Lab Work -03

Course Name: Microprocessor and Microcontroller Lab

Course: CSE 316

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Program: BSc in CSE (BUBT)

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AND

Code

```
 TITLE AL-032 : An AL Program to read a letter in Lower case and print it
            ; after converting it in to Upper case letter ( using AND
            ; Logic instruction )
.MODEL SMALL
.STACK 100H
.DATA
  PROMPT_1  DB  'Enter the Lower Case Letter : $'
   PROMPT_2  DB  0DH,0AH,'The Upper Case Letter is : $'
.CODE
  MAIN PROC
    MOV AX, @DATA              ; initialize DS
    MOV DS, AX
    LEA DX, PROMPT_1            ; load and print PROMPT_1
    MOV AH, 9
    INT 21H
    MOV AH, 1                  ; read a letter
    INT 21H
    MOV BL, AL                  ; save the letter in BL
    LEA DX, PROMPT_2            ; load and print PROMPT_2
    MOV AH, 9
    INT 21H
    AND BL, 0DFH              ; convert a lower case letter to upper
                          ; case letter
    MOV AH, 2                 ; print the Lower case letter
    MOV DL, BL
    INT 21H
    MOV AH, 4CH               ; return control to DOS
    INT 21H
  MAIN ENDP
END MAIN
```

Introduction

This is an assembly language program written in AL-032 to read a lowercase letter from user input and then convert it to an uppercase letter using the AND logic instruction. The program will then print the uppercase letter.

Program structure

The program starts by defining the memory model and stack size. The data section defines two strings to be displayed to the user: PROMPT_1 and PROMPT_2. PROMPT_1 asks the user to enter a lowercase letter, while PROMPT_2 displays the resulting uppercase letter.

The main code starts by initializing the data segment register and loading PROMPT_1 to be displayed to the user. It then reads a single character from the user and saves it in the BL register. The program then loads PROMPT_2 and displays it to the user.

To convert the lowercase letter to uppercase, the program performs an AND operation on the letter with the hexadecimal value 0DFH. This works because the ASCII codes for lowercase letters have the sixth bit set to 1, while the corresponding uppercase letters have that bit set to 0. Performing an AND operation with 0DFH sets that bit to 0, effectively converting the lowercase letter to uppercase.

Finally, the program prints the resulting uppercase letter using the DOS interrupt 21H and returns control to the operating system.

Conclusion

This program demonstrates how to convert a lowercase letter to uppercase using the AND logic instruction in assembly language. The code is well-structured and easy to follow, with comments explaining each step.

OR

Code:

```
 TITLE AL-031 : An AL Program to read a letter in Upper case and print it
            ; after converting it in to Lower case letter ( using OR Logic
            ; instruction )
 .MODEL SMALL
 .STACK 100H
 .DATA
   PROMPT_1  DB  'Enter the Upper Case Letter : $'
   PROMPT_2  DB  0DH,0AH,'The Lower Case Letter is : $'
 .CODE
  MAIN PROC
    MOV AX, @DATA              ; initialize DS
    MOV DS, AX
    LEA DX, PROMPT_1           ; load and print PROMPT_1
    MOV AH, 9
    INT 21H
    MOV AH, 1                  ; read a letter
    INT 21H
    MOV BL, AL                 ; save the letter in BL
    LEA DX, PROMPT_2           ; load and print PROMPT_2
    MOV AH, 9
    INT 21H
    OR BL, 20H         ; convert a upper case letter to lower
                  ; case letter
    MOV AH, 2          ; print the Lower case letter
    MOV DL, BL
    INT 21H
    MOV AH, 4CH          ; return control to DOS
    INT 21H
  MAIN ENDP
 END MAIN
```

Introduction

This is an assembly language program written in AL-031 to read an uppercase letter from user input and then convert it to a lowercase letter using the OR logic instruction. The program will then print the lowercase letter.

Program structure

The program starts by defining the memory model and stack size. The data section defines two strings to be displayed to the user: PROMPT_1 and PROMPT_2. PROMPT_1 asks the user to enter an uppercase letter, while PROMPT_2 displays the resulting lowercase letter.

The main code starts by initializing the data segment register and loading PROMPT_1 to be displayed to the user. It then reads a single character from the user and saves it in the BL register. The program then loads PROMPT_2 and displays it to the user.

To convert the uppercase letter to lowercase, the program performs an OR operation on the letter with the hexadecimal value 20H. This works because the ASCII codes for uppercase letters have the sixth bit set to 0, while the corresponding lowercase letters have that bit set to 1. Performing an OR operation with 20H sets that bit to 1, effectively converting the uppercase letter to lowercase.

Finally, the program prints the resulting lowercase letter using the DOS interrupt 21H and returns control to the operating system.

Conclusion

This program demonstrates how to convert an uppercase letter to lowercase using the OR logic instruction in assembly language. The code is well-structured and easy to follow, with comments explaining each step.

Left shift

Code:

```
TITLE AL-034 : An AL Program that multiply the contents of AL by 8 ( using

             ; SHL instruction ).

 .MODEL SMALL

 .STACK 100H

 .DATA

    PROMPT_1  DB  'Original value of AL : $'

    PROMPT_2  DB  0DH,0AH,'Processed value of AL : $'

 .CODE

   MAIN PROC

     MOV AX, @DATA               ; initialize DS

     MOV DS, AX

     LEA DX, PROMPT_1             ; load and print PROMPT_1

     MOV AH, 9

     INT 21H

     MOV AL, 31H                 ; place 1 in the AL

     MOV BL, AL                  ; save AL in to BL

     MOV AH, 2                   ; print the original value of AL

     MOV DL, AL

     INT 21H

     LEA DX, PROMPT_2             ; load and print PROMPT_2
     MOV AH, 9
     INT 21H
     AND BL, 0FH                ; convert ascii to decimal code
     MOV CL, 3                 ; multiply AL by 8
     SHL BL, CL
     OR BL, 30H                ; convert decimal to ascii code
     MOV AH, 2                 ; print the processed value of AL
     MOV DL, BL
     INT 21H
     MOV AH, 4CH                ; return control to DOS
     INT 21H
   MAIN ENDP
 END MAIN
```

Introduction

This is an assembly language program that multiplies the contents of AL by 8 using the SHL (shift left) instruction. The program begins by initializing the DS register and printing a prompt to enter the original value of AL. It then reads in a value for AL, saves it in BL, and prints the original value of AL. Next, it prints a prompt for the processed value of AL, performs the multiplication by shifting the bits left three times, and then converts the decimal value back to ASCII before printing the processed value of AL. Finally, it returns control to DOS.

Code Walkthrough

- The program starts by initializing the DS register with the @DATA segment value and moves the AX value to DS.
- It then loads the prompt to enter the original value of AL and prints it using the interrupt 21H function with AH set to 9H.
- The program reads a value for AL using the interrupt 21H function with AH set to 1H.
- It then moves the value of AL to BL and prints the original value of AL using the interrupt 21H function with AH set to 2H.
- Next, the program loads the prompt for the processed value of AL and prints it using the interrupt 21H function with AH set to 9H.
- It then performs the multiplication by shifting the bits of the value stored in BL left three times using the SHL instruction with CL set to 3H.
- After that, it converts the decimal value back to ASCII by ORing the value with 30H.
- Finally, the program prints the processed value of AL using the interrupt 21H function with AH set to 2H and returns control to DOS using the interrupt 21H function with AH set to 4CH.

Conclusion

This assembly language program demonstrates the use of the SHL instruction to multiply the contents of a register by a power of two. The program reads in a value for AL, multiplies it by 8 using the SHL instruction, and then converts the decimal value back to ASCII before printing it. The program could be used as a template for other programs that need to perform bit-level operations.

Shift Right

Code:

```
TITLE AL-035 : An AL Program that divide the contents of AL by 4 ( using
             ; SHR instruction ).
 .MODEL SMALL
 .STACK 100H
 .DATA
    PROMPT_1  DB  'Original value of AL : $'
    PROMPT_2  DB  0DH,0AH,'Processed value of AL : $'
 .CODE
   MAIN PROC
     MOV AX, @DATA                ; initialize DS
     MOV DS, AX
     LEA DX, PROMPT_1             ; load and print PROMPT_1
     MOV AH, 9
     INT 21H
     MOV AL, 38H                 ; place 8 in the AL
     MOV BL, AL                  ; save Al in to BL
     MOV AH, 2                  ; print the original value of AL
     MOV DL, AL
     INT 21H
     LEA DX, PROMPT_2             ; load and print PROMPT_2
     MOV AH, 9
     INT 21H
     AND BL, 0FH                ; convert ascii to decimal code
     MOV CL, 2                 ; divide AL by 4
     SHR BL, CL
     OR BL, 30H                ; convert decimal to ascii code
     MOV AH, 2                 ; print the processed value of AL
     MOV DL, BL
     INT 21H
     MOV AH, 4CH                 ; return control to DOS
     INT 21H
   MAIN ENDP
 END MAIN
```

Introduction

The AL-035 program is an example of a simple Assembly Language program that demonstrates how to divide the contents of a register by a power of 2 using the SHR instruction. The program takes the contents of the AL register, divides it by 4, and then displays the processed result.

Shift right operation is a common bitwise operation that is often used in programming to divide an integer by a power of two. The SHR instruction in Assembly Language performs a logical right shift operation, where each bit in the operand is shifted right by a certain number of bits.

Program Structure

This program is written in Assembly Language (AL) and is intended to divide the contents of the AL register by 4 using the SHR instruction.

The program starts by initializing the data segment and stack with the relevant instructions. It then defines two prompts, PROMPT_1 and PROMPT_2, which will be used to display messages to the user.

The main body of the program starts by loading and printing PROMPT_1, which prompts the user to enter a value for AL. The program then reads the value of AL from the user and saves it in the BL register.

Next, the program prints the original value of AL using the INT 21H instruction with AH set to 2.

The program then loads and prints PROMPT_2, which prompts the user that the processed value of AL will be shown next.

To divide the value of AL by 4, the program first converts the ASCII code of the value in BL to its corresponding decimal value using the AND instruction. Then, it uses the SHR instruction to shift the bits of BL to the right by 2, effectively dividing the decimal value by 4. Finally, the program converts the decimal value back to ASCII and prints the processed value of AL using the INT 21H instruction with AH set to 2.

The program ends by returning control to DOS using the INT 21H instruction with AH set to 4CH.

Conclusion

In conclusion, the AL-035 program demonstrates how to perform division by a power of two using the SHR instruction in Assembly Language. The program takes an integer value in the AL register, divides it by 4 by shifting its bits right by 2 positions, and then displays the result. Shif

XOR

Code:

```
 TITLE AL-031 : An AL Program to read a letter in Upper case and print it
              ; after converting it in to Lower case letter ( using OR Logic
              ; instruction )
 .MODEL SMALL
 .STACK 100H
 .DATA
    PROMPT_1  DB  'Enter the Upper Case Letter : $'
    PROMPT_2  DB  0DH,0AH,'The Lower Case Letter is : $'
 .CODE
   MAIN PROC
     MOV AX, @DATA                ; initialize DS
     MOV DS, AX
     LEA DX, PROMPT_1             ; load and print PROMPT_1
     MOV AH, 9
     INT 21H
     MOV AH, 1                    ; read a letter
     INT 21H
     MOV BL, AL                   ; save the letter in BL

     LEA DX, PROMPT_2             ; load and print PROMPT_2
```

```
  MOV AH, 9

  INT 21H

  XOR BL, 20H        ; convert a upper case letter to lower

               ; case letter

  MOV AH, 2         ; print the Lower case letter

  MOV DL, BL

  INT 21H

  MOV AH, 4CH        ; return control to DOS

  INT 21H

 MAIN ENDP

END MAIN
```

Introduction

The AL program discussed in this report is designed to prompt the user to enter an uppercase letter, convert it to lowercase using OR logic, and then print the lowercase letter. The program makes use of several key AL instructions and interrupts to achieve this functionality, and provides a useful example of how to perform basic input and output operations in AL.

Program Structure

This is an AL program that prompts the user to enter an uppercase letter, converts it to lowercase using OR logic, and then prints the lowercase letter.

The program starts by defining the model as small and allocating 100H bytes of stack memory. The program also declares two prompts, PROMPT_1 and PROMPT_2, which will be displayed to the user.

The code section starts with the main procedure, which first initializes the data segment register (DS) by moving the data segment address to the AX register and then copying it to the DS register.

The program then displays the first prompt (PROMPT_1) using the INT 21H interrupt, which is a DOS interrupt for displaying messages to the console. It uses the MOV AH, 9 instruction to set the interrupt type for displaying the message, and then passes the address of the message to the DX register using the LEA (load effective address) instruction.

Next, the program reads a single character from the user using the INT 21H interrupt and the MOV AH, 1 instruction. The character is stored in the AL register, which is then copied to the BL register.

The program then displays the second prompt (PROMPT_2) and converts the uppercase letter to lowercase by using the XOR BL, 20H instruction. This instruction flips the 6th bit of the BL register, which corresponds to the difference between uppercase and lowercase letters in ASCII.

Finally, the program prints the lowercase letter to the console using the INT 21H interrupt and the MOV AH, 2 instruction. It then returns control to DOS using the MOV AH, 4CH instruction and the INT 21H interrupt.

Conclusion

In conclusion, this AL program provides a clear example of how to perform basic input and output operations in AL, and demonstrates how to manipulate register values using logical operations. While the program is relatively simple, it provides a useful starting point for those learning AL programming, and can be easily modified to perform more complex operations