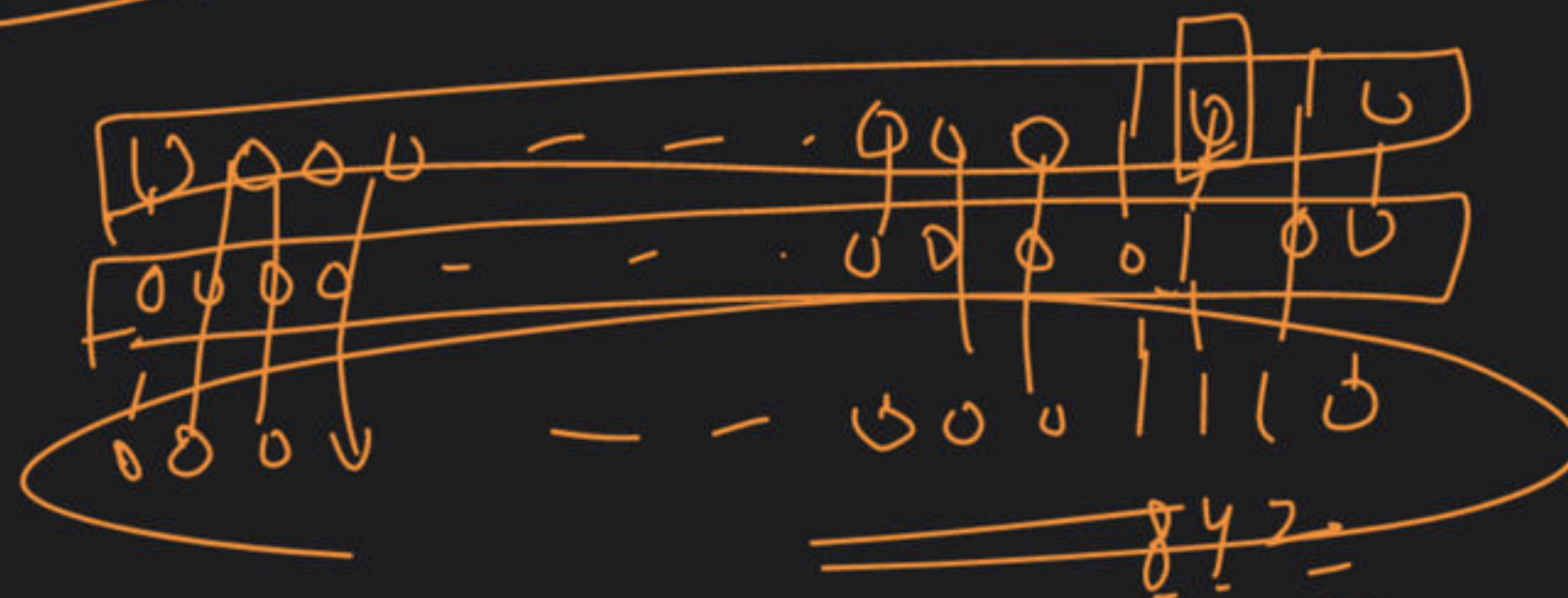
→ Set i^{th} bit

$n = 10$

mask $1 << i$

mask →

ans →



10

0 or 1

0 | 1 → 1

~~n~~
~~n | mask~~

→ clear ^{5th} ^{ith} bit

set → 1

clear → 0

n = 10 i = 1

0000 - - - 0000 10 1 0

1st bit

mask

Δ

1111 - - - 1111 11 0 1

1 & 0 → 0

as) 0000 - - - 0000 1000

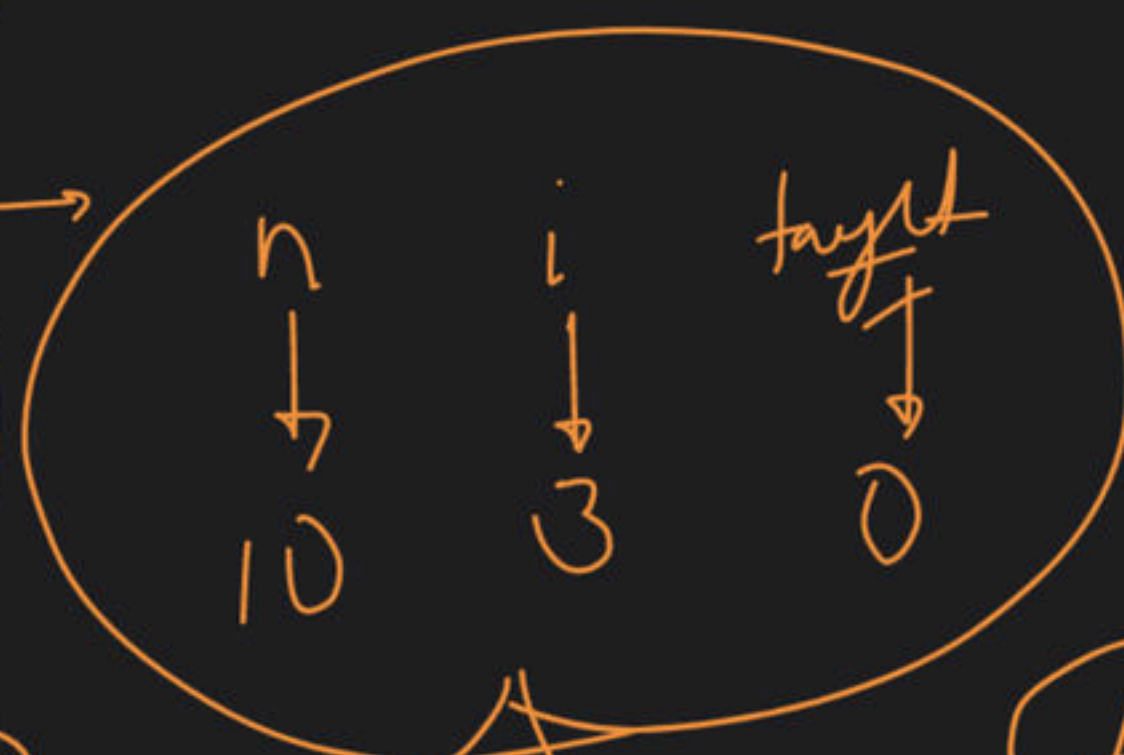
0000 - - - 0001 0
1111 - - - 1110 1

$1 \ll i$

$\sim (1 \ll i)$ ← mask

Update i^{th} bit

- ① clear i^{th} bit
- ② $\text{mask} = n / \text{mask}$



$\text{target} = 1, i = 2$

$\text{get} \rightarrow 2$
 $\text{set} \rightarrow 1$
~~clear~~
 $\rightarrow 110 \dots$
 $\rightarrow 8$
 $\rightarrow (1 \ll i)$

0000 --- 000010

~~or~~
 0000000000000000
 0000000000000010

0000 --- 001010
 OR 0000 --- 000100
 0000 --- 001010

$\boxed{4}$ $\cancel{1}, \cancel{2}, \cancel{1}, \cancel{2}$



ay

XOR

$\cancel{0}^1 \cancel{4}^1$

$\cancel{1}^1 \cancel{2}^1 \cancel{1}^1 \cancel{2}^1$

$\rightarrow 4$

$\cancel{0}^1 \cancel{0}^1 \cancel{0}^1 \cancel{7}^1$
 $\rightarrow 4$

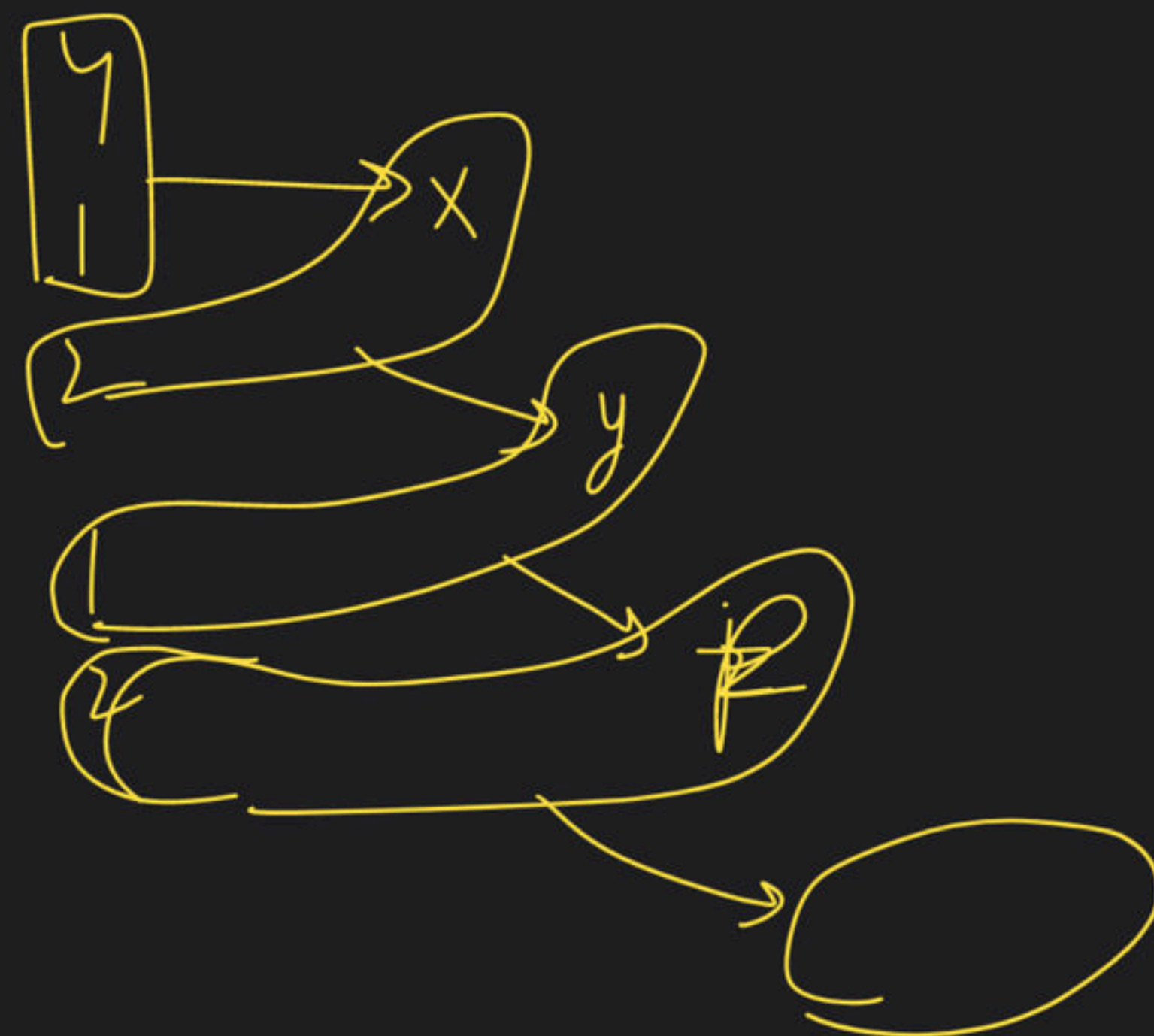
$4^1 1$

000 - 000 | 00
000 - 000 | 01

000 - 00 | 01

5

$$\textcircled{y} \quad \frac{x^{\wedge} z^{\wedge} x^{\wedge} z}{\quad}$$





clear last
4 bit

120 → 0

$$n=15$$

0000 - - 0000 1111

$t=2$

000 - - 0000 1100

12

→ Check power of 2

→ $n = 16$ → 2^4

2 → 0000 - 0010

4 → 0000 - 0100

8 → 0000 001000

16 → 0000 001000

17 → ~~2^4~~

Get bit count → (1)
number ↗
 ~~2^4~~

formula



last set bit remove

$n = 8 \rightarrow 1000$

$n-1 \rightarrow 7 \rightarrow 0111$

④

0000

$n \& (n-1)$



0



Power of 2

$n \& (n-1)$



no. of set
bits

0000 - - 00 00 00 00 00 00

mask

$n \& (n-1)$
 $n \& (n-1)$
 $n \& (n-1)$ 3x/p

→ Fast Exponentiation → $(17/w)$

2^n
100%
 $2 \times 2 \times 2 \dots 2$
using

2^4

$2^{n/2}$

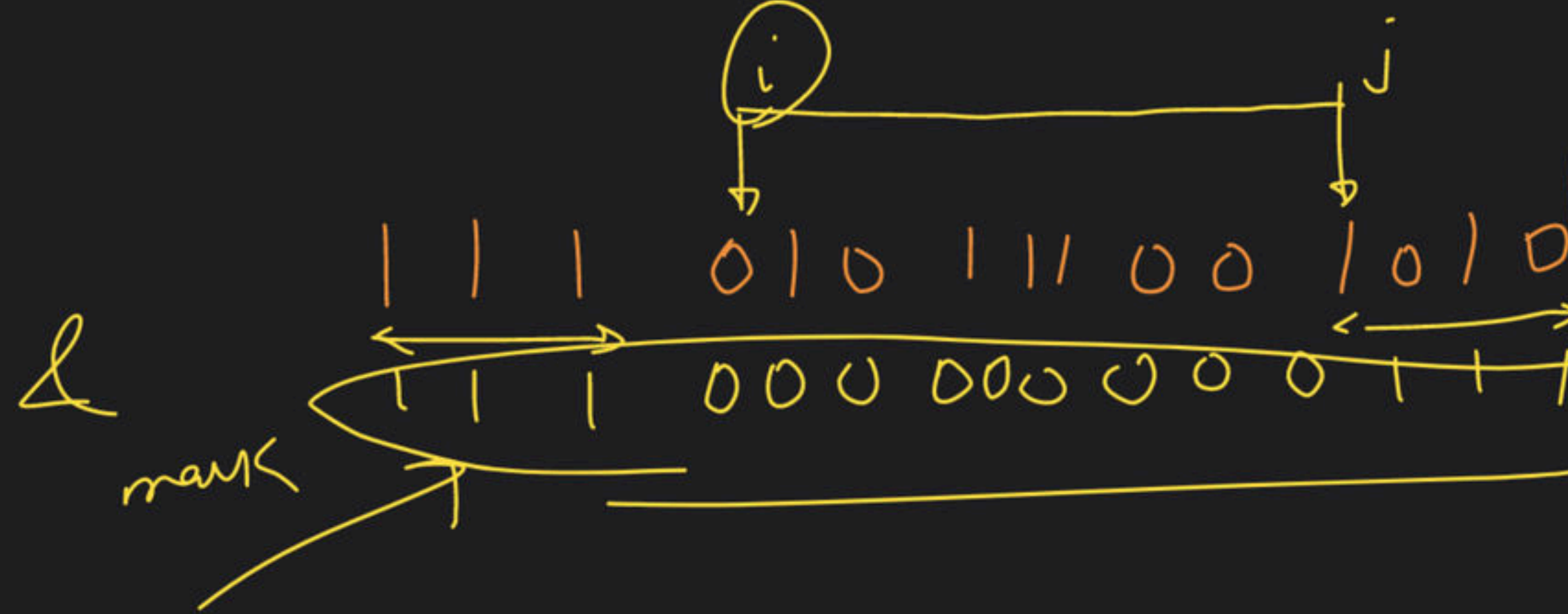
$2^{n/4}$

$2^{n/8}$

$2^{n/16}$

$\< 1$
 $>> 1$

2^0
 2^1



$a \rightarrow (-1 < i)$
 $b \rightarrow \neg(-1 < j)$ (can
 a Ray
 $man = a / b$
 $as = n \& mark$

$a \rightarrow$ 1 1 1 0 0 0 0 0 0 0 0 1 0

1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 0 0 0
 0 0 0 0 0 0 0 1 1 1

$mark \rightarrow$ 1 1 1 0 0 0 0 0 0 0 0 1 1

$1 \& 0 \rightarrow 0$
 $0 \& 0 \rightarrow 0$

$a \rightarrow$ 1 1 1 0 0 0 0 0 0 0 0 0 0
 $b \rightarrow$ 0 0 0 0 0 0 0 0 0 1 1 1
 $-1 < i$ ✓
 $\neg(-1 < j)$ ✓
 1 1 1 0 0 0 0 0 0 0 0 1 1

$1 \& 1 \rightarrow 1$
 $0 \& 1 \rightarrow 0$

$$1024 \rightarrow 2^{10}$$

$$\underline{\underline{1023}} \rightarrow$$



1 0 0 0 0 0 0 0 0 1

$$(2^9 + 1) \rightarrow \underline{\underline{513}}$$

$$1024 \rightarrow 2^{10}$$

$$\bar{i} = 8 \quad \bar{j} = 1$$

$$1023 \rightarrow \begin{array}{cccccccccc} & & & & \bar{i} & & & & & \bar{j} \\ & & & & \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow \\ 0000 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \end{array}$$

$$0000000001$$

$$a \rightarrow (-1 < \dots < \dots)$$

$$b = \neg(-1 < \dots < \dots)$$

$$\left(\begin{array}{cccccc} 1 & 1 & 1 & 1 & - & 1 & 1 & 1 & 0 \end{array} \right)$$

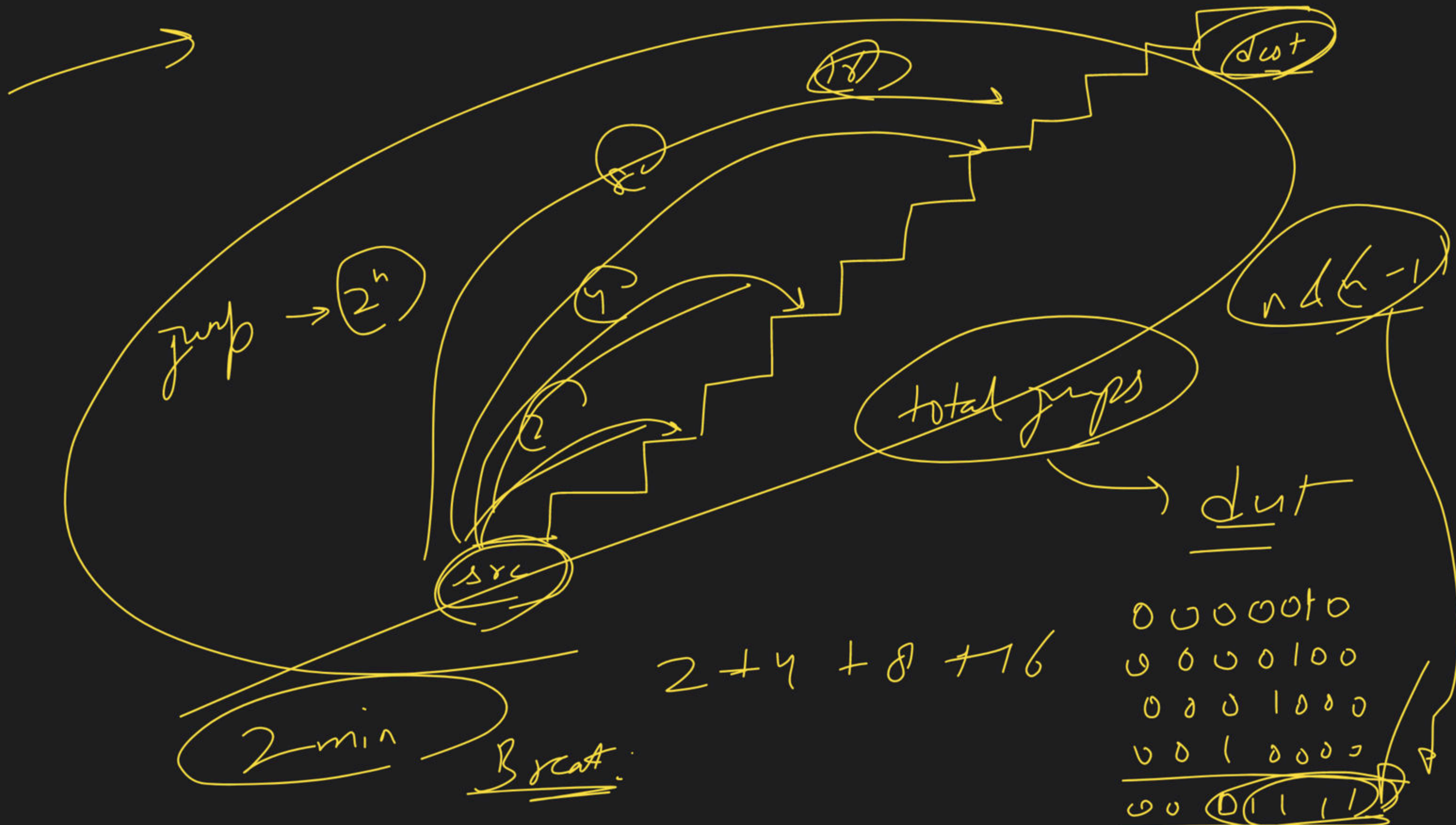
$$a \rightarrow 1111 \dots 1100000000$$

$$000 \dots 0001$$

$$0000 \dots 0101011111$$

math

$$111 \dots 1100000001$$



dot n2.0

Kal →

2 pm

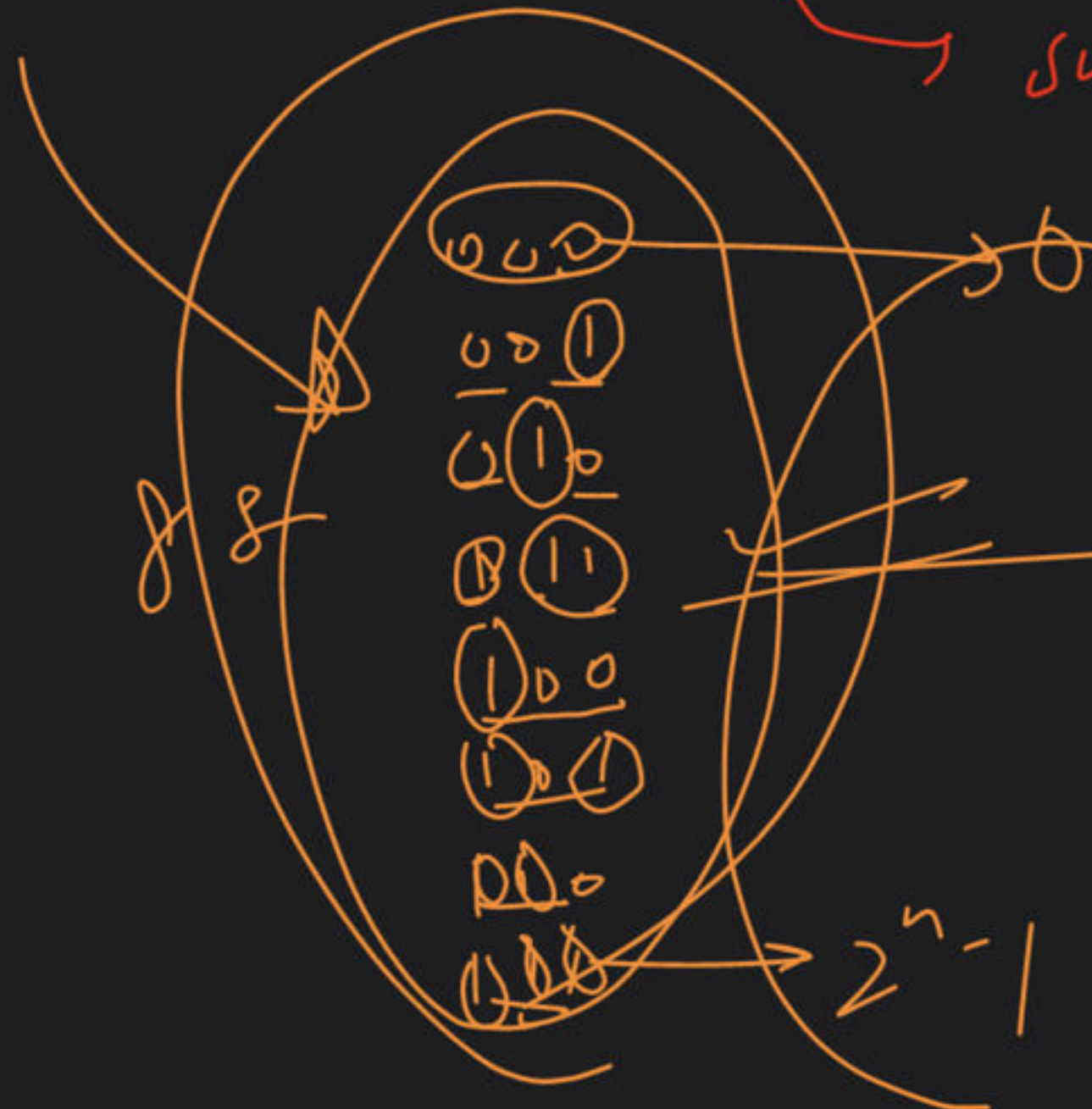
d

BT

Subsequence of a String

String str = "abc"
z? \rightarrow 0

n-length \rightarrow Power set
subseq $\rightarrow 2^n$



0 \rightarrow exclude

1 \rightarrow include

1 1 1
✓ ✓ ✓
a b c
x ✓ ✓
a b c
x x ✓
a b c
x ✓ x
a b c
x x x
a b c
x x x
a b c

\rightarrow abc

\rightarrow bc

\rightarrow ac

\rightarrow ab

\rightarrow b

\rightarrow a

\rightarrow c

\rightarrow ""

for (0 \longrightarrow 2^{h-1})
{

number

\searrow we

for (
 { subarray
 }

}