

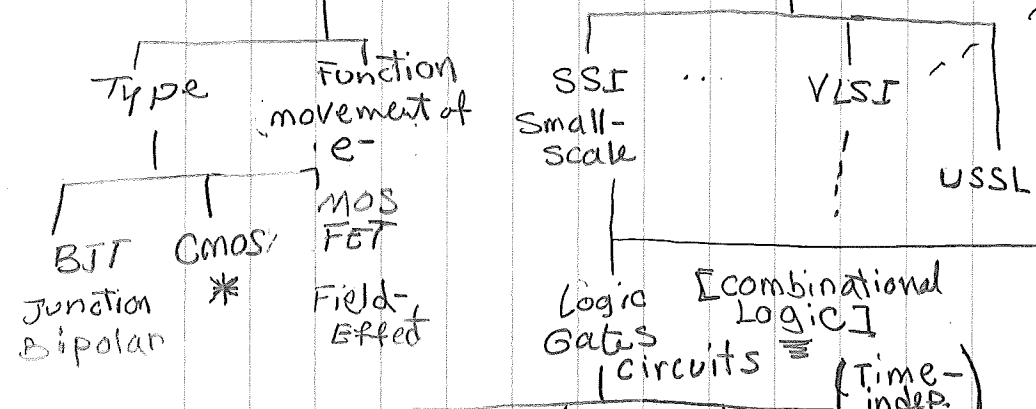
Transistors (Silicon sandwich)

Integrated circuits

Devices → MPU

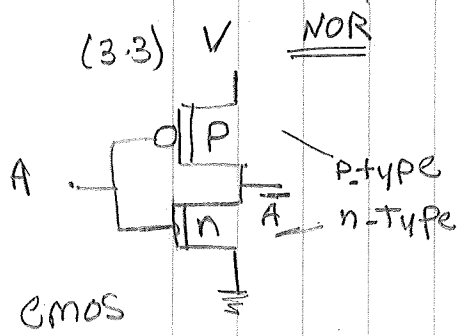
Micro controller units
Small computer on a single chip

CPU memory I/O Bus

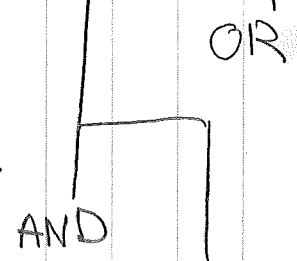
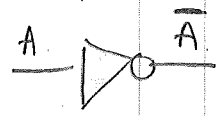


Latches (or Flip-Flops) circuits (one-bit memory)

[Sequential Logic]



A	\bar{A}
1	0
0	1



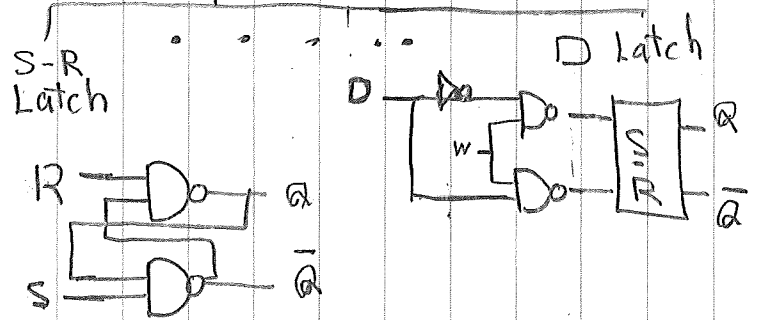
A	B	C	\bar{C}
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

$C = (A \cap B)$

XOR

A	B	C	\bar{C}
0	0	0	1
0	1	1	0
1	0	1	0
1	1	0	1

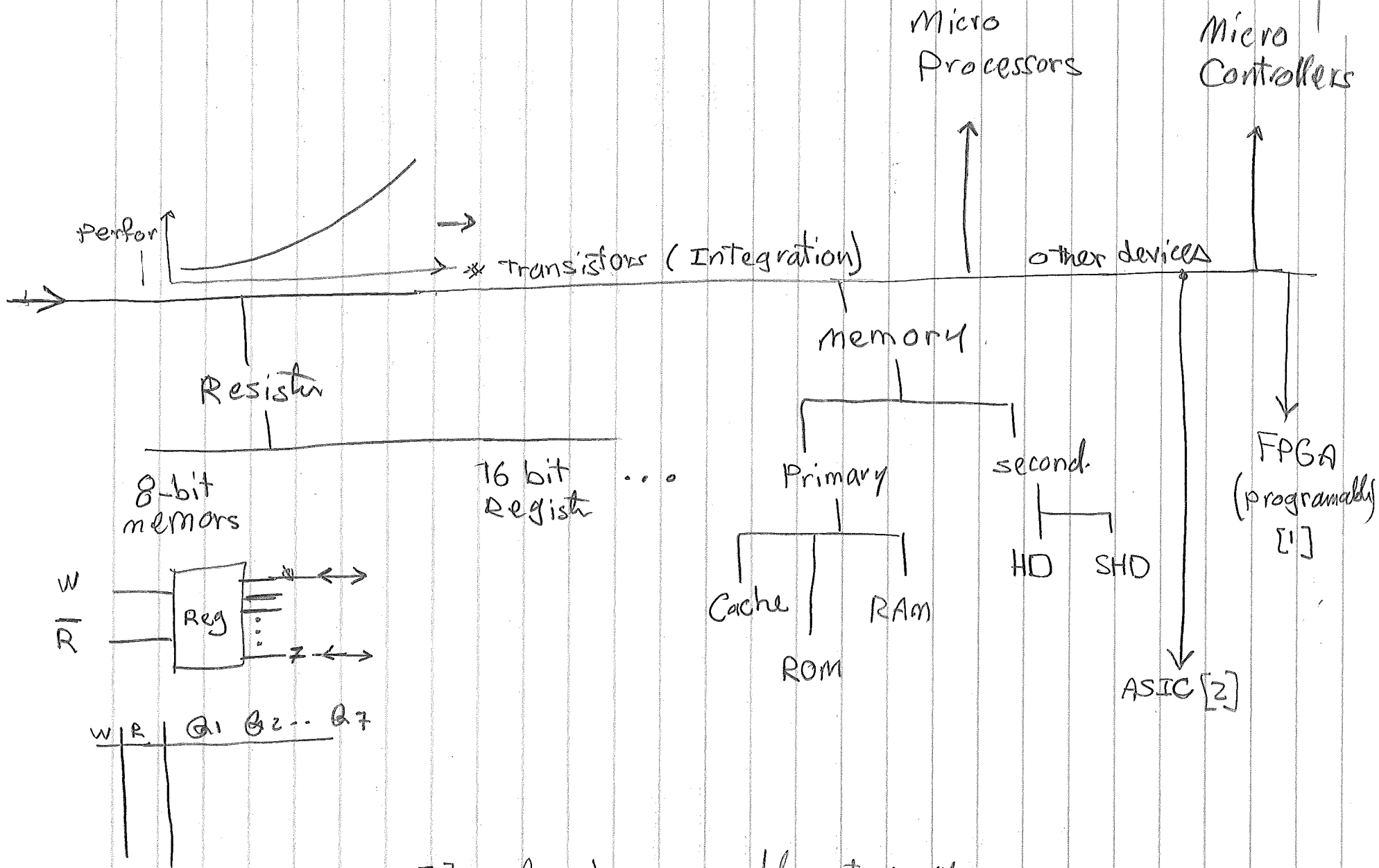
$C = A \oplus B$



S	R	Q
0	0	Latch
0	1	0
1	0	1
1	1	0

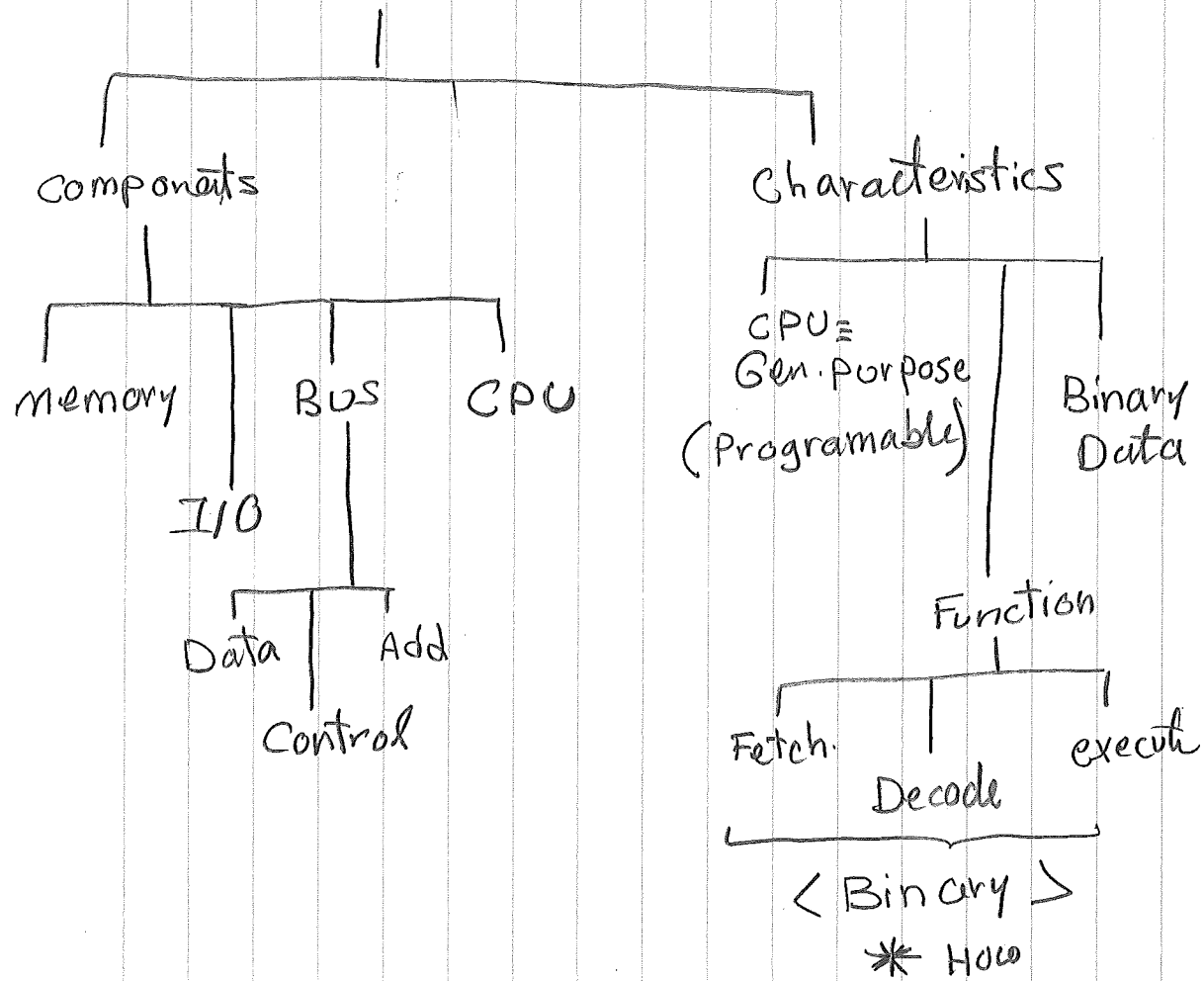
W	D	Q
0	0	Latch
0	1	Latch
1	0	0
1	1	1

* complementary (symmetry) metal-oxide-semicond.



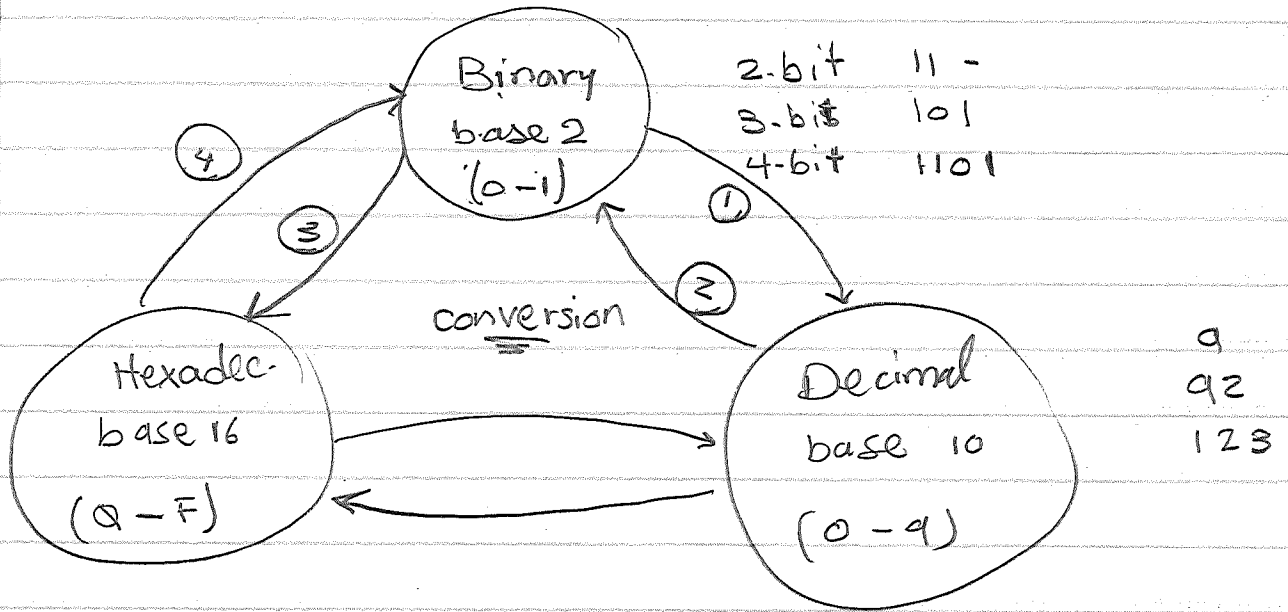
[1] A field-programable gate Array
 [2] Application specific Integ. circuit

Micro processors



Understanding the binary data

• number system



① $101 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 4 + 1 = \underline{\underline{5}}$

$1010 = 1 \times 2^3 + \dots + 1 \times 2^0 = \underline{\underline{10}}$

Negative numbers

② $10/2 \rightarrow 5$ ~~0~~ LSB

$5/2 \rightarrow 2$ 1

$2/2 \rightarrow 1$ ~~0~~

$1/2 \rightarrow \text{0}$ 1 MSB

