

[<sup>•</sup>1 <sup>•</sup>1 <sup>•</sup>1 2]

[<sup>•</sup>1, <sup>•</sup>2, <sup>•</sup>3, <sup>•</sup>3, <sup>•</sup>1, <sup>•</sup>2, <sup>•</sup>2, <sup>•</sup>1, <sup>•</sup>3, <sup>•</sup>5]

2 =

5

[ 1 2 3 , 2, 3 ]

$\begin{bmatrix} 2 \rightarrow 010 \\ 2 \rightarrow 010 \end{bmatrix}$

$\begin{bmatrix} \cancel{2} \rightarrow 11\textcircled{1} \\ \cancel{2} \rightarrow 11\textcircled{1} \end{bmatrix}$

• 1  $\rightarrow$  101

$\text{xor} \rightarrow$   
 000  
 010 ^ 010  
 000 ^ 111  
 111 ^ 111  
 000

^ n

01010  
 11000  
 -----  
 10010

$\overbrace{\quad\quad\quad}$   
 $\cancel{1} \ 4 \ \boxed{3}$   
 3  
 101

3 repeats

1

$\begin{bmatrix} a \\ a \\ a \end{bmatrix} \rightarrow$

$\begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \end{bmatrix}$

$\begin{bmatrix} c \end{bmatrix}$

$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 \end{bmatrix}$

$\begin{bmatrix} b \\ b \\ b \end{bmatrix}$

$\begin{bmatrix} 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 \end{bmatrix}$

1 1 0 0 1

2 2 0 0 2

0 0 0 0 0

0 1 1 1 1

1 1 1 2 2

2 1 1 0 0

0 1 1 1 1



twon

00  
01

6 4 1 4 7

0 1 1 1 1

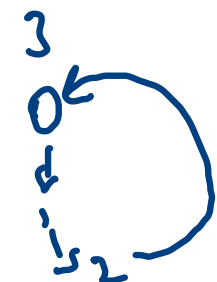
0 0 1 1 1 1

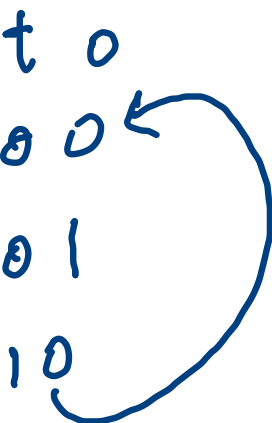
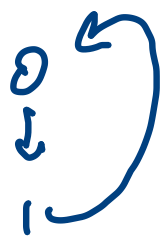
4 6 6 0 6 0



xy -> 1 - - -

0  
1  
10





$4 \rightarrow 0 \overset{\cdot}{1} 1 0 1 0 1$   
 $6 \rightarrow 1 1 0 0 0 1 0$

$0 1 1 0 1 0 1$   
 $1 1 0 0 0 1 0$

$0 1 1 0 1 0 1$   
 $1 1 0 0 0 1 0$   
 $1 1 0 0 1 1 1$

	•	•	•	•	•	•	•
one	0	1	1	0	1	0	1
two	0	0	0	0	0	0	0

01  
10

	•	•	•	•	•	•	•
one	1	0	1	0	1	1	1
two	0	1	0	0	0	0	0

	•	•	•	•	•	•	•
one	0	0	1	0	0	0	0
two	1	0	0	0	1	1	1

two one  
 $0 \rightarrow 00$   
 $1 \rightarrow 01$   
 $2 \rightarrow 10$

t	o	b
0	0	0
0	1	0
1	0	0



ohe

0

1

0

$$ohe = (\sim t \ \& \ ohe \ \& \ \sim b) \mid (\sim t \ \& \ \sim ohe \ \& \ b)$$

$$o = (\sim t \ \& \ o \ \& \ \sim b) \mid (\sim t \ \& \ \sim o \ \& \ b)$$

$\sim t \ \& \ o \ \& \ \sim b$   
"

t	ohe	b
0	0	1
0	1	1
1	0	1



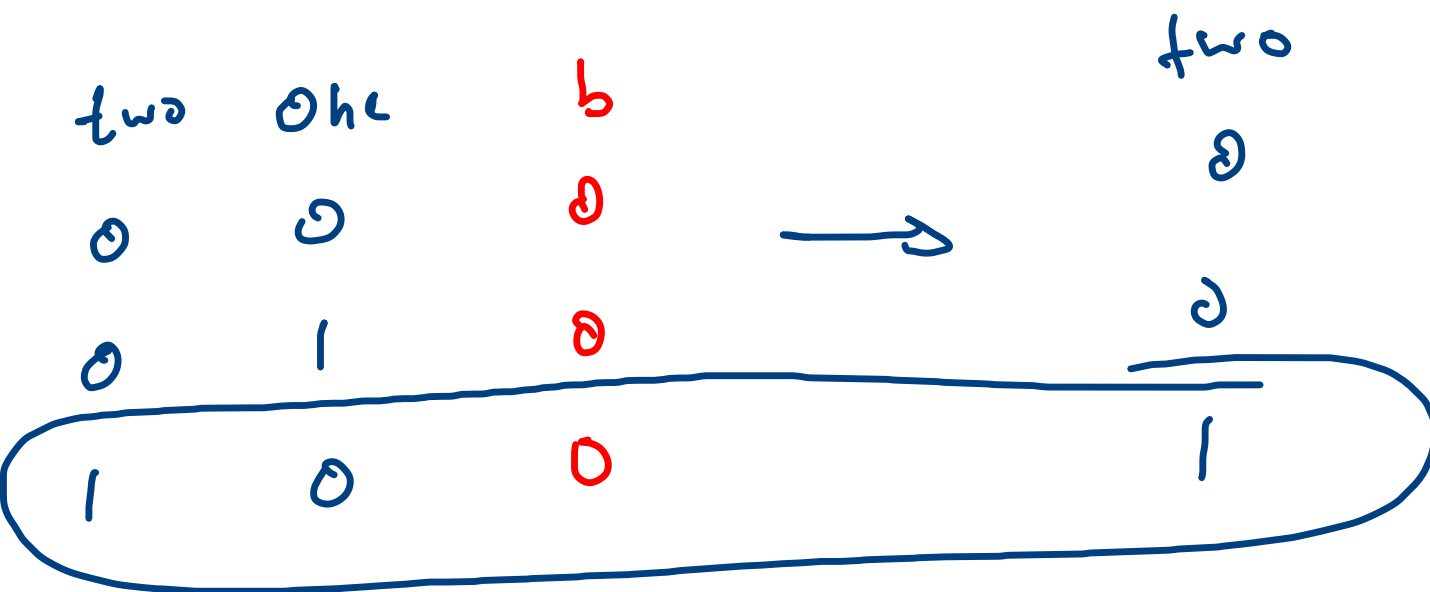
ohe

1

0

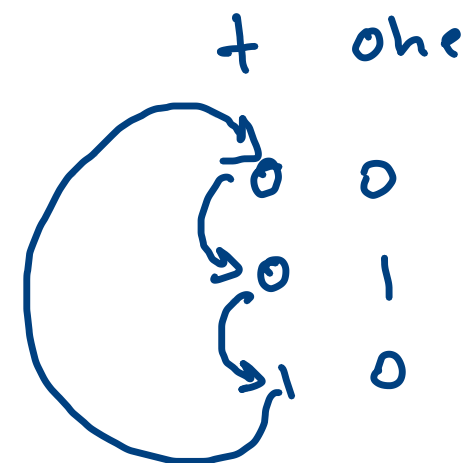
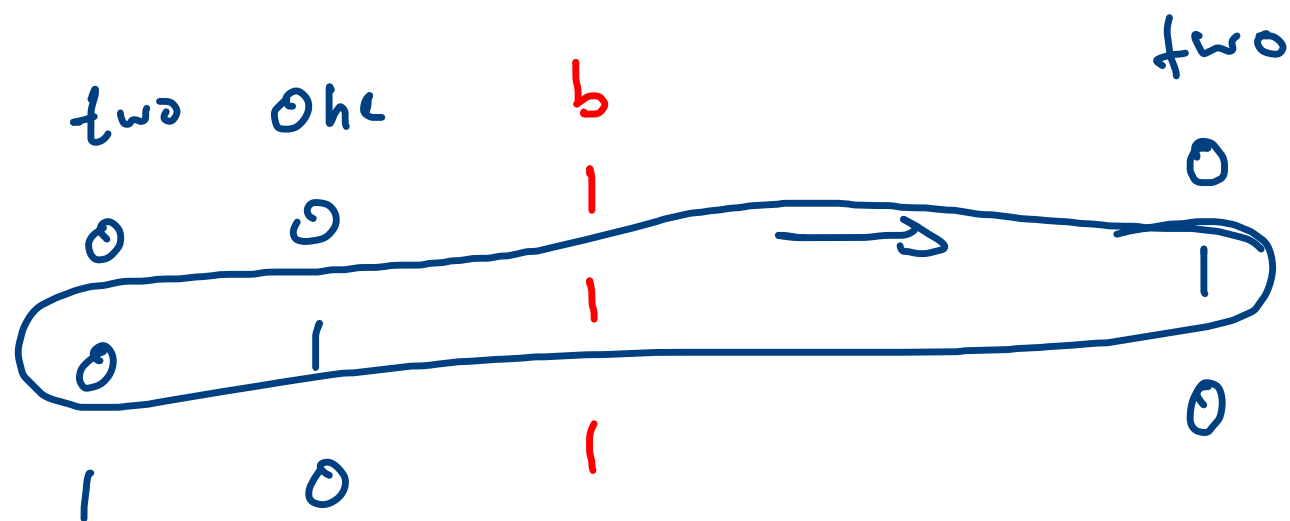
0





$$two = (t \oplus \sim o \oplus \sim b) | (\sim t \oplus o \oplus b)$$

$$t = (t \& \sim o \& \sim b) | (\sim t \& o \& b)$$



```

int o=0;
int t=0;

for(int v: arr){
    int oo = (~t&o&~v) | (~t & ~o & v);
    int tt = t (t&~o&~v) | (~t & o & v);

    o = oo;
    t = tt;
}

System.out.println(o);

```

$00 \rightarrow 0000$   
 $11 \rightarrow 0000$

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

	1	1	1	1
o	0	0	1	1
t	0	0	1	0

$$\begin{array}{r} 1010 \\ 1111 \\ 0101 \\ \hline 0006 \end{array}$$

$$\begin{array}{r} 0101 \\ 1111 \\ 1010 \\ \hline 0066 \end{array}$$

10	01
0	0
0	1
1	0

$h \rightarrow 1$

$\begin{matrix} 0 \\ 1 \end{matrix} \rightarrow 1 =$

$[0 \ 1]$

2

$\begin{matrix} 00 \\ 01 \\ 10 \\ 11 \end{matrix}$

$\begin{matrix} 00 & \rightarrow & 0 \\ 01 & \rightarrow & 1 \\ 11 & \rightarrow & 3 \\ 10 & \rightarrow & 2 \end{matrix}$

3

$--- \textcircled{2^3} = 8$

$111$

$000 - 0$

$001 - 1$

$011 - 3$

$010 - 2$

$110 - 6$

$111 - 7$

$101 - 5$

$100 - 4$



$h=1 \rightarrow [0 \quad 1]$

$h=2 \rightarrow [00 \quad 01 \quad 11 \quad 10]$

$1 \ll (1)$   
10

$h=3 \rightarrow [000 \quad 001 \quad 011 \quad 010]$

~~$100 \quad 101 \quad 111 \quad 110$~~

$1 \ll (2)$   
100

$\checkmark \rightarrow 011001010$   
01 mask 0001 00000  
0110101010

001

$1 \ll (3-1) = 100$

$h=4$

val | mask

$1 \ll (3)$

$$\begin{array}{r} \infty \\ 1 \ 10 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 01 \\ 1 \ 10 \\ \hline 11 \end{array}$$

```

List<Integer> fans = grayCode(n-1);
List<Integer> ans = new ArrayList<>();

for(int v: fans){
    ans.add(v);
}

int mask = 1<<(n-1);
for(int i=fans.size()-1;i>=0;i--){
    int v = fans.get(i);

    ans.add(v|mask);
}

return ans;

```

$1 \ll (1)$   
 $1 \ll (0) = 1$

$10$

$010$

$h=0$

$h=1$

$h=2$

$h=3$

$[0]$

$[0, 1]$

$[0, 1, 3, 2]$

გაგან

5

$$(a \quad b \quad c \quad d \quad e)$$
[illegible]

4

e d c b a

0 0 0 1 0 1

1 8 1 8 0

1 1 1 0 0



1

2

2

a c

b.



d c e

$[0, 3, 1]$

$$[a, c, d, e, b]$$

subsequence

K  
0  
2  
1

0 0 0 1 0 1

1 1 1 0 0

୧ । ୧ । ୧

A hand-drawn diagram of a bus. A circle on the left represents the driver's seat, with a small figure inside. The bus body is a long rectangle with several vertical lines inside representing passengers. The entire bus is enclosed in a larger rectangular frame.

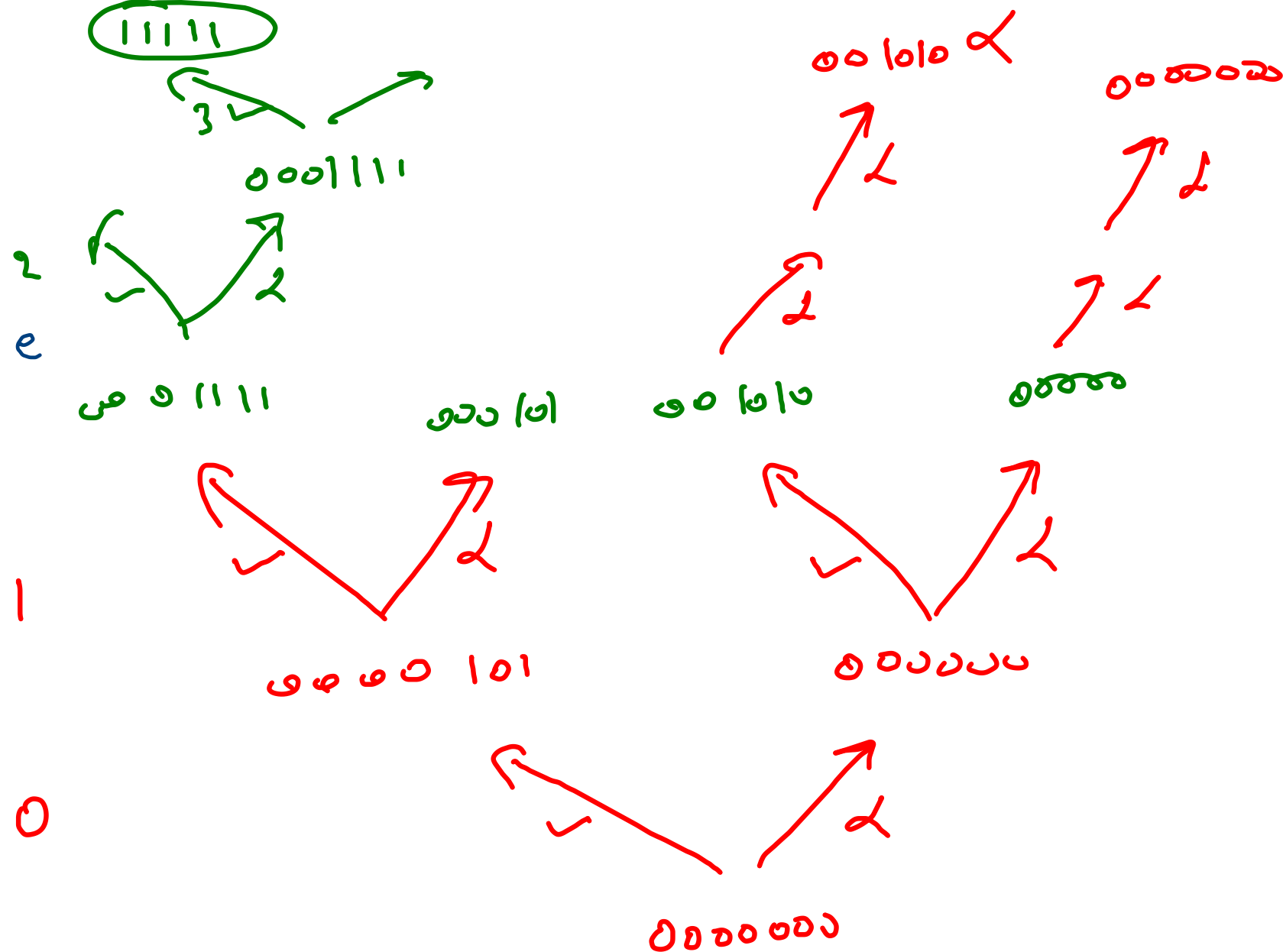
or

Handwritten notes illustrating a Huffman tree construction process:

- A sequence of bits: 1 1 1 1 1 (circled in green).
- A diagram showing a merge operation with a green arrow and the number 3.
- A sequence of bits: 0 0 0 1 1 1 1.
- A diagram showing a merge operation with a green arrow and the number 2.
- A sequence of bits: 0 1 1 1 1.

$$\begin{array}{r}
 10000101 \\
 10010101 \\
 \hline
 10010111
 \end{array}$$

11/20/20



skills = 001111

hskills = 4

$$\begin{array}{r} 10000 \\ - 1 \\ \hline 01111 \end{array}$$



$$\begin{array}{r} 11 \\ - 1 \\ \hline 15 \end{array}$$

1 < 4

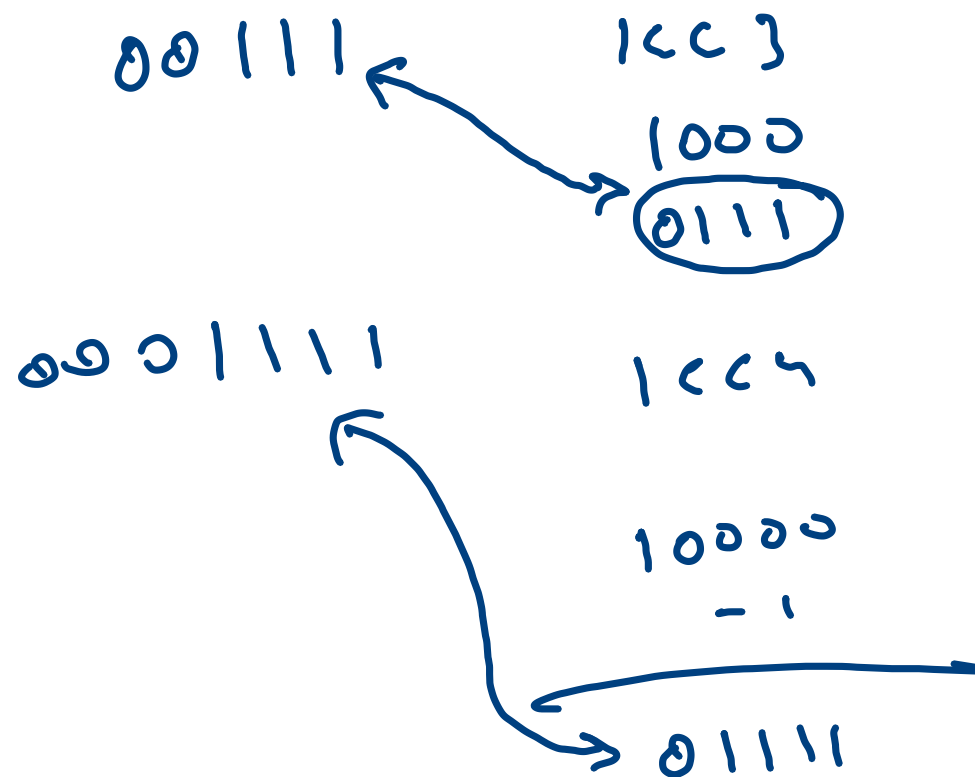
$$\begin{array}{r} 10000 \\ - 1 \\ \hline 01111 \end{array}$$

$$\text{skills} = 2$$

skills  
00011

$$= 3$$

$$4$$



$$\begin{array}{r} 1000 \rightarrow \\ 0111 \end{array} \rightarrow \begin{array}{r} 8 \\ -1 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 10000 \rightarrow 16 \\ -1 \\ \hline 15 \end{array}$$

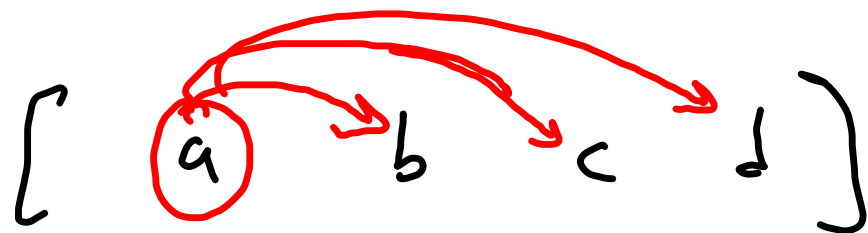
1	5	2	1	2
1 + 1	5 + 1	2 + 1	1 + 1	2 + 1
1 + 5	5 + 5	2 + 5	1 + 5	2 + 5
1 + 2	5 + 2	2 + 2	1 + 2	2 + 2
1 + 1	5 + 1	2 + 1	1 + 1	2 + 1
1 + 2	5 + 2	2 + 2	1 + 2	2 + 2

h

$\overline{h^2}$  ←  
↑  $\alpha$

$O(h)$

xor → 2 ^ 6 ^ 3 ^ 2 ^ 3 ^ 6 ^ 10 ^ 2 ^ 6 ^ 7 ^



$$\begin{array}{cccccccc}
 (a+a)^{\wedge} & (\cancel{a+b})^{\wedge} & (\cancel{a+c})^{\wedge} & (\cancel{a+d})^{\wedge} & (\cancel{b+a})^{\wedge} & (\cancel{b+b})^{\wedge} & (\cancel{b+c})^{\wedge} & (\cancel{b+d})^{\wedge} \\
 (\cancel{c+a})^{\wedge} & (\cancel{c+b})^{\wedge} & (\cancel{c+c})^{\wedge} & (\cancel{c+d})^{\wedge} & (\cancel{d+a})^{\wedge} & (\cancel{d+b})^{\wedge} & (\cancel{d+c})^{\wedge} & (\cancel{d+d})^{\wedge}
 \end{array}$$

$$4 \wedge 4 \rightarrow 0$$



$$N = \begin{matrix} & & 3 & 4 & 2 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{matrix} \rightarrow 12$$

5

0	0	0	0	
1	0	0	0	
2	0	0	1	0
3	0	0	1	1 ✓
4	0	1	0	0
5	0	1	0	1 ✓
6	0	1	1	0 ✓
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1 ✓
10	1	0	1	0 ✓
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1

0 0 0 1 1 0 0

0 0 0 0 1 1 1 1

h → 1 0 1 0 0 0 0 → 2 1

0 1 1 1 1 1 1 1

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

6 2

0 1 1 1

0 0 0

0 0 1

0 1 0

0 1 1

1 0 0

1 0 1

1 1 0

1 1 1

3 2 3

3

1 0 1 0



1 - - -

1	0	0	great
0	1	0	equal
0	0	1	small

0 ( - - - ) →

3 < 2

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

$$\begin{matrix} \bullet \\ 10 & 1 & 10 & 10 \end{matrix} \longrightarrow 0 \text{ ----- } \quad \begin{matrix} 6 \\ \swarrow \end{matrix} c_4$$

$$\downarrow$$

$$\begin{matrix} & & 8 \\ 1 & 0 & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \end{matrix} \quad f(11010)$$

$$\begin{matrix} 8 \\ 11 & 010 \end{matrix} \longrightarrow 0 \text{ ----- } \quad \begin{matrix} 4 \\ \swarrow \end{matrix} c_3$$

$$\downarrow$$

$$\begin{matrix} 4 \\ 1 & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \end{matrix} \quad f(1010)$$

$$\begin{matrix} 1010 \end{matrix} \longrightarrow 0 \text{ ----- } \quad \begin{matrix} 3 \\ \swarrow \end{matrix} c_2$$

$$\downarrow$$

$$\begin{matrix} 1 \\ 1 & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \end{matrix} \quad f(010)$$

$$010 = \begin{matrix} 1 \\ f(10) \end{matrix}$$

$$\downarrow$$

$$\begin{matrix} 10 \end{matrix} \longrightarrow 0 \text{ ----- } \quad \begin{matrix} 1 \\ \swarrow \end{matrix} c_1$$

$$\downarrow$$

$$\begin{matrix} 0 \\ 1 & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \end{matrix} \quad f(0)$$

$$h(n) \rightarrow \frac{h!}{1! \times (h-1)!}$$

$$\frac{3 \times \pi}{2 \times 1}$$

$$\frac{4 \times 2 \times 2 \times \pi}{2 \times 2 \times \pi \times 1}$$

16 8 4 2 1

$$11010 \longrightarrow$$

26

0

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

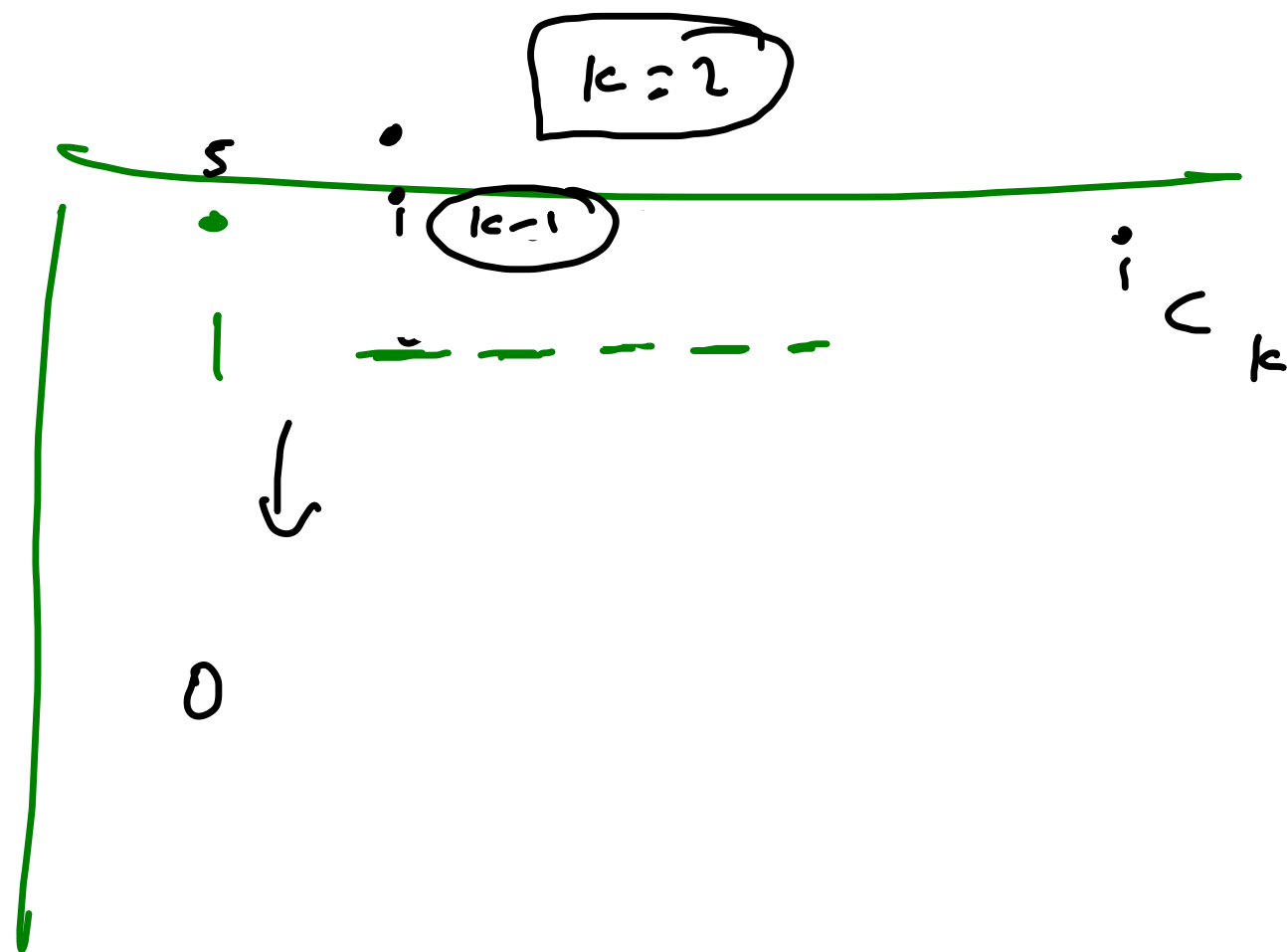
19

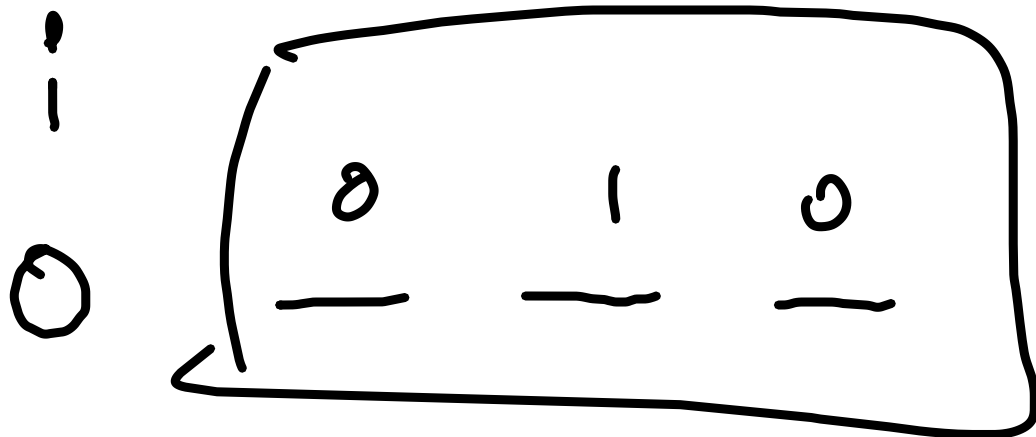


0 - - - - - 6 5 4

1 1 0 1

11010 ← Small 3





hcr

010 small 1

001



3  
↓

2

1

9

1

1

0

0

~

0

—

—

—

0

1

0

<

X

1

<

0