

Discussion 2

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①

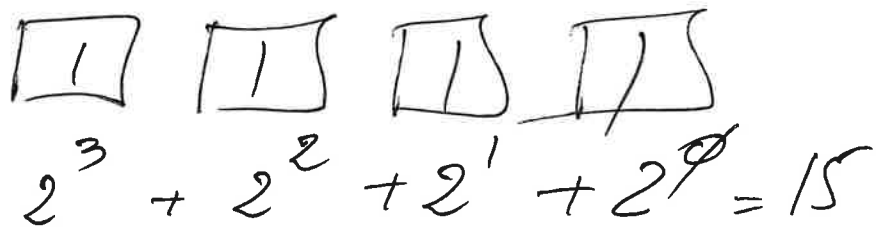
Exercise 1:

a) What is the largest natural number that can be represented on 4 bits?

• Memory: The largest number that can be represented on N bits is $2^N - 1$

when $N = 4$: $2^4 - 1 = 15$

• Other approach:

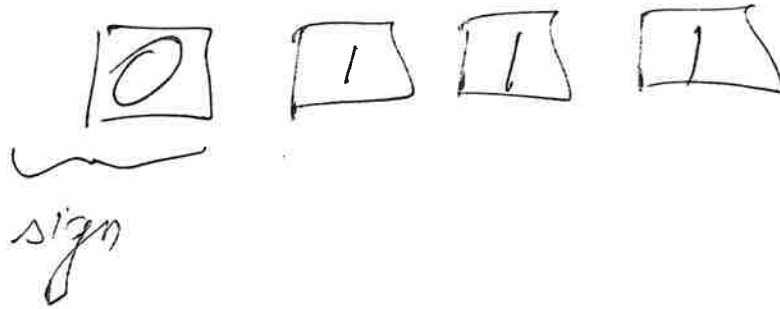

$$2^3 + 2^2 + 2^1 + 2^0 = 15$$

b) What is the smallest natural number that can be represented on 4 bits?

c) What is the largest integer that can be represented on 4 bits?

On my 4 bits:

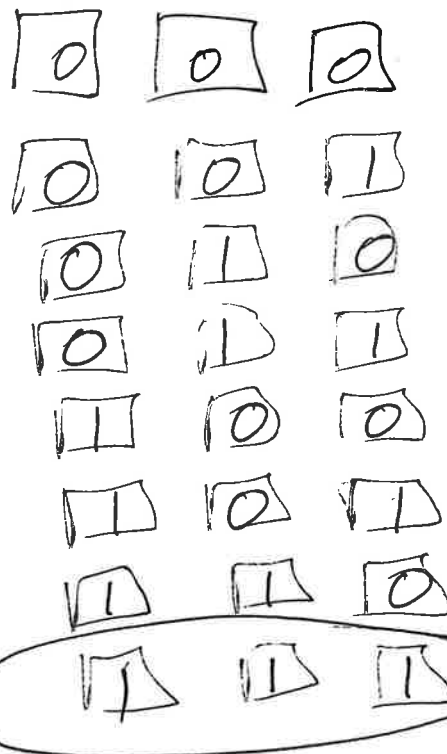
②



The largest positive integer that can be represented on N bits is $2^{N-1} - 1$

Why 2^N or $2^{N-1} - 1$?

Take 3 bits as an example:



there are $2^3 = 8$ such numbers.

The largest number is $7 = 2^3 - 1$

Hexadecimal numbers

Base 10	Base 2	Base 16
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

(101111)₂

0001 0111

#(17)

#3F

" (00111011)₂

#FF
" (11111111)₂

23

Exercise 2

(2)

What is the binary representation of the hexadecimal 3D?

Answer: $(0011\ 1101)_2$

Exercise 3:

Let A be the binary number $(1010)_2$
and B be the binary number $(11011)_2$

Find the binary representation of the number X that satisfies $A + X = B$

Answer:
We rewrite this equation in decimal format:

$$A = (1010)_2 = (10)_{10}$$

$$B = (11011)_2 = (27)_{10}$$

In decimal format:

$$10 + X = 27$$

$$X = (17)_{10}$$

$$X = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 \end{pmatrix}_2 \text{ as natural number} \quad \textcircled{3}$$

Exercise $X = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 \end{pmatrix}_2$ as an integer

Some of the trunks are made by Bellini. Other trunks are made by Cellini.

If the trunk is made by Bellini, the sign is true; otherwise is false.

①
Portrait is here.
Trunk 3 is made by Bellini

②
Portrait is here
Trunk 1 is made by Cellini

③
Portrait is here
This trunk was made by the same maker as trunk 2

①	②	③	S_1	S_2	S_3
B	B	B	T	F	T
B	B	C	F	F	F
B	C	B	T	F	F
B	C	C	F	F	T
C	B	B	T	T	T
C	B	C	F	T	F
C	C	B	T	T	F
C	C	C	F	T	T