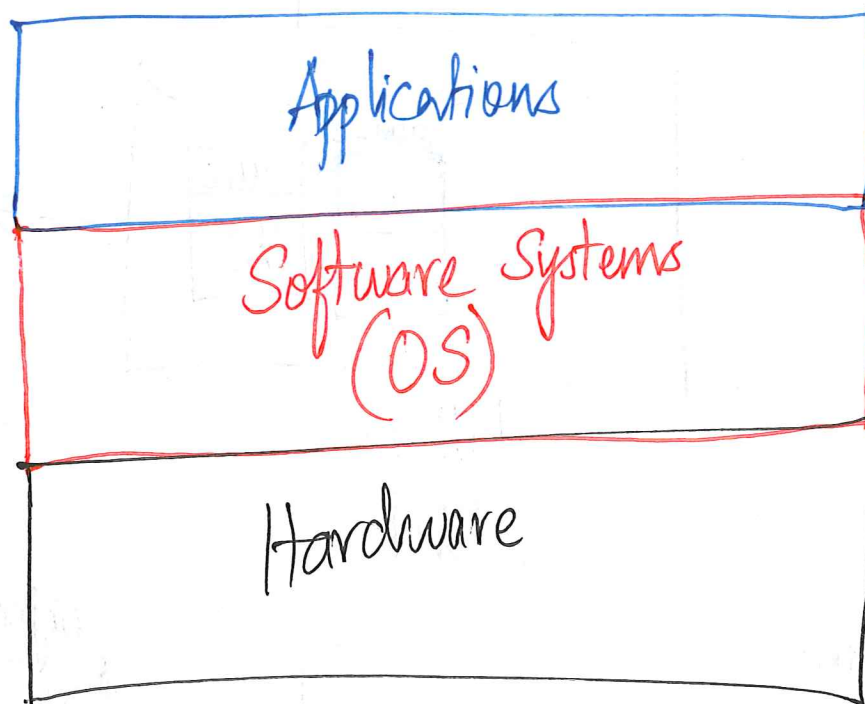


CS 354 ^①

"Gerald" Intro to Computer Systems

Today Machine Org. & Prog.

1. How computers work?
2. C Programming
3. Logistics



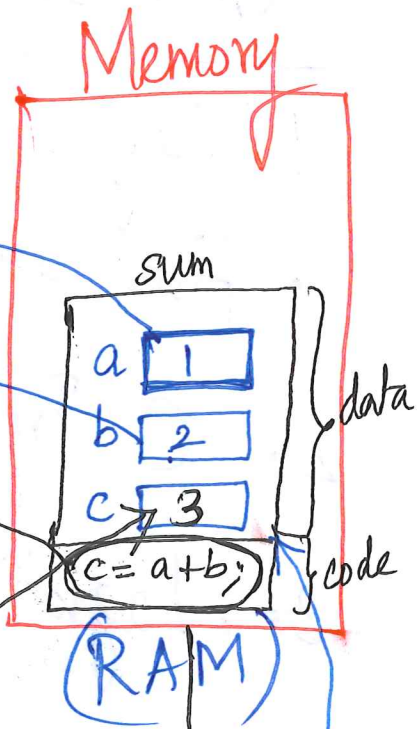
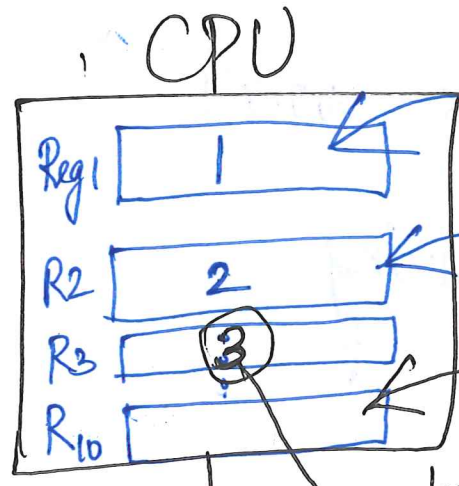
(2)

```

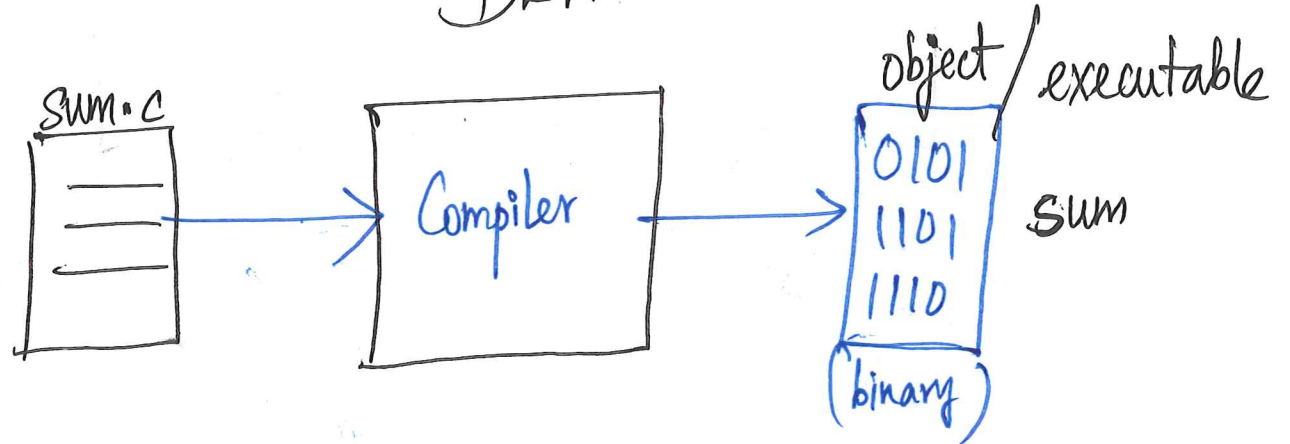
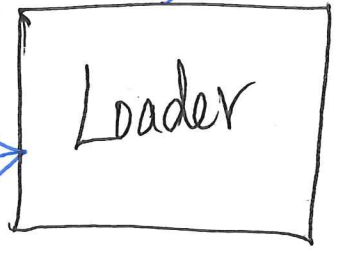
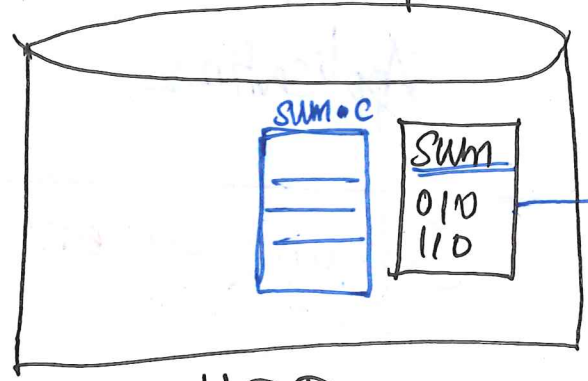
sum.c
a=1;
b=2;
c=a+b;
printf("%d",c);

```

- CPU
1. fetch
 2. decode
 3. execute
- Loop



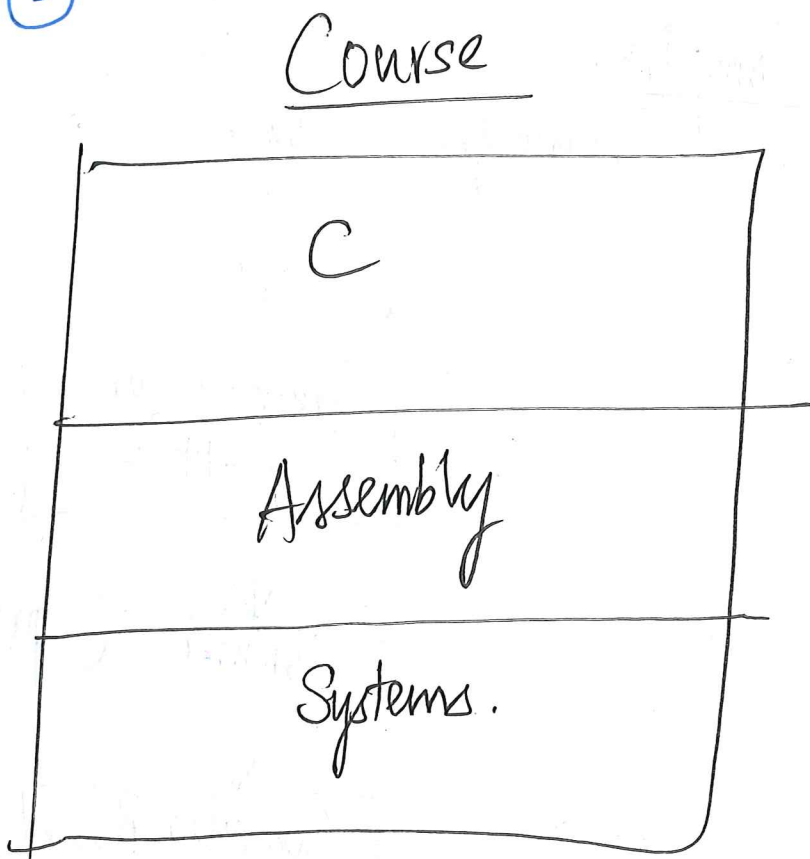
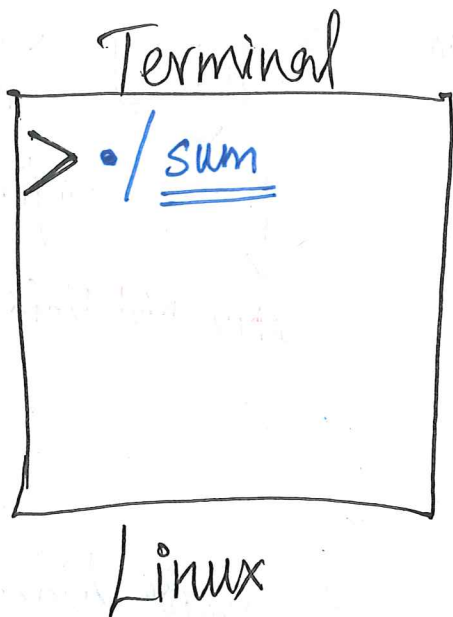
bus interconnects.



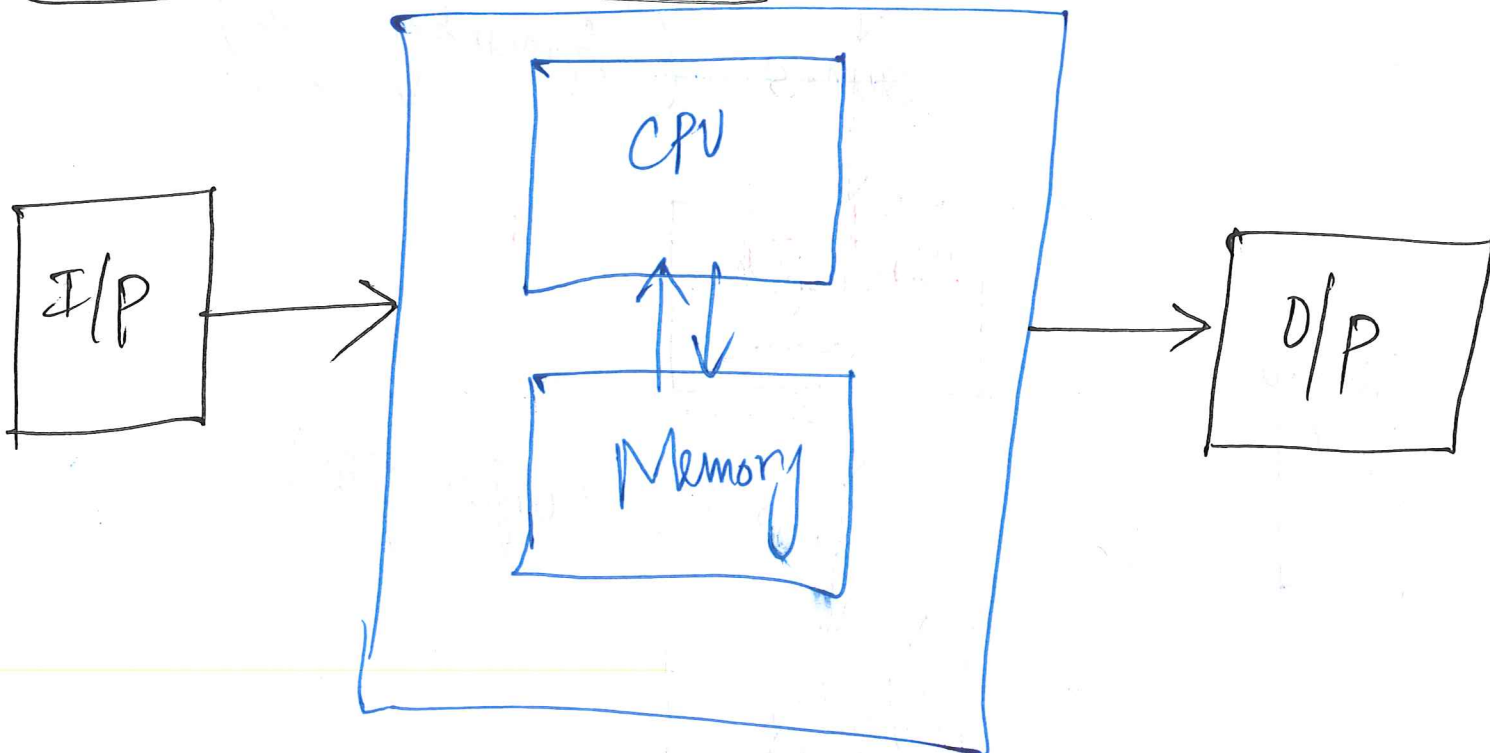
load

store

3

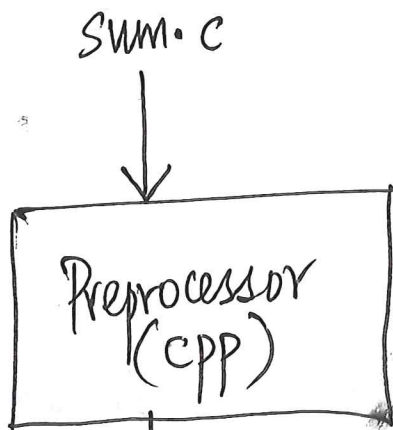
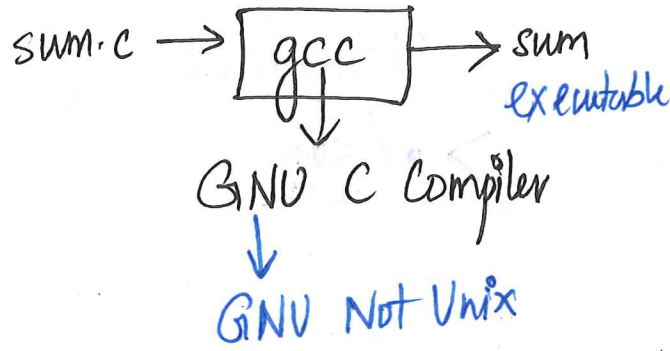


Von Neumann Architecture

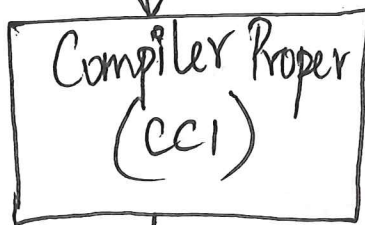


Compiler
source file

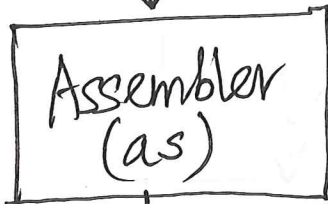
(4)



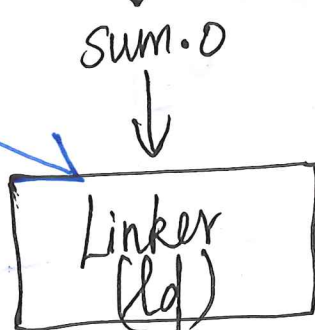
sum.i (preprocessed source file)



sum.s (Assembly file)



(object file)



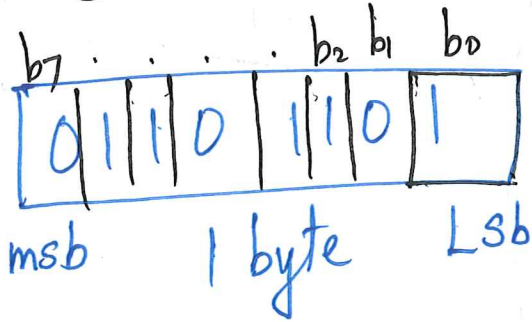
(executable file)

sum

C Programming

bit : 0 or 1

1 byte = 8 bits



circuit
low voltage
high voltage

b - bit

B - byte

$$12_{10} = 1 \times 10^1 + 2 \times 10^0 = 10 + 2 = 12$$
$$123_{10} = 1 \times 10^2 + 2 \times 10^1 + 3 \times 10^0 = 100 + 20 + 3 = 123$$

$$1010_2 = 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$$
$$= 8 + 0 + 2 + 0 = 10$$

2 bits	decimal
$\frac{0}{0}$	→ 0
$\frac{0}{1}$	→ 1
$\frac{1}{0}$	→ 2
$\frac{1}{1}$	→ 3

} $2^2 = 4$

3 bits

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

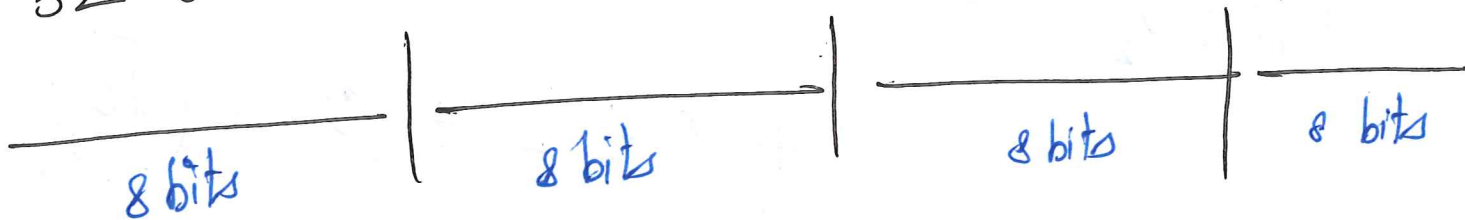
(6)

(3)
 $2^3 =$

8

4 bits $\rightarrow 2^4 = 16$ values.

32 bits $\rightarrow 2^{32} = 2^2 \times (2^{30}) = \underline{\underline{4}} \text{ M/G}$



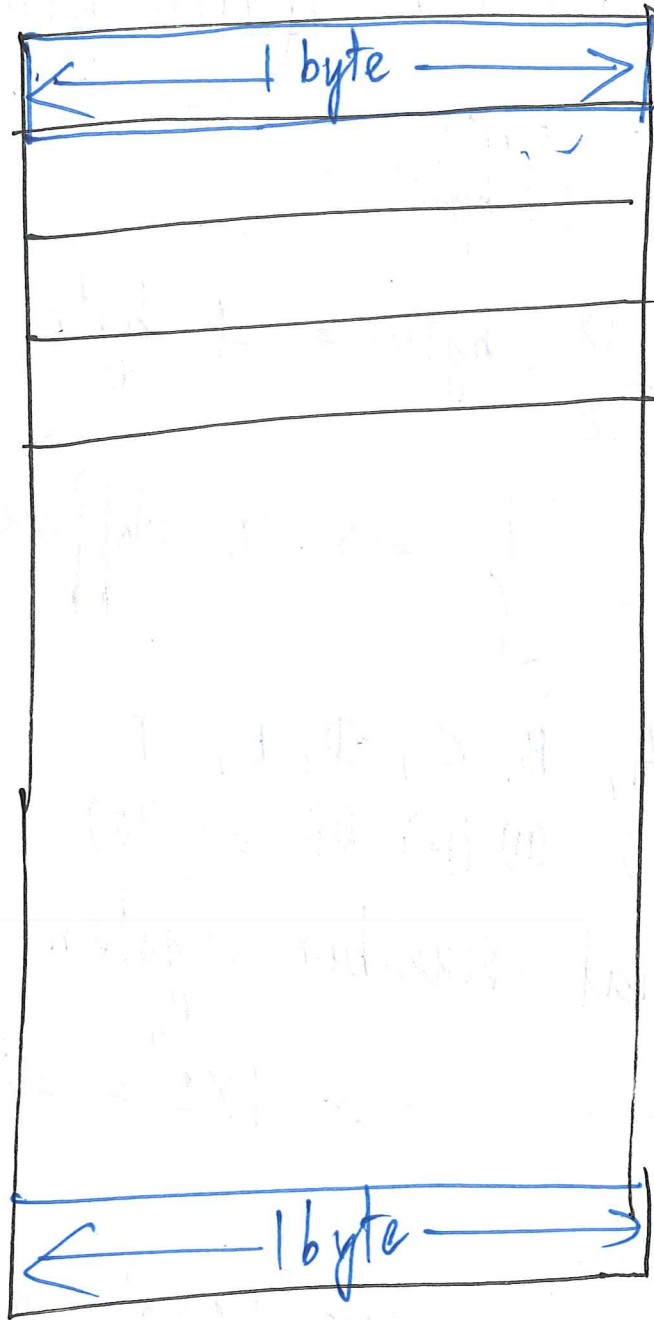
$2^{10} \Rightarrow 1K = 1024$

$2^{20} \Rightarrow 1M = 1024 \times 1024$

$2^{30} \Rightarrow 1G = 1024 \times 1024 \times 1024$

Memory (RAM) (7)

0 0 0 0
0 0 0 1
.
.
.

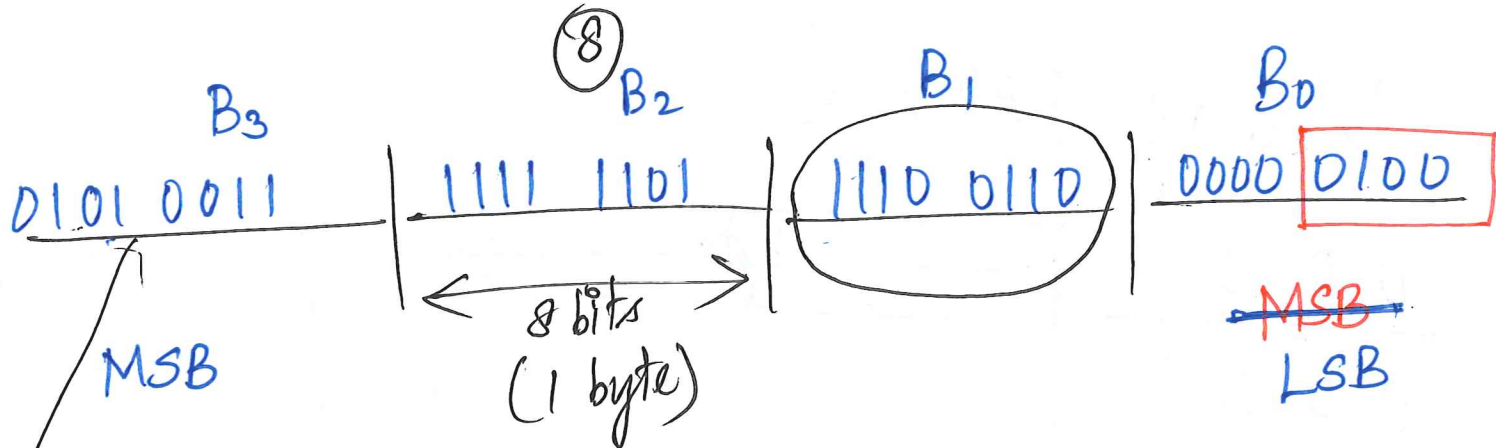


2^4
 $= 16 \text{ bytes}$

1 1 1 1

$n = 32 \text{ bits}$

Memory = 2^{32} bytes
 $= 2^2 \times 2^{30}$ bytes
 $= 4 \times \text{MB}$
 $= \boxed{4 \text{ MB}}$



$32 \text{ bits} = \frac{32}{8} \text{ bytes} = 4 \text{ byte}$

----- } \Rightarrow 16 different values

- 0 - 9, A, B, C, D, E, F
 (10) (11) (12) (13) (14) (15)

Hexadecimal number system.

$0100_2 \xrightarrow{2^3, 2^2, 2^0, 2^0} 1 \times 2^2 = 4_{10} \rightarrow 4_{16}$

$1100_2 \xrightarrow{1 \times 2^3 + 1 \times 2^2} 12_{10} \rightarrow C_{16}$
 (OR)

$1110_2 \mid 0110_2 \rightarrow \boxed{0xE6}$

$0xC$
 \downarrow
 hexadecimal.

$\boxed{0x53FD E6 04}$

9

$$10 \rightarrow \text{0xA} \rightarrow 0/2_{8^1 8^0}$$

$$1 \times 8 + 2 \times 1 = 10$$

$$\begin{aligned} 0x64 &= 6 \times 16^1 + 4 \times 16^0 \\ &= \cancel{64} + \cancel{16} \\ &= 96 + 4 = 100 \end{aligned}$$

$$\begin{aligned} 0144 &= 1 \times 8^2 + 4 \times 8^1 + 4 \times 8^0 \\ &= 64 + 32 + 4 \\ &= 100 \end{aligned}$$

$$0xFF = \underline{1} \underline{1} \underline{1} \underline{1} \quad \underline{1} \underline{1} \underline{1} \underline{1}$$

$$2^8 - 1 = 256 - 1 = 255$$