



Macros

ENEE 3582

Microp

MACRO

- ❖ Used to make the code more readable.
- ❖ A group of instructions are associated with an identifier that is defined as a MACRO.
 - Used to create pseudo instruction from a combo of other instructions
- ❖ The macro can then be used in the program repeatedly if needed.
- ❖ The assembler will expand the MACRO to the group of instructions that define it.
 - A macro is NOT a procedure.
 - You do not save any instructions when you write a MACRO
 - You save instructions when you write a procedure

MACRO Definition

```
.MACRO macro_name  
    [executable instructions]  
.ENDMACRO/.ENDM
```

- ❖ You can pass up to 10 parameters to a MACRO
- ❖ Inside the MACRO, input parameters are labeled as @0 - @9.
- ❖ Example:

```
.MACRO    ADDI  
          SUBI @0, -@1  
.ENDM
```

MACRO Call

macro_name @0, @1, ...

❖ @0-@9 are input parameters

➤ Input parameters must match in type and syntax their use inside the macro

❖ Example:

ADDI R16, 5 ;equivalent to SUBI r16, -5

ADDI R16, R17 ;equivalent to SUBI r16, -r17 => syntax error

PC inside MACRO

❖ PC can be used to offset relative jumps

❖ Example:

```
.MACRO    JGT
          CP @0, @1
          breq PC+2    ;PC+1=next instruction. PC+2 = skip 2 lines
          brge PC+@2   ;relative jump

.ENDM

JGT r16, t17, label1 ;@0=r16, @1=r17, @2=label1
```

Exercise

- ❖ Create a macro called ADD2W that works as follows:
 ADD2W result, num1, num2
 where result is a DM variable;
 num1, num2 are PM constants.

```

MACRO                                ADD2W
    LDI ZH, HIGH(@1*2)
    LDI ZL, LOW(@1*2)
    LPM R16, Z+
    LPM R17, Z+

    LDI ZH, HIGH(@2*2)
    LDI ZL, LOW(@2*2)
    LPM R18, Z+
    LPM R19, Z+

    ADD R18,R16
    ADC R19,R17

    LDI XH, HIGH(@1*0)
    LDI XL, LOW(@2*0)
    ST X+, R18
    ST X+,R19
ENDM
  
```

Good Programming Considerations

- ❖ It is very difficult to debug the internal code in a MACRO
 - Test your code thoroughly before writing it as a MACRO
- ❖ PUSH/POP all registers used by the macro at the beginning/end
 - The macro will have no effects on existing register values
- ❖ MACROs can be put into file
 - .INCLUDE <FILE>