HACETTEPE UNIVERSITY

ELECTRICAL AND ELECTRONICS ENGINEERING

ELE338 MICROPROCESSOR ARCHITECTURE AND PROGRAMMING LAB.

PRELIMINARY WORK 3
PROCEDURE USAGE AND STACK OPERATIONS
2020-2021 SPRING

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1. Question

EMU 8086 CODE

```
.Model Small
.Stack 64
.Data
      String1 DB 'The Offset is: ','$'
      NextRow DB 0Ah,0DH,'$'                        ; To the next row
      Numbers DW 1230h,1F05h,045Ah,0B0ACh,4708h     ; My Values
.Code

Proc Main

  Mov AX,Data
  Mov DS,AX

  LEA SI,Numbers            ; I take the value in DATA Segement.
  MOV AX,[SI]               ; And put the value in AX Register.
  Mov BL,00h                ; This is my counter.(Highest-->Lowest)
  Mov BH,05h                ; Loop counter for retrieving numbers from memory

 Tımes:
  Call Foffset              ; I call the Foffset.

  ADD SI,2                  ; I add 2 to SI because to move to the next number.
  MOV AX,[SI]               ; The reason I add 2 is because its number is word type.
                            ; And put the new value in AX Register.
  DEC BH                    ; Loop Counter
  CMP BH,00h                ; To finish the code when the loop is over.
  JE  Over
  JMP Tımes                 ; Return to get a new number      .

  Mov AH,004Ch              ; To stop program.
  Int 21h

Endp  Main

Proc Foffset

 RETURN:                    ; To examine the next bit
  Inc BL                    ; I ıncrease my counter to find offset.
  MOV DI,0h                 ; To reset 4 bıts
  MOV CX,4h                 ; To control 4 bits each time because of 4 BINARY = 1 HEX

 TRY:
  SHL AX,1d                 ; And ı shift the number 1 bit to the left.
  JC HERE                   ; IF CF=1,it jumps to HERE
  JCXZ COMP                 ; If CX =0,ıt jumps to COMP
  DEC CX                    ; 4 Bit Counter
  CMP CX,00h                ; If the counter finish, CF=1
  JNE TRY                   ; If CX does not 0,it jumps to TRY

 COMP:
  CMP DI,00h                ; This is number controller.
                            ; If the number is 0, the offset has been found.
  JNE RETURN     ; If number isn't 0, it jumps to RETURN and starts to examine the next number
  JE FINISH                 ; If the number is 0, it jumps to Fınısh.

 HERE:                      ; The part that checks the 1 bit.
  INC DI                    ; IF DI increases, this number is not 0.
  DEC CX
  CMP CX,00h                ; If the counter finish, CF=1
  JE COMP                   ; IF CF=1, it jumps to COMP to control number finally.
  JMP TRY
```

```
FINISH:
  Mov AH,09h
  Mov DX,OFFSET String1    ; To show string on the screen
  Int 21h

  Add BL,48d               ; I add 48 to the counter to show the number on the screen.
  Mov DL,BL

  Mov AH,02h               ; Print the offset
  Int 21h

  Mov AH,09h
  Mov DX,OFFSET NextRow    ; To pass the next row.
  Int 21H

  Mov BL,0h
  Mov DL,0h                ; I have to make Registers 0 for the next number.
  Mov AX,0h
  Ret
Endp Foffset
Over:
Ends
```

RESULTS

```
Numbers DW 1230h,1F05h,045Ah,0B0ACh,4708h
```

emulator screen (80x25 chars)

```
The Offset is: 4
The Offset is: 3
The Offset is: 1
The Offset is: 2
The Offset is: 3
```

In order, it finds the offsets in the numbers.

COMMENT

I entered 5 numbers in the data section. I put my procedure in a loop that will cycle 5 times. In this loop, it will do the operation for each number, then move on to the next number and do the operation for that number as well. My code worked 5 times with procedure.

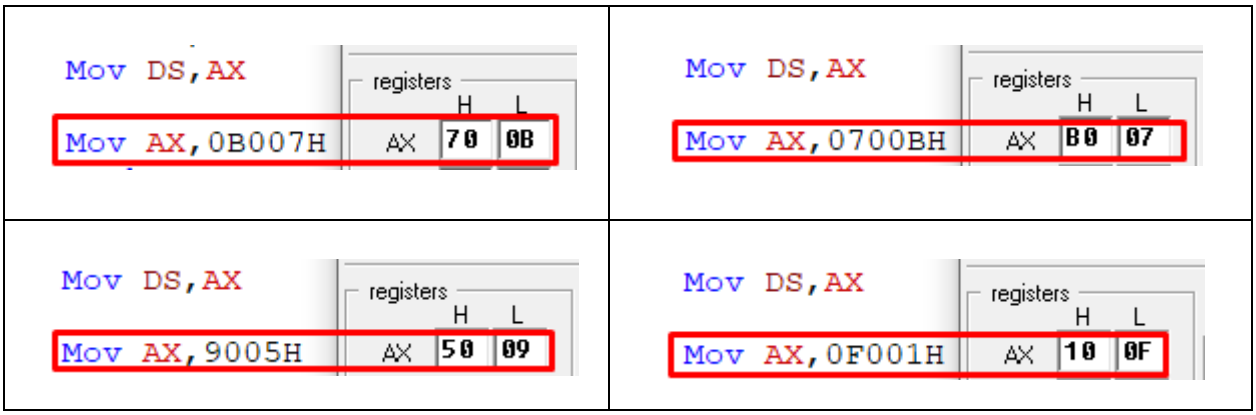
In the procedure part, I examined the number I entered bit by bit. And I grouped these bits in 4. If the bit is 0, I set it to the beginning of the loop, if bit is 1, I incremented my DI recorder by 1. After checking 4 bits, I checked my DI value with the CMP command. If my DI value is 0, I found my value 0 in the number. I code the offset of the number into the BL Register. Increments 1 for every 4 bit check. When 0 is found, it gives me the offset. Finally, I printed this on the screen.

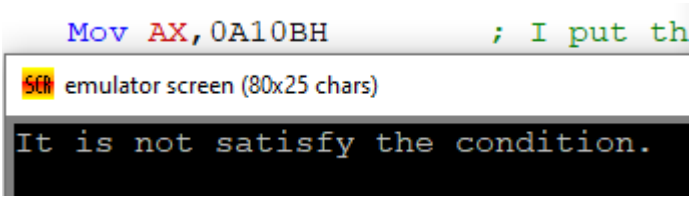
2. Question

EMU8086 CODE

```
.Model Small
.Stack 64
.Data
    String1 DB "It is not satisfy the condition.","$"
.Code
Proc Main
  Mov AX,Data
  Mov DS,AX

  Mov AX,0A00BH          ; I put the value in AX Register
  Call Funct             ; Call the procedure
Endp Main
Proc Funct
  Push AX                ; To saves it to use later

  Rol AX,4               ; To checks the middle nibbles are zero
  Cmp AH,00h
  Je Exists              ; If the middles are zero, it jumps to Exists
  Jne NotExists          ; If the middles are not zero, it jumps to NotExists

  Exists:
  Pop AX                 ; Pop the first value AX
  Xchg AH,AL             ; Exchanges the AL and the AH
  Ror AL,4               ; Rotates the AL
  Rol AH,4               ; Rotates the AH
  Jmp Finish             ; The reason for rotating 4 times is that the hex value is 4 bits.

NotExists:
  Mov AH,09h
  Mov DX,OFFSET String1    ; If the middles are not zero
  Int 21h                  ; To print the screen "It is not satisfy the condition.".
  Finish:
Endp Funct
End
```

RESULTS





COMMENT

I put the value in AX Register. And I called the procedure. My procedure part consists of 2 parts. The first part checks whether the number is exists or not exists. The second part does its operation if the number is exists.

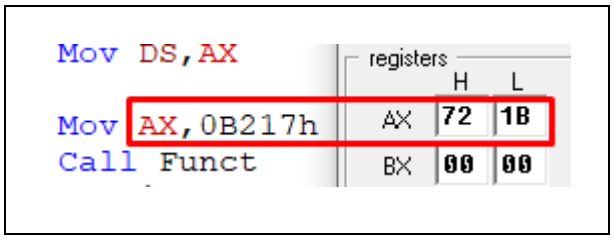
In my second part, I put the AX value, which ı previously held with push, with pop. Then I swapped the AH and AL values with the XCHG command. Then I rotated the new AL value to the right and the new AH value to the left. And finally I found the value I wanted and finished the code.

2.Question(Bonus)

EMU8086 Code

```
.Model Small
.Stack 64
.Data
.Code
Proc Main
   Mov AX,Data
   Mov DS,AX

   Mov AX,0B217h          ; I put the value in AX Register
   Call Funct             ; Call the procedure
Endp Main
Proc Funct

   Ror AH,4d               ; Rotates the AH
   Ror AX,4d               ; Rotates the AX
   Ror AL,4d               ; Rotates the AL

Endp Funct
End
```

RESULTS



Comment

I put the value in AX Register and ı call the procedure. In the procedure, I rotated the AH , AX and AL in order. And finally I found the value I wanted and finished the code