

$$A \rightarrow \begin{array}{ccccccc} & & 100 & & 101 & & \\ 100 & \cancel{0} & \cancel{1} & \cancel{1} & 0 & \cancel{0} & \cancel{1} & \cancel{0} \end{array}$$

$$B \rightarrow \begin{array}{ccccccc} 10 & 100 & 10101 \end{array}$$

6

$$A \rightarrow \begin{array}{ccccccc} 100 & 111 & 0 & \cancel{0} & \cancel{1} & \cancel{0} \end{array}$$

$$B \rightarrow \begin{array}{ccccccc} 10 & 100 & 10101 \end{array}$$

$$A \oplus B = \begin{array}{ccccccc} 00 & 111 & 0011 \end{array}$$

15

$A \rightarrow$

$B \rightarrow$

Right

Left

12

4 3 2 1

1001101000010010101

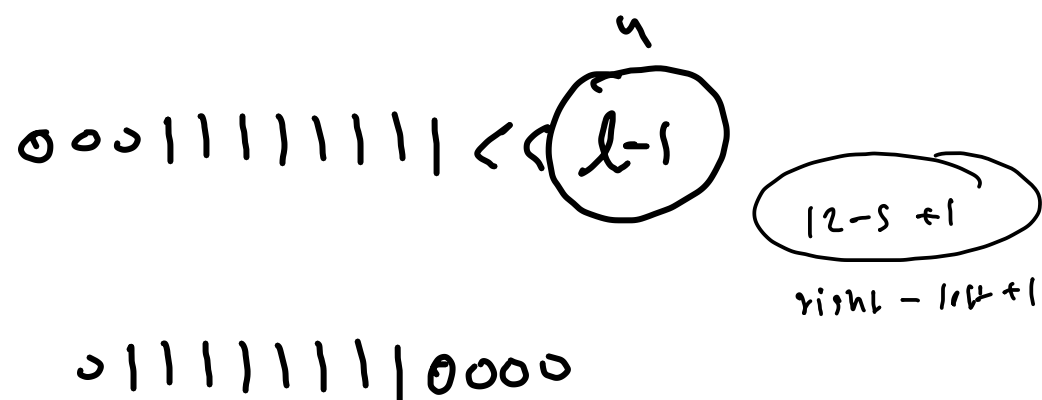
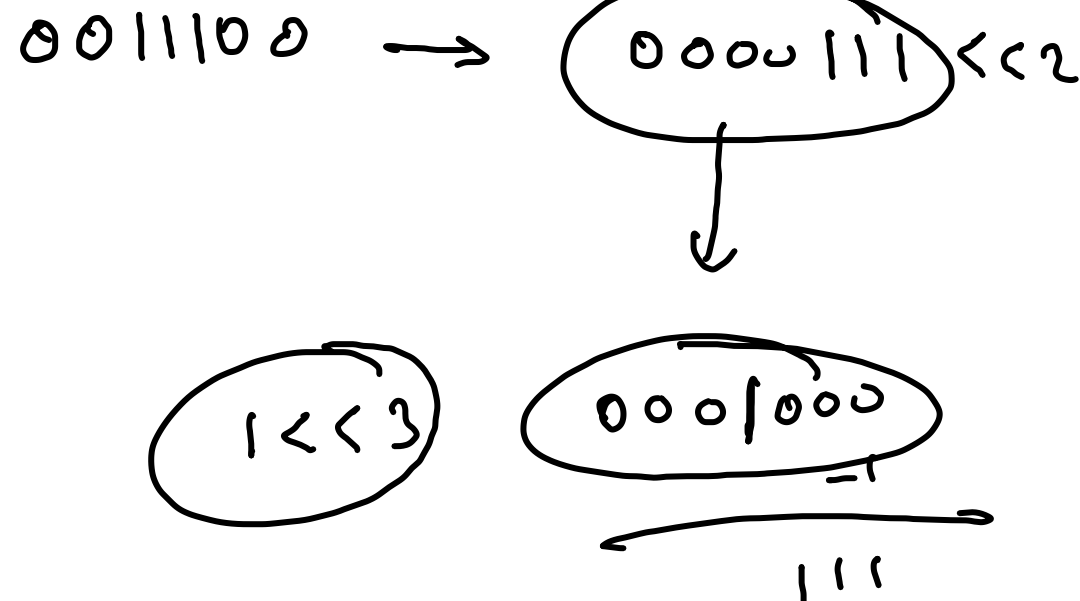
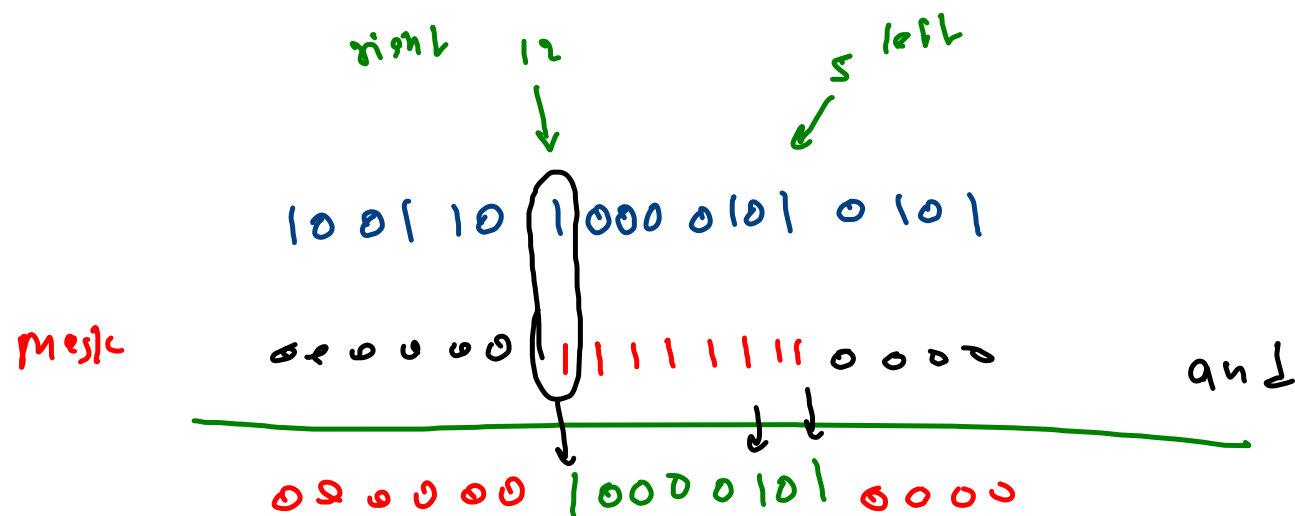
1000110100010000111



B set

$\beta \rightarrow$
 Merkle \rightarrow

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



$mask = 1 \ll (R - L + 1);$ 00010000

$mask = mask - 1;$ 001111

$mask = mask \ll (Left - 1);$ 001110000

$mask \& mask$

$ans = b \& mask;$

h

$\boxed{/ \star \circ /}$ α

$$h \ll 1 = 2h$$

$$\textcircled{h \ll 2} = 2 \times 2 \times h$$

$$h \ll 3 = \boxed{2 \times 2 \times 2} \times h$$

$8h$

$$\frac{7h}{8} = \frac{8h - h}{8} \frac{(h \ll 3) - h}{8}$$

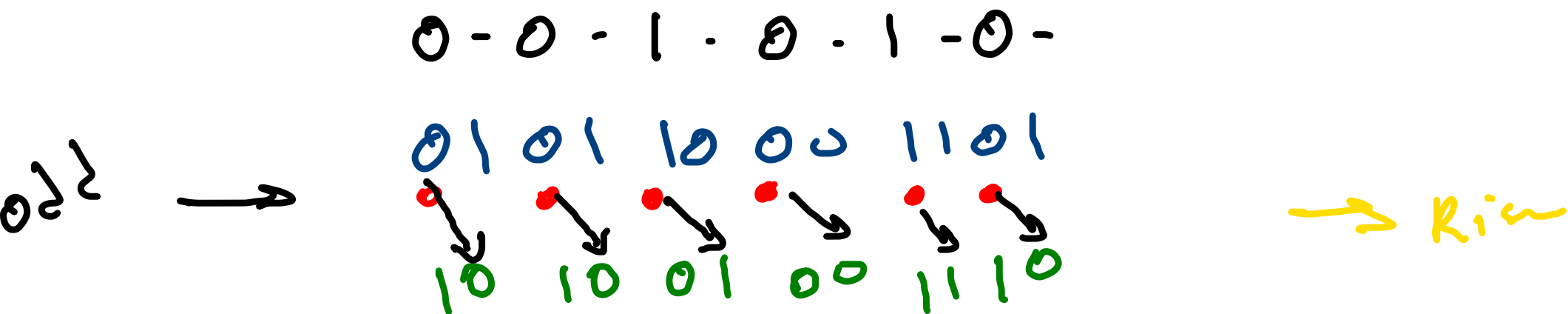
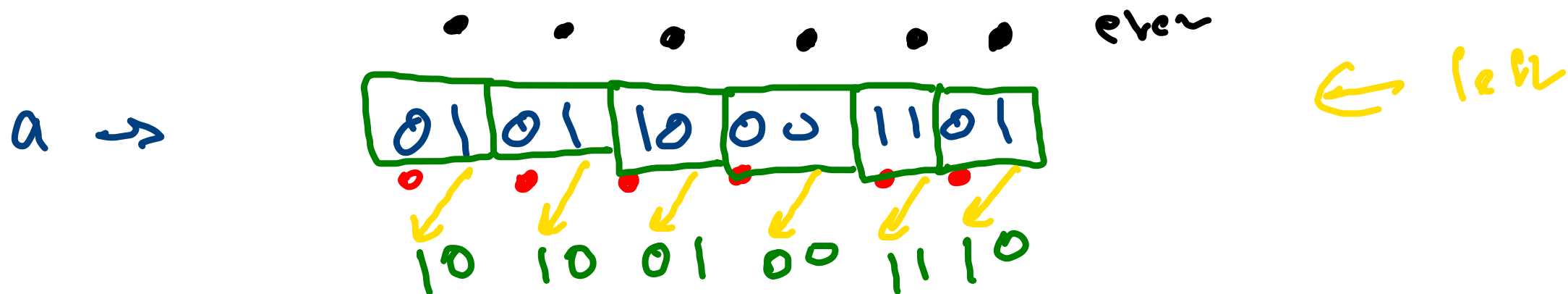
$$\frac{2h}{8} = \frac{8h - h}{8} = \left((h \ll 3) - h \right) \gg 3$$

$$\underbrace{101000}_{40} \gg 3$$

$$\underbrace{101}_{5}$$

$$48/8 = 6$$

$$49/8 = 6 \cdot \textcircled{\dots}$$



01010101

even

odd

even << 1

odd >> 1

ans →

even | odd

000001000100

101000001010

000001000100

1010100110

odd

mask

S

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

1 0 1 0 1 0 1 0 1 0

0 0 0 0 1 0 0 1 0 0 0

hi

0, 1

odd

0 --- 7

oddmask = 0xAAAA AAAA

1010

evenmask = 0x5555 5555

0101

odd = val & oddmask

even = val & evenmask

even = even < 1

odd = odd > 1

even 1011

hexa

0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

0101

A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

0x AAAA AAAA

1010 1010 1010 ----

1
2
3

a 001
b 010
c 011

8
1

$O(n^2)$

ab

3 2 1 0
001
010 → 2

ba

010
001 → 2

ca

011
001 → 1

ac

001
011 → 1

bc

010
011 → 1

cb

011
010 → 1
011

\downarrow
 a 0 0 1
 b 0 1 0
 c 0 1 1

bit

zero \rightarrow 1

one \rightarrow 2

$ab = \begin{matrix} - & - & 1 \\ - & - & 0 \end{matrix}$
 $ba = \begin{matrix} - & - & 0 \\ - & - & 1 \end{matrix}$
 $cb = \begin{matrix} - & - & 1 \\ - & - & 0 \end{matrix}$
 $bc = \begin{matrix} - & - & 0 \\ - & - & 1 \end{matrix}$

ab
 ba

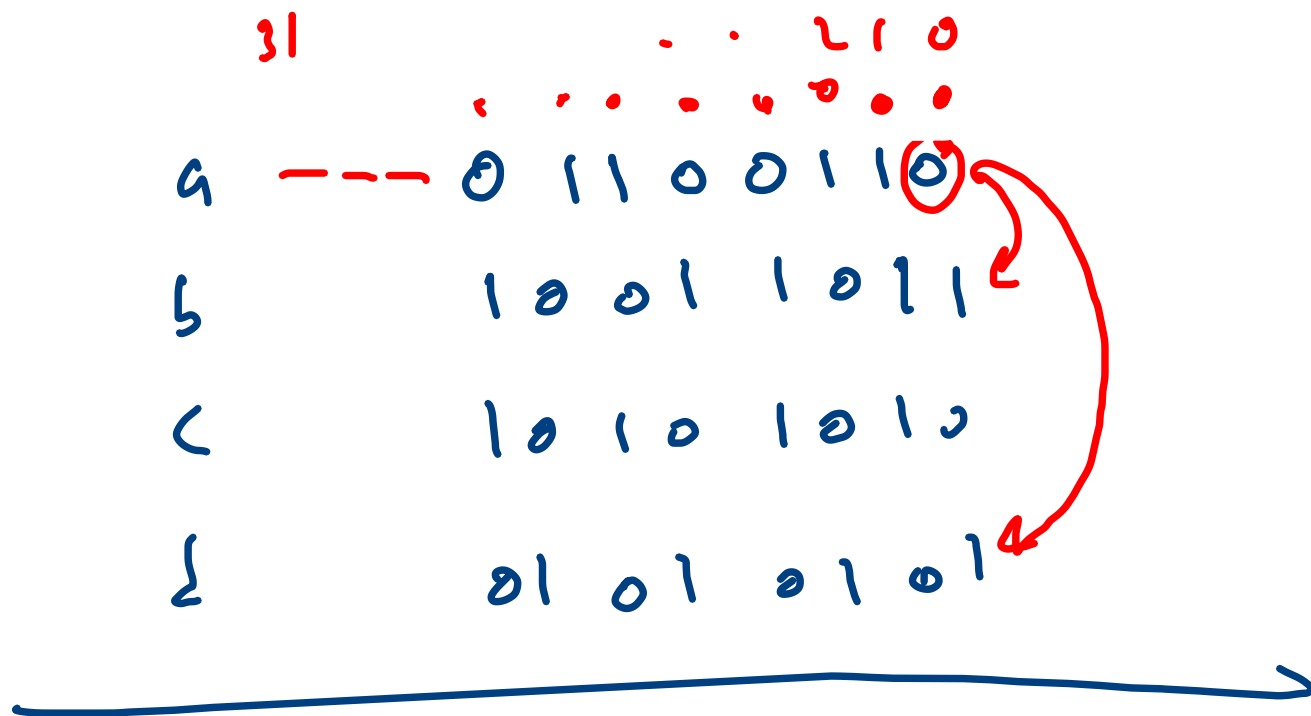
zero x zero

1 2 = 2

ok zero

2 x 1 = 2

32
int



0 1	
a b	b a
a d	d a
c b	b c
c d	d c

int → 32

31...0

h

2000 → 2

0h → 2

32x4

2x2 7x2

str = "1001100111" → true

binary
string

"1101100111" → false

value

32 16 8 4 2 1

rem

2 1 2 1 2 1

$$\begin{array}{r} 1 + 2 \\ 0 + 0 \\ a + b \end{array} \quad 3$$
$$3 =$$

$$4 + 2 = 6$$

$$4 + 8 = 12$$

long 64

10,000

2^{10,000}

10¹⁸

$$3 \rightarrow \begin{array}{c} 0 \ 1 \ 1 \\ \uparrow \uparrow \\ 2 \ 1 \end{array}$$

$$6 \rightarrow \begin{array}{c} 8 \ 4 \ 2 \ 1 \\ 1 \ 1 \ 0 \\ \uparrow \ \uparrow \\ 1 \ 2 \end{array}$$

$$9 \rightarrow \begin{array}{c} 8 \ 4 \ 2 \ 1 \\ 1 \ 0 \ 0 \ 1 \\ \downarrow \quad \downarrow \\ 2 \quad 1 \end{array}$$

$$12 \rightarrow \begin{array}{c} 8 \ 4 \ 2 \ 1 \\ 1 \ 1 \ 0 \ 0 \\ \downarrow \ \downarrow \\ 2 \quad 1 \end{array}$$

$$\begin{array}{ccccccc} \bullet & & \bullet & & \bullet & & \\ \hline 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ \hline & 1 & & 1 & & 1 & 1 \\ & & & & 0 & & 0 \end{array}$$

$$1 + 1 + 2 + 2 + 2 = 6$$

$$\begin{array}{lcl} \text{km} & 2 & \rightarrow n \\ \text{vkm} & 1 & \rightarrow n \end{array}$$

$\frac{1}{1}$ $\frac{0}{1}$ $\frac{1}{1}$ $\frac{0}{1}$ $\frac{1}{1}$ $\frac{0}{1}$ $\frac{1}{1}$ $\frac{1}{1}$

$$4 \times 2 = 8$$

$$1 \times 1 = 1$$

sym

$$2 \rightarrow 4$$

$$1 \rightarrow 1$$

2, 2, (2, 2)

1

2, 2

1, (1)

(2, 2)

$$4 \times 2 = (2)$$

2

2, (2)

1, 1

1, 1, 1, 1



1, 1

2cm

1

2

2, (2, 2)



1

2

1

2

1, 1, 1, 1, 1
2, 1, 2, 2, 1, (1, 2, 2)

1, 1, 1

2, 2, 2, (2, 2)

$n = 17$

0...17

8

$2^3 \rightarrow$

8 8 8 8

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

$2^4 = 16$

17

18

$n = 19$

10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1

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

16

$2^4 =$

$4 \times 2^{4-1}$

$n - 2^4 + 1$

$2^n = n \times 2^{n-1}$
 $n - 2^n + 1$
 $\text{fail} \times (n - 2^n)$

$n - 2^n + 1$

$19 - 16 + 1$

