Department of Information and Communication Engineering

CSE-3102: Microprocessor and Interfacing Lab

Experiment No. 03:

Logic operations in assembly language.

Objective:

To load programs containing logic instructions to MDA-8086, execute the program in single step mode and verify the results.

Logical instructions:

Logical instructions include NOT, AND, OR, XOR, TEST etc. instructions. There job is to compare the data values and make results according to logic specified. For example,

```
MOV BX, 30H    ; In binary 110000
NOT BX         ; In binary 001111
```

This code takes BX value and then complements all the bits and stores the new value to BX. So it stores 0F value in BX after executing NOT operation. For another example,

```
MOV BX, 70H    ; In binary 1110000
MOV CX, 40H    ; In binary 1000000
AND CX, BX     ; In binary 1000000
```

AND operation performs bit by bit AND operation and then stores the value in first operand. In upper code CX holds the final result.

```
MOV BX, 70H    ; In binary 1110000
MOV CX, 40H    ; In binary 1000000
OR CX, BX      ; In binary 1110000
```

OR operation performs bit by bit OR operation and then stores the value in first operand. In upper code CX holds the final result. Similar case happens for XOR and it is given below,

```
MOV BX, 70H    ; In binary 1110000
MOV CX, 40H    ; In binary 1000000
XOR CX, BX     ; In binary 0110000
```

Test operation is a little different from AND operation. It performs bit by bit AND operation but it does not change any operands value.

```
MOV BX, 70H    ; In binary 1110000
MOV CX, 40H    ; In binary 1000000
TEST CX, BX    ; In binary CX value is 1000000
```

All the logical instructions stated above upgrades all the flag register values except AF register. NOT command does not effect any flags. How flags are affected is stated below.

```
MOV BX, 70H    ; In binary 1110000
MOV CX, 40H    ; In binary 1000000
AND CX, BX     ; In binary 1110000
```

After this operation Zero Flag is 0 (ZF = 0; as the value of CX is not 0), Carry Flag is 0 (CF = 0; as there is no carry), Parity Flag is 0 (PF = 0; as there are odd number of 1's), Sign Flag is 0 (SF = 1), Overflow Flag is 0 (OF = 0; as there is no overflow). In this all the flags can be determined.

Do not confuse yourself with semicolon given after each line in assembly codes above. Comments are written after semi colon ';' in assembly language.

Program:

```
CODE SEGMENT
        ASSUME  CS:CODE,DS:CODE,ES:CODE,SS:CODE
        ORG 1000H
        MOV AX, 1027H
        MOV BX, 5A27H
        MOV CX, 54A5H
        OR AX, BX
        XOR AX, CX
        NOT AX
        TEST CX, BX
        AND CX, AX
        HLT
CODE ENDS
        END
```

Experiment Requirements:

1. 8086 microprocessor kit.
2. Assembler "MASM" and loader "LOD186".
3. WinComm.

Experiment Procedures:

1. Write the program in notepad and save the file as "filename.asm". Place this file in the folder where "masm.exe" exists.
2. Go to command prompt and execute "masm.exe". You will see the following message

```
Microsoft (R) Macro Assembler Version 5.10
Copyright (C) Misrosoft Corp 1981, 1988. All right reserved.

Source filename [.ASM]:
```

3. Follow the procedure given below to prepare machine code for your program:

```
Source filename [.ASM]:          filename Press ENTER
Object filename [filename.OBJ]:  Press ENTER
Source listing [NUL.LST]:        filename Press ENTER
Cross reference [NUL.CRF]:       Press ENTER
```

4. Execute "LOD186.exe". You will see the following message Paragon LOD186 Loader-Version 4.0h

```
Copyright (C) 1983 - 1986 Microtec Research Inc. ALL RIGHT RESERVED.

Object/Command File [.OBJ]:
```

5. Follow the procedure given below to prepare HEX (ABS) file for your program:

```
Object/Command File [.OBJ]:      filename Press ENTER
Output Object File [filename.ABS]:  Press ENTER
Map Filename [C:NUL.MAP]:        Press ENTER
**LOAD COMPLETE
```

6. Turn on the 8086 microprocessor kit
7. Open the "Wincomm" window. Press "L" then "Enter". You will see the following message:

```
** Serial Monitor 1.0 **
** Midas 335-0964/5 **
8086 >L Press ENTER
Down load start !!
```

8. Strike PgUp or F3 key of your keyboard. A new window will appear. Locate the "filename.ABS" file and open it.

9. You will observe that file download has started. A message like the following one will be shown:

```
:14100000B800008ED88EC0BB00208B078A6F028A4F038BEBB6
:101014003E8B5604268B76068B7E088B1E0A20CCCC
:0E20000012345678ABCDF0146853B1C41020E2
:00000001FF
OK completed !!
```

10. After loading the program, execute it in single step mode. Fill up the data table and verify the results.

Offset Address	Instruction / Mnemonics	AX	BX	CX	DX	Set Flag Bit(s)	IP
	Initial Status						
	MOV AX, 1027H						
	MOV BX, 5A27H						
	MOV CX, 54A5H						
	OR AX, BX						
	XOR AX, CX						
	NOT AX						
	TEST CX, BX						
	AND CX, AX						

Report:

1. Discuss the effect of each instruction/ mnemonics that is used in this program.

References:

1. User's manual of MDA-8086 microprocessor kit, Midas Engineering, www.midaseng.com

2. "Assembly Language Programming and Organization of the IBM PC", Ytha Yu and Charles Marut, Mitchell McGraw-Hill.

Prepared by

Md. Sabbir Ejaz

Lecturer/ Dept. of ICE/ NSTU