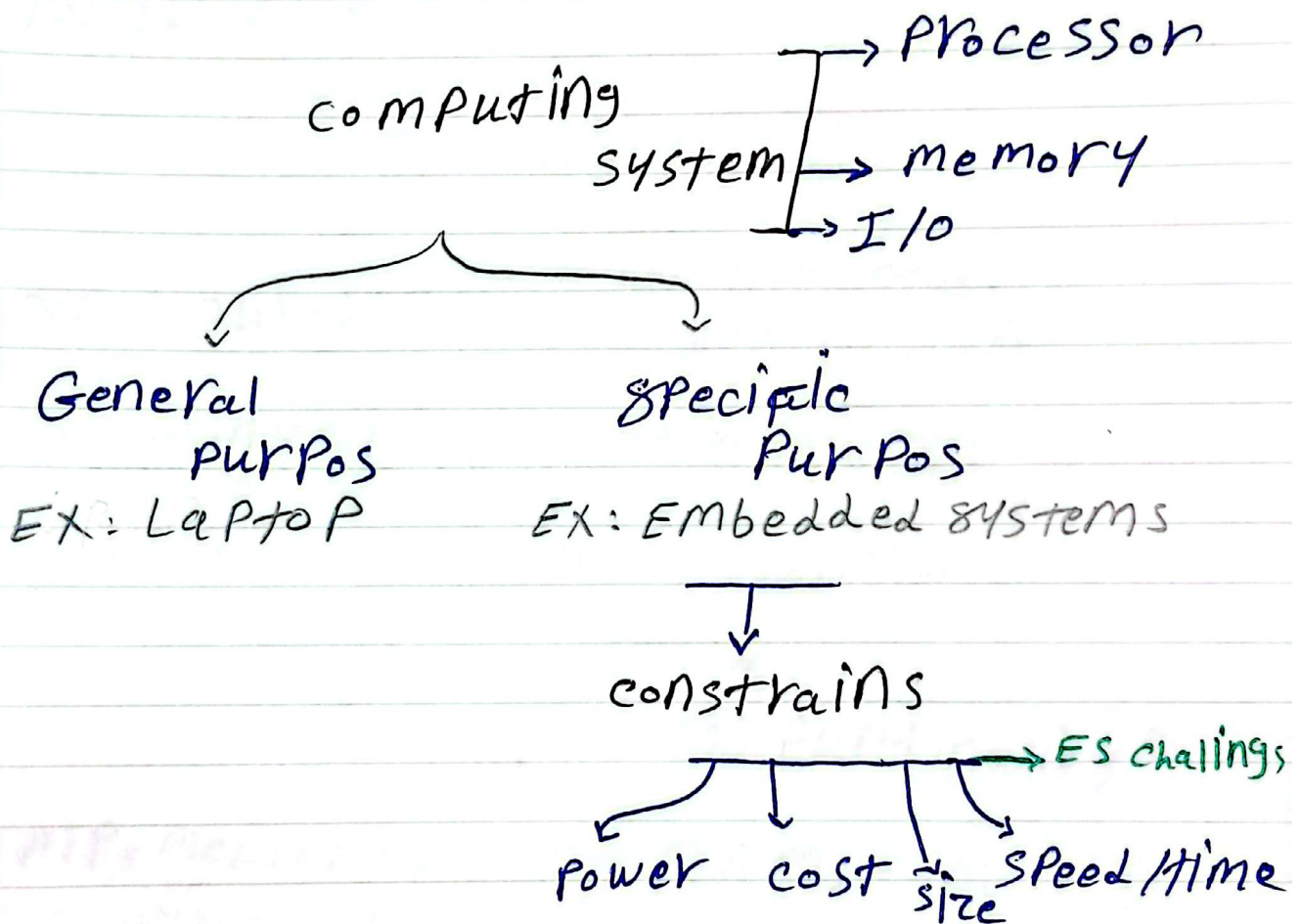


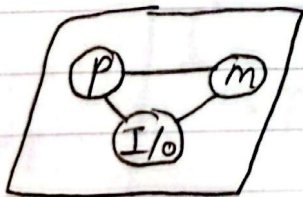
# introduction to Embedded systems

## concepts:-

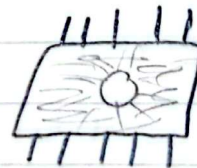


## Embedded systems:-

① system board



② system on chip



	SB	SOC
Size →	↑	↓
Cost →	↑	↓
Power →	↑	↓
	✓	X

configurability ✓ <sup>development stage</sup> → Easy to upgrade

IC :- integrated circuit EX: 555, op-amp

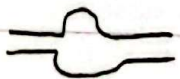
\* VLSI :- millions of Transistors

① size ↓      ② functionality ↑

MP, memory, SOC, RAM, ROM → IC

\* MPU

① Processor

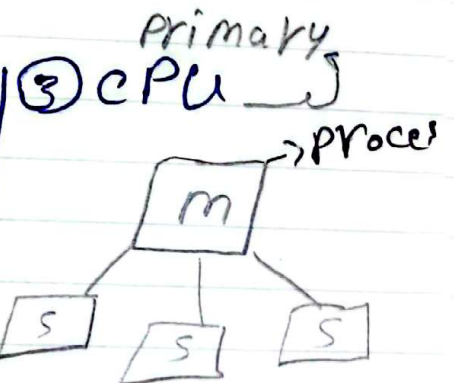


16bit  $\leftrightarrow$  0, 1

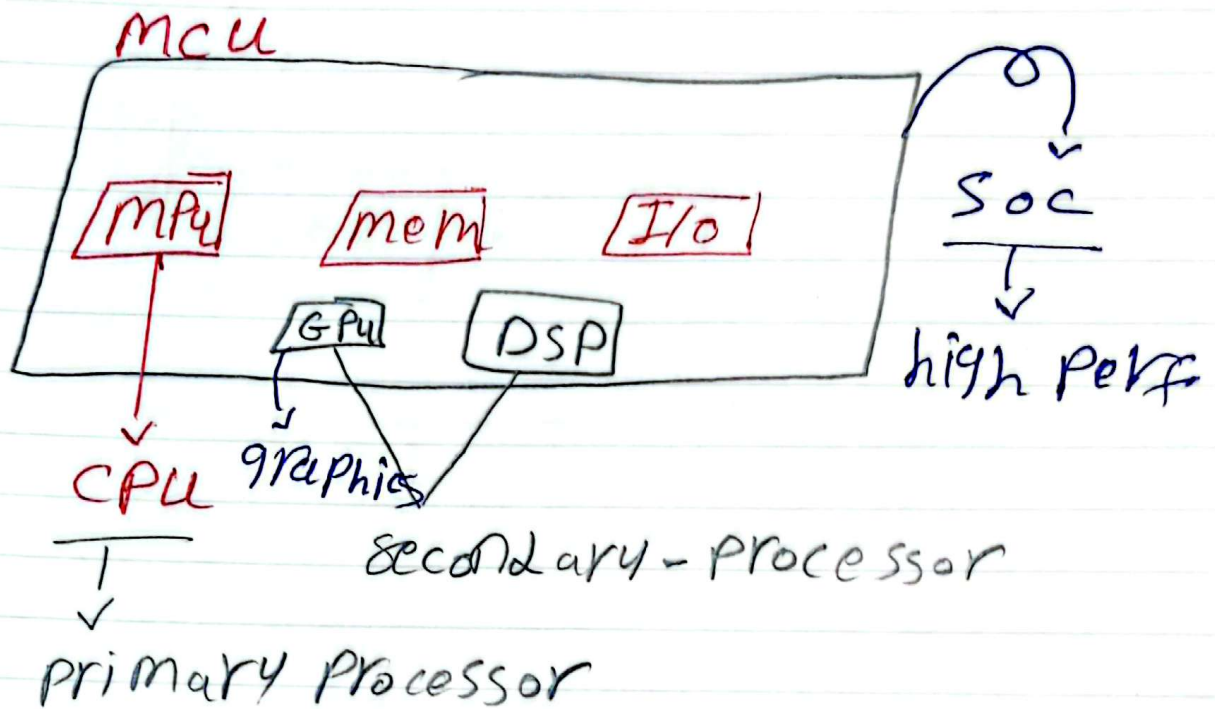
② micro processors

New Processors

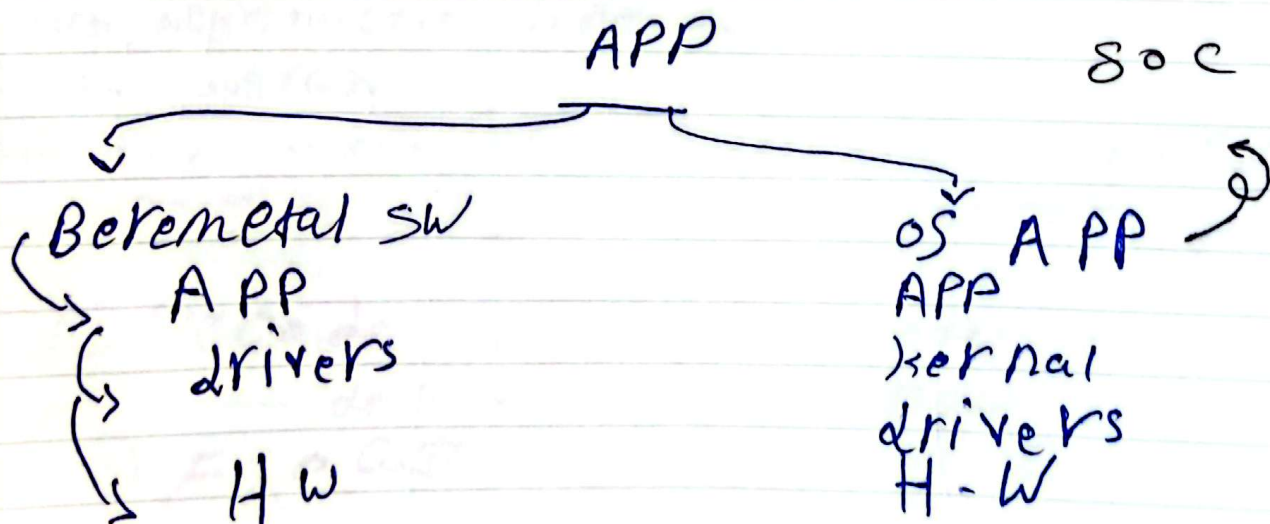
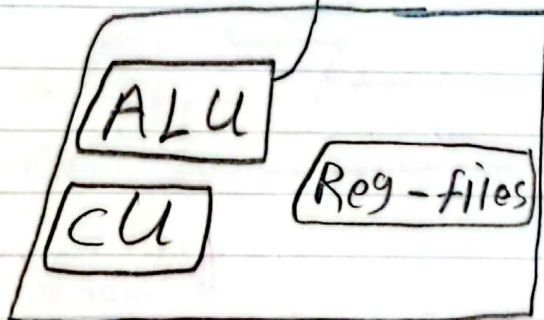
Transistor



\* MCU Micro <sup>controller</sup> ~~computer~~ unit "computing sys"

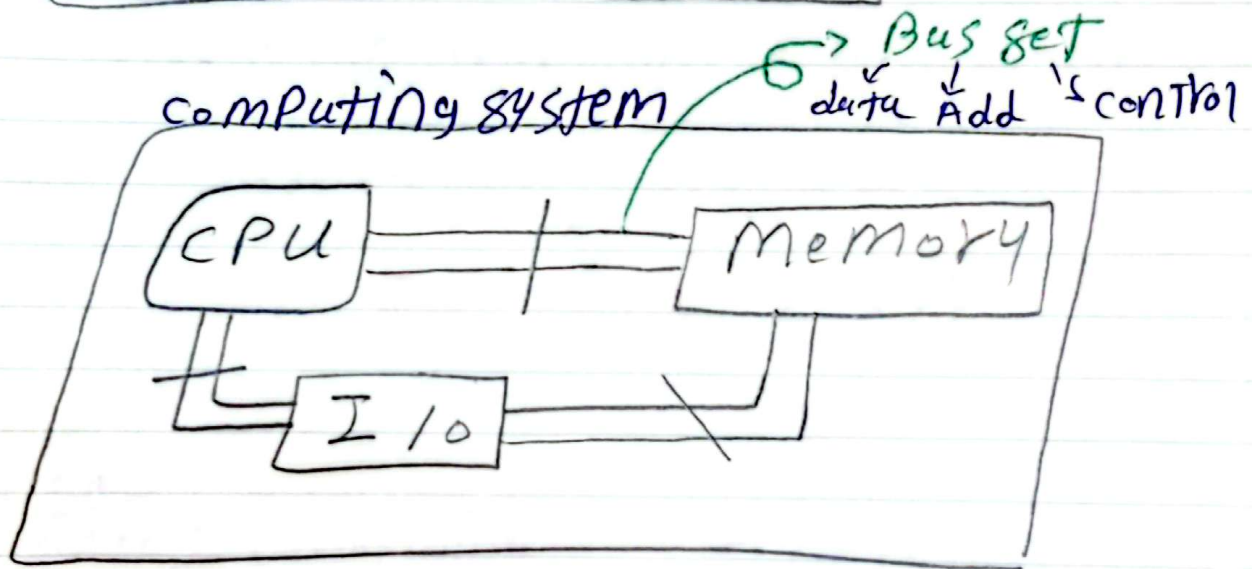
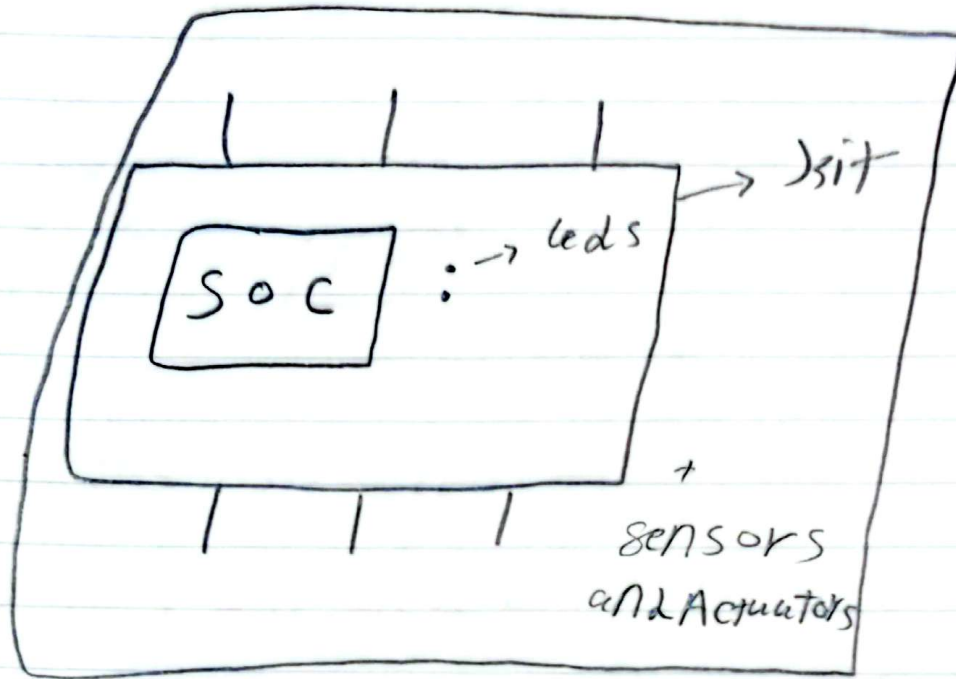


\* MPU Arithmetic Process





# ECU Electrical control unit



\* Process Or ...

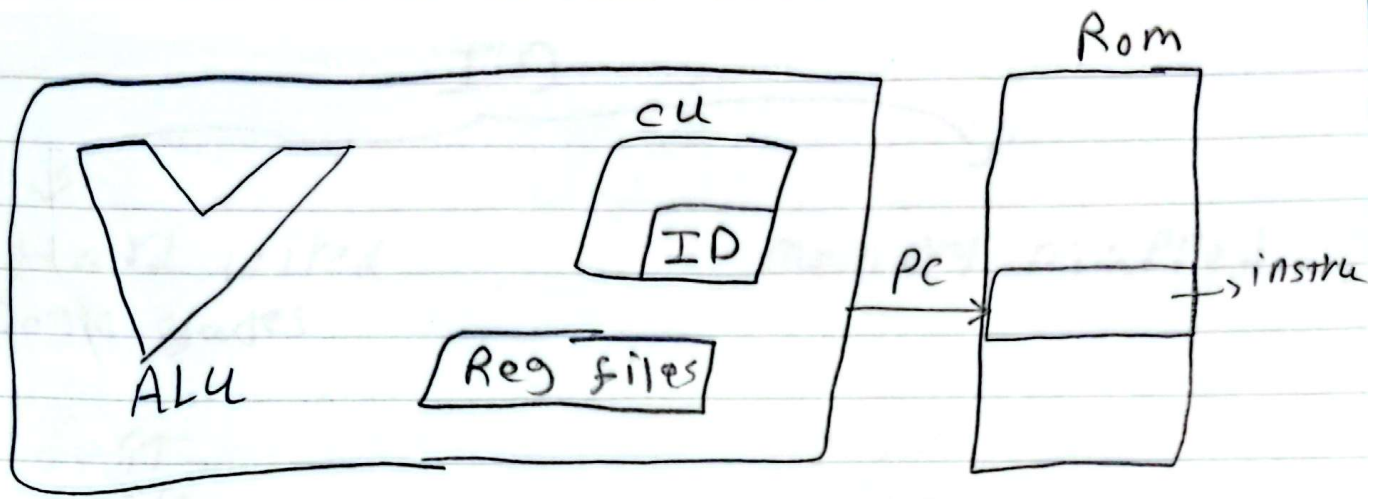
⇒ instruction life cycle

① fetch

CU fetch The instruction from rom to I R " instruction register

② Decode instruction decoder in CU  
decode the instruction

③ Execute



① CU fetch instruction from Rom

② ID Decode instruction

③ After decoding instruction CU send signal to ALU Then Result store → Register files

**\* instruction set Arch ISA**



ID

Hard wired  
logic gates

memory mapped

fast  
simple  
RISC

slow  
CISC

	RISC	CISC
size	ALU↓, ID↑	ALU↑, ID↓
cost	SW↑, HW↓	SW↓, HW↑
perform	=	
power	ALU↓, ID↑	ALU↑, ID↓

\* Register files :-

① General Purpose  
data store  
temporary

② special Purpose  
Each register  
has specific purpose



## \* Special Purpose Register

- ① PC → Program counter  
↳ next instruction
- ② SP → stack pointer
- ③ ACC → Accumulator → result store temp
- ④ IR → instruction Register → store  
The instruction from memory
- ⑤ PSW → Process status word  
↳ flags

## \* Memory: set of locations

- ① volatile → RAM
- ② non volatile → Rom
- ③ Hybrid

Ram  
    → Static → Transistor  
    → Dynamic → Based on Capacitor

① Dynamic Ram  
Advantage

① simple H.W

② low cost Per bit

③ High density

④ low power consumption

② Static Ram

faster, High cost

each bit has 6 Transistor

	S	D
Size	↓	↑
cost	↑	↓
Per	↑	↓
power	↓	↑



# Rom :-

- ① Masked Rom → fixed code
- ② P Rom "programmable rom" → one time Programmable
- ③ EP Rom erasable
- ④ EEPROM settings storage
- ⑤ flash Rom Rewritable firmware