Sheet 2

1. Write a program that adds the following two multiword numbers stored in memory and save the result using one-word transfers at a time:
   DATA1=5463F8A8D37EH and DATA2=87DE340892C2H

2. Repeat the previous program to subtract the two multiword numbers and save the result. Subtraction should be done one byte at a time.

3. In some applications it is a common practice to save all registers at the beginning of a subroutine. Assume that SP = 1288H before a subroutine CALL.
   For the following code:

```
1132:0450 CALL PROC1
1132:0453 INC BX

PROC1 PROC
        PUSH AX
        PUSH BX
        PUSH CX
        PUSH DX
        PUSH SI
        PUSH DI
        PUSHF
.......
PROC1        ENDP
```

A. Show the contents of the stack pointer and the exact memory contents of the stack after PUSHF.

B. To restore the original information inside the CPU at the end of a CALL to a subroutine, the sequence of POP instructions must follow a certain order. Write the sequence of POP instructions that will restore the information. At each point, show the contents of the SP.

C. Pushing all registers can be done in a single instruction. Same also applies for popping. What instructions are used to:
   a. Push all registers.
   b. Pop all registers.

4. The following program contains some errors. Fix the errors and make the program run correctly. This program adds four words and saves the result.

```
.MODEL SMALL
.STACK 32
;-------------------------------
.DATA
DATA DW 234DH,DE6H,3BC7H,566AH
ORG 10H
SUM DW ?
;-------------------------------
.CODE
START:      PROC        FAR
            MOV
            AX,DATA
            MOV DS,AX
            MOV CX,04 ;  LOOP COUNTER = 4
            MOV BX,0    ;INITIALIZE BX TO ZERO
            MOV DI,OFFSET DATA ;SET UP DATA POINTER BX
LOOP1:      ADD BX,[DI] ;ADD CONTENTS POINTED AT BY [DI] TO
BX
            INC DI      ;INCREMENT DI
            JNZ LOOP1   ;JUMP IF COUNTER NOT ZERO
            MOV SI,OFFSET RESULT ;LOAD POINTER FOR RESULT
            MOV [SI],BX ;STORE THE SUM
            HLT
START       ENDP
END         STRT
```

5. Find CF, ZF, and AF for each of the following. Also indicate the result of the addition and where the result is saved

a)
MOV BH,3FH
ADD BH,45H
	b)
	MOV
	BX,0FF01H
	ADD BL,BH
		c)
		MOV AH,0FEH
		STC
		ADC AH,00

d)
MOV DX,4599H
MOV CX,3458H
ADD CX,DX
	e)
	MOV AX,255
	STC
	ADC AX,00
		f)
		MOV CX,0FFFFH
		STC
		ADC CX,00

6. Assume that the following registers contain these HEX contents: AX = F000, BX = 3456, and DX = E390. Perform the following operations. Indicate the result and the register where it is stored. Give also ZF and CF in each case.
Note: the operations are independent of each other.

a) AND DX, AX	b) XOR AL, 76H	c) XOR AX,AX
d) AND AH, 0FF	e) XOR DX, 0EEEEH	f) MOV CL, 04 SHL AL,CL
g) MOV CL, 3 SHR DL,CL	h) MOV CL, 6 SHL DX,CL	

7. Indicate the status of ZF and CF after CMP is executed in each of the following cases.

MOV BX,2500 CMP BX,1400	SUB AX,AX CMP AX,0000	MOV DL,34 CMP DL,88
MOV AL,0FFH CMP AL,6FH	XOR DX,DX CMP DX,0FFFFH	MOV BX,2378H MOV DX,4000H CMP DX,BX

SUB CX,CX
DEC CX
CMP CX,0FFFFH
	MOV AL,0AAH AND
	AL,55H
	CMP AL,00	

8. Indicate whether or not the jump happens in each case.
   a) MOV CL,5 b) MOV BH,65H c) MOV AH,55H

MOV CL,5
SUB AL,AL
SHL AL,CL
JNC TARGET
	MOV BH,65H
	MOV AL,48H
	OR AL,BH
	SHL AL,1
	JC TARGET
		MOV AH,55H
		SUB DL,DL
		OR DL,AH
		MOV CL,AH
		AND CL,0FH
		SHR DL,CL
		JNC TARGET

9. Write a program to convert all uppercase letters to lowercase.
   .Data
   InputString DB 'THis iS A TEsT MESsaGE'
   ResultString DB 22 DUP(?)

10. An instructor named Mr. Mo Allem has the following grading policy: "Curving of grades is achieved by adding to every grade the difference between 99 and the highest grade in the class." If the following are the grades of the class, write a program to calculate the grades after they have been curved: 81, 65, 77, 82, 73,55, 88, 78, 51, 91, 86, 76. Your program should work for any set of grades.