Terna Engineering College
Computer Engineering Department

Program: Sem V

Course: Microprocessor Lab

Faculty: ARATHI BOYANAPALLI

LAB Manual

PART A

(PART A: TO BE REFERRED BY STUDENTS)

Experiment No. 3

A.1 Aim:
Write an assembly language program to find the length of an input string. [Use BIOS/DOS interrupts to read input and display results.]

A.2 Prerequisite:
Basic knowledge of DOS/BIOS Interrupts of 8086

A.3 Outcome:
After successful completion of this experiment, students will be able to

1. Use appropriate instructions to program microprocessors to perform various tasks.
2. Develop the program in assembly/ mixed language for Intel 8086 processor.
3. Demonstrate the execution and debugging of assembly/ mixed language programs.

A.4 Theory
The DOS interrupt INT 21H provides a large number of services. A function code has been allocated to each service provided by INT 21H. The function code should be loaded into the AH register before calling INT 21H to avail the service provided by the function

- INT 21h - The general function dispatcher

Most of the general functions and services offered by DOS are implemented through this interrupt. The functions available are well standardized and should be common to all MS-DOS, PCDOS and DOS Plus systems. Well behaved programs, therefore, should use these facilities in preference to any other methods available for the widest range of compatibility.INT 21h in the 512's implementation of DOS Plus 2.1 provides 77 official functions, two of which are non-functional and return with no action. Within

this range, some calls have sub-functions which further extend the range of operations.

In all calls, on entry AH defines the function. Other parameters may also be required in other registers. Where a memory block is used by the call this is specified in the normal segment: offset form. In all cases, the general programming technique is to set AH to the function pointer, set up the required register contents (and the memory block if necessary) then to issue the call by the assembly code INT instruction. To call the recommended program terminate routine, INT 21h function 4Ch,

- Examples of most popular functions can be used here

DOS INT 21H Useful DOS interrupt to input information from the keyboard and display it on the screen
Function 09 – outputting a string of data to the monitor
AH = 09; function number DX = offset address of the ASCII data to be displayed, the data segment is assumed The ASCII string must end with the dollar sign $
Function 02 – outputting a single character to the monitor
AH = 02; function number DL = ASCII code of the character to be displayed
Function 01 – inputting a single character, with an echo
AH = 01; function number After the interrupt AL = ASCII code of the input and is echoed to the monitor
Function 0A – inputting a string of data from the keyboard
AH = 0A; function number DX = offset address at which the string of data is stored (buffer area), the data segment is assumed and the string must end with

A.5 Algorithm

1. Defines the memory model
2. Initialize the data segment with variables to store the strings and array, Eg:-msg1 db “enter your string-$”,msg2 db” length of the string” and for array eg:-string1 db 50 DUP(“$”)
3. Initialize the code segment
4. Apply the Dos Interrupt with Function 09h to display content on the screen(Eg: Enter your string)
5. Apply function 0Ah to get the string from keyboard and o2h for outputting a single character to the monitor
6. Compare SI with AL until JE is zero, if not increment the SI and the string count
7. Store the result and display
8. Terminate the program

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the ERP or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no ERP access available)

Roll No. : 50	Name: Amey Thakur
Class: TE-Comps B	Batch: B3
Date of Experiment: 03/08/2020	Date of Submission: 03/08/2020
Grade:	

B.1 Software Code written by a student:

(Paste your code completed during the 2 hours of practical in the lab here)

Refer B.2

B.2 Input and Output:

Input -

```
DATA SEGMENT
    STR1 DB "ENTER YOUR STRING HERE       :$"
    STR2 DB "ENTERED STRING IS            :$"
    STR3 DB "LENGTH OF STRING IS (DIRECT) :$"
    STR4 DB "LENGTH OF STRING IS (COUNT) :$"
    INSTR1 DB 20 DUP("$")
    NEWLINE DB 10,13,"$"
    LN DB 5 DUP("$")
    N DB "$"
    S DB ?
DATA ENDS

CODE SEGMENT
ASSUME DS:DATA,CS:CODE
    FILLY:
    MOV AX,DATA
    MOV DS,AX
    LEA SI, INSTR1
```

```
; GET STRING
    MOV AH,09H
    LEA DX,STR1
    INT 21H
    MOV AH,0AH
    MOV DX,SI
    INT 21H
    MOV AH,09H
    LEA DX,NEWLINE
    INT 21H

; PRINT THE STRING
    MOV AH,09H
    LEA DX, STR2
    INT 21H
    MOV AH,09H
    LEA DX,INSTR1+2
    INT 21H
    MOV AH,09H
    LEA DX,NEWLINE
    INT 21H

; PRINT LENGTH OF STRING (DIRECT)
    MOV AH,09H
    LEA DX, STR3
    INT 21H
    MOV BL, INSTR1+1
    ADD BL,30H
    MOV AH,02H
    MOV DL,BL
    INT 21H
    MOV AH,09H
    LEA DX,NEWLINE
    INT 21H

; PRINT LENGTH OF STRING ANOTHER WAY
    MOV AH,09H
    LEA DX, STR4
    INT 21H
    ADD SI,2
    MOV AX,00
    L2:CMP BYTE PTR[SI],"$"
    JE L1
    INC SI
    ADD AL,1
```

```
    JMP L2
    L1: SUB AL,1
    ADD AL,30H
    MOV AH,02H
    MOV DL,AL
    INT 21H
    MOV AH,4CH
    INT 21H
    CODE ENDS
END FILLY
```

Output -

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ subpart assigned)

- 8086 Microprocessor is an enhanced version of 8085Microprocessor that was designed by Intel in 1976. It is a 16-bit Microprocessor having 20 address lines and16 data lines that provides up to 1MB storage. It consists of a powerful instruction set, which provides operations like multiplication and division easily.
- It supports two modes of operation, i.e. Maximum mode and Minimum mode. The maximum mode is suitable for systems having multiple processors and Minimum mode is suitable for systems having a single processor.

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

We successfully learned assembly language programs to find the length of an input string and also to Use BIOS/DOS interrupts to read input and display results.

B.5 Question of Curiosity

Q1. List and explain any four string operation instruction

Ans:

The string is a group of bytes/words and their memory is always allocated in sequential order. Following is the list of instructions –

1. REP – Used to repeat the given instruction till CX ≠ 0.
2. REPE/REPZ – Used to repeat the given instruction until CX = 0 or zero flag ZF = 1.
3. REPNE/REPNZ – Used to repeat the given instruction until CX = 0 or zero flag ZF = 1.
4. MOVS/MOVSB/MOVSW – Used to move the byte/word from one string to another.
5. COMS/COMPSB/COMPSW – Used to compare two string bytes/words.
6. INS/INSB/INSW – Used as an input string/byte/word from the I/O port to the provided memory location.
7. OUTS/OUTSB/OUTSW – Used as an output string/byte/word from the provided memory location to the I/O port.
8. SCAS/SCASB/SCASW – Used to scan a string and compare its byte with a byte in AL or string word with a word in AX.
9. LODS/LODSB/LODSW – Used to store the string byte into AL or string word into AX.

Q2. Write an assembly language program to transfer a block by using string instructions

Ans: Input -

```
DATA SEGMENT
BLK DB 10H, 20H,30H,40H, 50H
DATA ENDS

EXTRA SEGMENT
RESULT DB 5 DUP(?)
EXTRA ENDS

CODE SEGMENT
ASSUME DS: DATA, CS: CODE, ES: EXTRA
    START: MOV BX,DATA
    MOV DS,BX
    MOV BX,EXTRA
    MOV ES, BX
    LEA SI, BLKZ
    LEA DI, RESULT
    MOV CX,0005H
    REP MOVSB
    MOV AH,4CH
    INT 21H
    CODE ENDS
END START
```