



Microprocessors and Interfaces: 2021-22

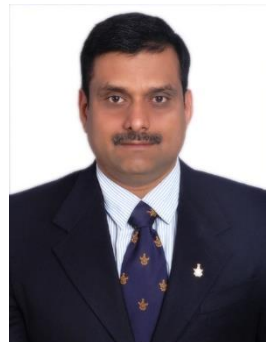
Lab 6

ALP for

1. Arranging numbers in ascending order

2. Matrix addition

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ALPs to be completed

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Problem 1: Arrange numbers in ascending order.

Problem 2: Find matrix addition (2×2) for two numbers.

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6.1 Arrange numbers in ascending order



Assume the numbers and memory locations are given by

Data	A2h	23h	66h	12h	7Dh
Add.	501	502	503	504	505

Number of passes required: N-1

Pass1	A2h	23h	66h	12h	7Dh
	23h	A2h	66h	12h	7Dh
	23h	66h	A2h	12h	7Dh
	23h	66h	12h	A2h	7Dh
	23h	66h	12h	7Dh	A2h

(1 number sorted)

6.1 Arrange numbers in ascending order

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Pass 2	23h	66h	12h	7Dh	A2h
	23h	66h	12h	7Dh	A2h
	23h	12h	66h	7Dh	A2h
	23h	12h	66h	7Dh	A2h

(2 numbers sorted)

Pass 3	23h	12h	66h	7Dh	A2h
	12h	23h	66h	7Dh	A2h
	12h	23h	66h	7Dh	A2h

(3 numbers sorted)

Pass 4	12h	23h	66h	7Dh	A2h
	12h	23h	66h	7Dh	A2h

(All numbers sorted)

6.1 Arrange numbers in ascending order

Pseudocode

```
org 100h

MOV SI, xxxxh
MOV CL, [yy]
DEC CL
L1: MOV SI, xxxxh
    MOV CH, [yy]
    DEC CH
    INC SI
L2: MOV AL, [yy]
    INC SI
    CMP AL, [yy]
    JC L3
    XCHG AL, [yy]
    DEC SI
    XCHG AL, [yy]
    INC SI
L3: DEC CH
    JNZ L2
    DEC CL
    JNZ L1
    HLT

ret
```

Assume SI = 0500h

Change the values of xxxxh and yy to complete the code.

Load the following numbers in the exact order:
A2, 23, 66, 12, 7D

Load the number in the RAM prior to execution of your code.

6.1 Review Questions

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1. How CMP instruction works?
2. Which registers are to be modified for 16-bit data?
3. Repeat the problem using the data in the following order:
99H,12H,56H,45H,36H
4. What should be the content of the memory location
0700:0500?

6.2 Matrix addition (3 × 3) for two numbers

- Matrix to be stored in the form of array in the memory location.
- Storing matrix data to be taken care by BX, BP and DI registers.
- SI to be used to identify the data locations.
- Arithmetic operation to be done element wise.
- Loop instruction to be used to repeat the operations
- CL register to store the number of data in a matrix.

2. To be loaded by BP register

$\begin{bmatrix} 01 & 02 & 03 \\ 04 & 05 & 06 \\ 07 & 08 & 09 \end{bmatrix}$	+	$\begin{bmatrix} F0 & E1 & D2 \\ C3 & B4 & A5 \\ 96 & 87 & 78 \end{bmatrix}$	=	$\begin{bmatrix} F1 & E3 & D5 \\ C7 & B9 & AB \\ 9D & 8F & 81 \end{bmatrix}$
Matrix 1		Matrix 2		Matrix 3

1. To be loaded by BX register

3. To be loaded by DI register

6.2 Matrix addition (3 × 3) for two numbers

Pseudocode

```
org 100h

MOV BX, xxxxH
MOV BP, yyyyH
MOV DI, zzzzH
MOV SI, 0001H
MOV CL, wwH
L1: MOV AL, [BX+SI]
    ADD AL, [BP+SI]
    MOV [zz], AL
    INC SI
    INC DI
    LOOP L1
HLT
ret
```

Assume: BX = 1300H; BP = 1400H and DI = 1500H.

Changes are to be made to complete the ALP.

6.2 Matrix addition

```
; Same-size matrices addition (of 16b word elements): C = A + B
; ds:si = A address, ds:bx = B address
; ds:di = C address, cx = total amount of elements
; modifies: all input registers and ax
matrices_add:
    mov     ax,[si]
    add     ax,[bx]      ; ax = A[i] + B[i]
    mov     [di],ax      ; C[i] = ax
    ; ++i (actually advancing all three pointers instead of using index)
    add     si,2
    add     bx,2
    add     di,2
    ; loop until all elements are added
    dec     cx
    jnz     matrices_add
    ret
```

6.2 Review Questions

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1. What should be the value of CL represent in the given pseudocode?
2. Change the previous code to solve the following.

$$\begin{bmatrix} 02 & 03 \\ 07 & 09 \end{bmatrix} + \begin{bmatrix} 97 & 31 \\ A2 & 87 \end{bmatrix}$$

Thankyou

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