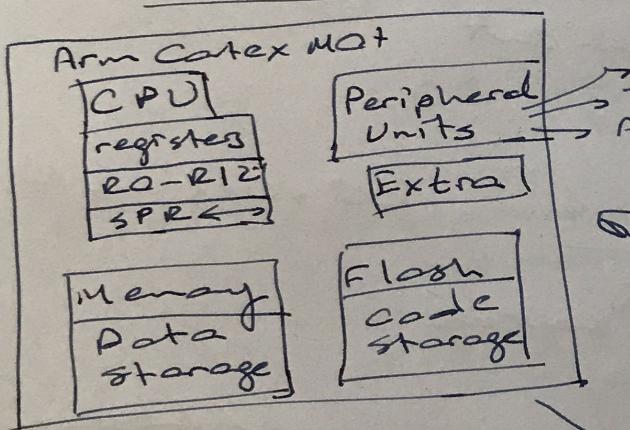


- Assembly Language
- Visual2 Simulator / ← A
- Microcontroller / Assembly language.
- Assembly language
  - "the" language of the MC
  - lowest level language
  - Mnemonics (instructions)
    - Commands
  - Arm Assembly Language
    - Operations are performed on registers.

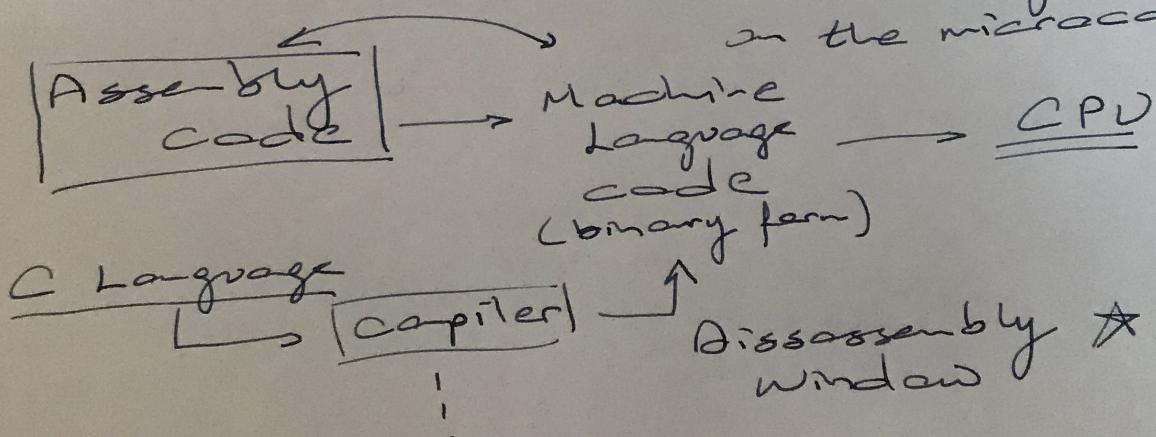
### Microcontroller Architecture (Hardware)



### Microcontroller Architecture (Software)

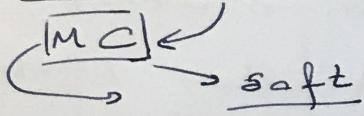
Arm Assembly Language for Cortex M0+ MC  
Mnemonics instructions

Executing commands in the microcontroller.



## Data Moving and Processing Instructions

⇒ Simulator, Emulator



MOV    destination, source  
register    number  
register

Registers    R0 - R12

{MOV R0, #0x12

→ copy 0x12 to register R0

MOV R1, R0

→ copy the content of register R0  
to register R1

→ Data Movement

ADD R1, R0, #0x4       $R0 + 0x4 \rightarrow R1$

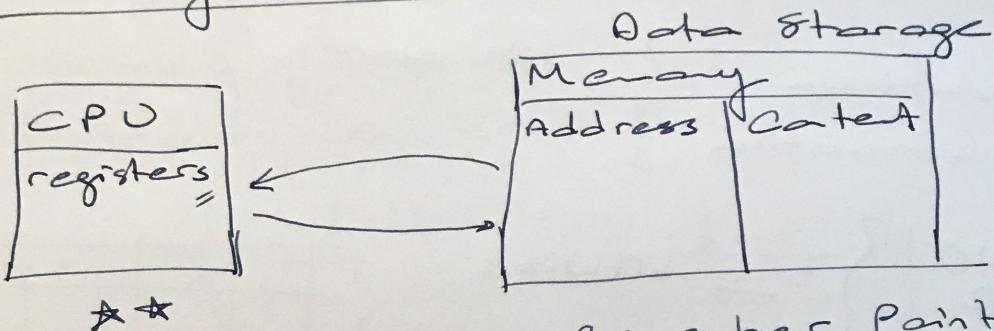
destination    ↓  
                  source

Data Processing

→ Arithmetic and Logic operations  
will be considered.

# Memory Access Instructions

W7-3



★ ★

remember Pointers in C Language.

~~LDR instead using content to register memory~~

LDR R3, =0x20000040  
dest.                  memory address  
register

LDR → ① to store a memory address  
to register

② store a memory content to  
register

LDR R0, [R3]      Pointers  
          ↑               ↑

STR → stores register content to  
memory      Pointers

STR R2, [R3]  
          ↑

# Arithmetic and Logic Operations

W7-5

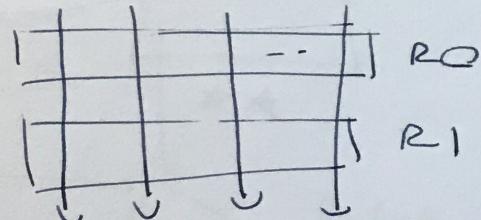
Addition  
Subtraction

} with carry

AND  
OR  
NOT  
XOR

} — bitwise

R0 AND R1



→ Subtraction in arithmetic operators.

⇒ Addition operation in twos comp. form.

$$\begin{array}{r} 0001 \\ \rightarrow 1110 \\ + \quad \quad | \\ \hline 1111 \end{array}$$

twos complement

→ Digital Design

## Branch and Control Instructions

if, while, for NOT available

### Branching instructions

→ Change the flow of the code

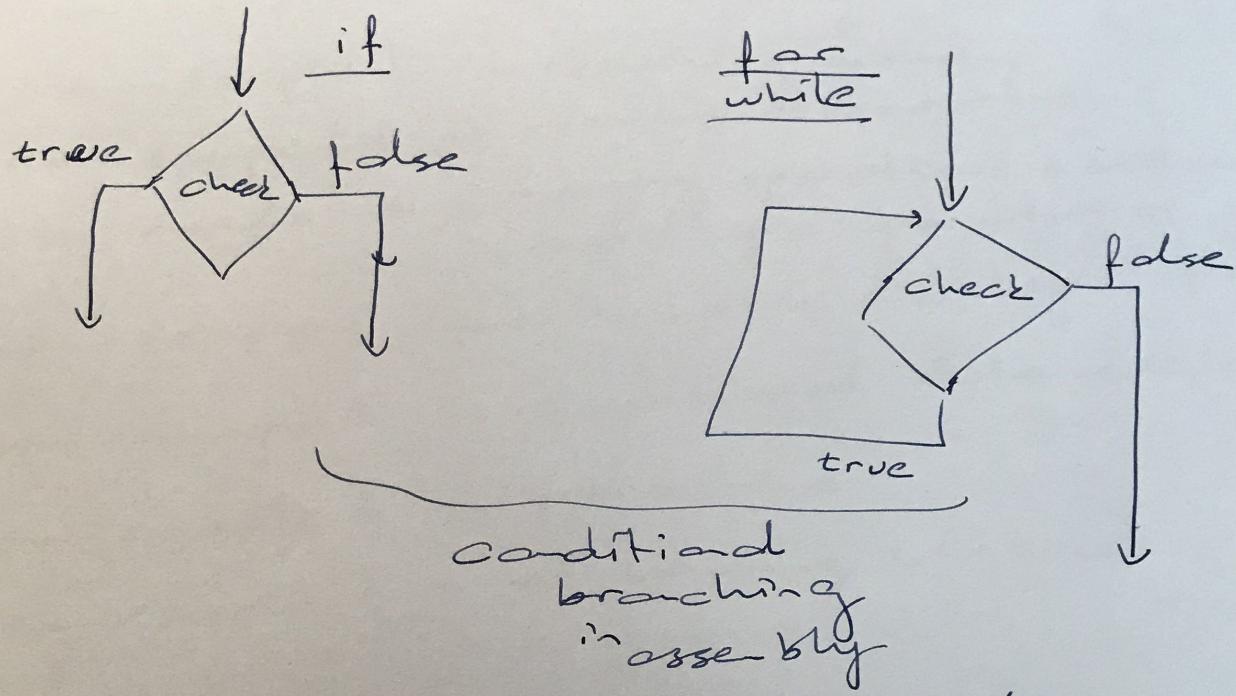
→ conditionally

→ unconditionally

→ Label (where to branch)

CMP → Conditional branching

- We do not have if, for, while in assembly language.
- Instead, we have "conditional" branching.



→ I will share "conditioning" table.