



HACETTEPE UNIVERSITY  
ELECTRICAL AND ELECTRONICS ENGINEERING  
ELE338 MICROPROCESSOR ARCHITECTURE AND  
PROGRAMMING LAB.  
PRELIMINARY WORK 1  
REGISTERS AND CONDITIONAL EXPERSIONS  
2020-2021 SPRING

Student

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Date: 28.03.2021

## 1. Question

### EMU8086 CODE

```
org 100h

LEA BX,Number1      ;I took the addresses of numbers with LEA.
LEA BP,Number2

MOV AX,[BP]          ;I stored the value of Number2 in the AX Register.
ADD AX,[BX]          ;And sum the numbers in the AX Register.

Ret
Number1 DW 8916h     ;I wrote the number1 and number2 in the memory.
Number2 DW 76EAh
End
```

### RESULTS

registers	H	L
AX	00	00
BX	01	0C
CX	00	10
DX	00	00
CS	F400	
IP	0154	
SS	0700	
SP	FFFA	
BP	010E	
SI	0000	
DI	0000	
DS	0700	
ES	0700	

flags	
CF	1
ZF	1
SF	0
OF	0
PF	1
AF	1
IF	0
DF	0

analyse

### COMMENT

I placed two numbers in word type into memory. Next, I uploaded the addresses of the numbers to the BX AND BP Registers with the LEA command. I called the value (Number2) in the BP Register with the MOV command. I also added the numbers with the ADD command.

When we add two numbers, if CF and ZF values are 1:

The number must exceed the bit size. (For Carry Flag = 1)

The remainder of the number must be 0.(For Zero Flag = 1)

In My Example

8916h = (1000 1001 0001 0110)b

76EAh = (0111 0110 1110 1001)b

+\_\_\_\_\_ +\_\_\_\_\_  
10000h (1 0000 0000 0000 0000)b

1	0	0	0	0
---	---	---	---	---

1 is represent Carry Flag

0000 is represent AX Register.

## 2. Question

### EMU8086 CODE

```
org 100h

Mov AX,0b                ;AX Register is my counter.
Lea BX,Number
Mov BX,[BX]

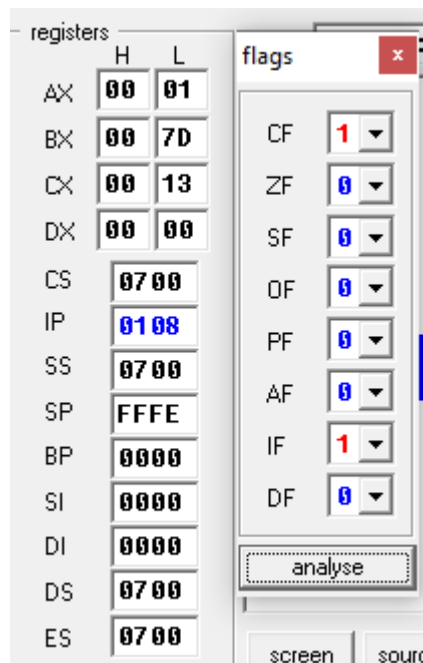
TRY:
Shr BX,1                ;Shift all bits right, the bit that goes off is set to CF.
Jnc Find                ;If CF=0 then jump.
Inc AX                  ;We increment AX to find the 0 bit position.
Jmp TRY                 ;Since CF = 1, we go back to the beginning.

Find:                    ;If CF=0,We increase the AX once more and find the result.
Inc AX

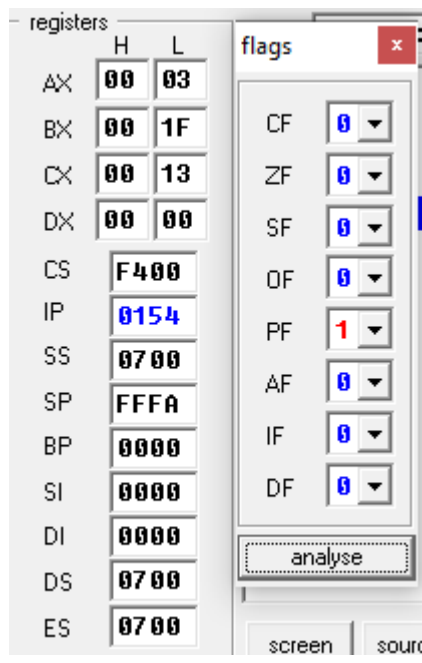
Ret

Number DW 11111011b      ;I wrote the number in the memory.
End
```

### RESULTS (For Number 11111011b)



When the first loop is over, the number is shifted. CF equals 1 and AX Register becomes 1.



When carry flag equal to 0, code jump to Find position and finally increment the AX Register. Then, the codes end. AX Register shows us the position of '0' bit.

## COMMENT

I placed the number in word type into memory. Next, I uploaded the addresses of the numbers to the BX Registers with the LEA command and I called the number in the Bx Register with the MOV command. I solved this question using the SHR command. SHR Shift all bits right, the bit that goes off is set to CF. I designed like a loop to find a position of '0'.

The most point of the this code is JNC Command. JNC command moves according to CF. If CF is 0, it can jump to Find label. If CF=1, it can not jump. This process increase the AX Register(Counter). Also, it back the loop again. When CF=0, JNC Command jump to Find label and increase of the AX Register last time. Then, the code ends.

AX Register indicates where the 0 bit is.  
11111011b → AX = 3h

## 3. Question

### EMU8086 CODE

```
org 100h

Mov AX,0b           ;AX Register is the counter of '0'.
Mov DX,01101010b    ;I wrote the number in the DX Register.
Mov CX,8             ;This is the counter of JCXZ

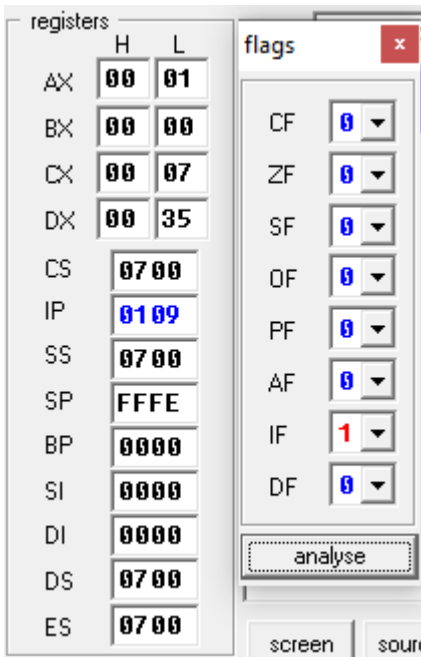
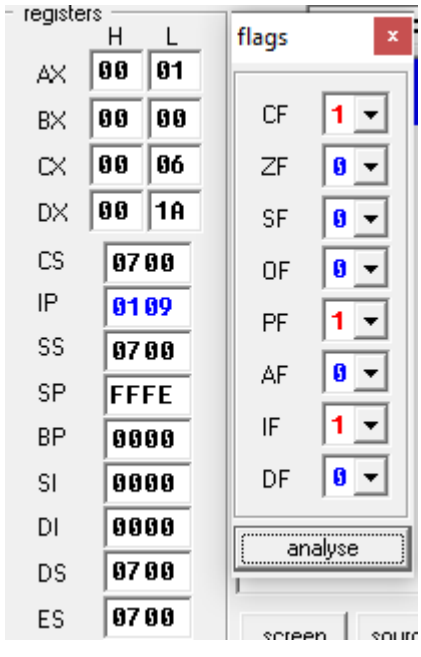
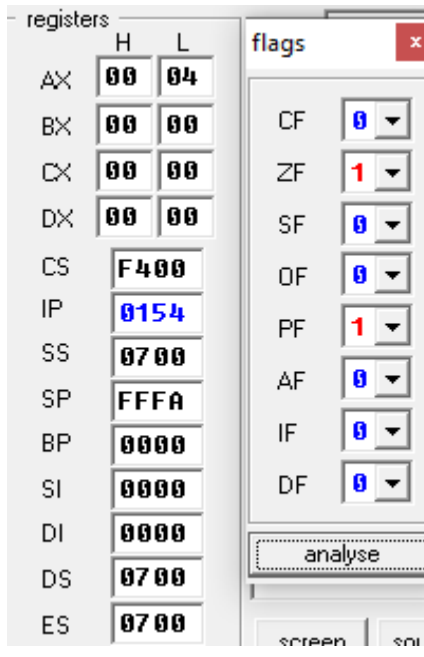
TRY:
Jcxz Finish         ;JCXZ is repeated until CX=0. Since CX=0, it jump to Finish label.
Shr DX,1             ;Shift all bits right, the bit that goes off is set to CF.
Jnc Find             ;IF CF=0, then jump
Dec CX               ;Decrease the counter of JCXZ
Jmp TRY              ;We go back to the beginning.

Find:
Inc AX               ;IF CF=0, increase the AX Register
Dec CX               ;Decrease the counter of JCXZ
JMP TRY              ;We go back to the beginning.

Finish:

Ret
End
```

## RESULTS (For Number 01101010b)

 <p>registers</p> <table><thead><tr><th></th><th>H</th><th>L</th></tr></thead><tbody><tr><td>AX</td><td>00</td><td>01</td></tr><tr><td>BX</td><td>00</td><td>00</td></tr><tr><td>CX</td><td>00</td><td>07</td></tr><tr><td>DX</td><td>00</td><td>35</td></tr><tr><td>CS</td><td>07</td><td>00</td></tr><tr><td>IP</td><td>01</td><td>09</td></tr><tr><td>SS</td><td>07</td><td>00</td></tr><tr><td>SP</td><td>FF</td><td>FE</td></tr><tr><td>BP</td><td>00</td><td>00</td></tr><tr><td>SI</td><td>00</td><td>00</td></tr><tr><td>DI</td><td>00</td><td>00</td></tr><tr><td>DS</td><td>07</td><td>00</td></tr><tr><td>ES</td><td>07</td><td>00</td></tr></tbody></table> <p>flags</p> <table><tbody><tr><td>CF</td><td>0</td></tr><tr><td>ZF</td><td>0</td></tr><tr><td>SF</td><td>0</td></tr><tr><td>OF</td><td>0</td></tr><tr><td>PF</td><td>0</td></tr><tr><td>AF</td><td>0</td></tr><tr><td>IF</td><td>1</td></tr><tr><td>DF</td><td>0</td></tr></tbody></table> <p>analyse</p> <p>screen source</p>		H	L	AX	00	01	BX	00	00	CX	00	07	DX	00	35	CS	07	00	IP	01	09	SS	07	00	SP	FF	FE	BP	00	00	SI	00	00	DI	00	00	DS	07	00	ES	07	00	CF	0	ZF	0	SF	0	OF	0	PF	0	AF	0	IF	1	DF	0	 <p>registers</p> <table><thead><tr><th></th><th>H</th><th>L</th></tr></thead><tbody><tr><td>AX</td><td>00</td><td>01</td></tr><tr><td>BX</td><td>00</td><td>00</td></tr><tr><td>CX</td><td>00</td><td>06</td></tr><tr><td>DX</td><td>00</td><td>1A</td></tr><tr><td>CS</td><td>07</td><td>00</td></tr><tr><td>IP</td><td>01</td><td>09</td></tr><tr><td>SS</td><td>07</td><td>00</td></tr><tr><td>SP</td><td>FF</td><td>FE</td></tr><tr><td>BP</td><td>00</td><td>00</td></tr><tr><td>SI</td><td>00</td><td>00</td></tr><tr><td>DI</td><td>00</td><td>00</td></tr><tr><td>DS</td><td>07</td><td>00</td></tr><tr><td>ES</td><td>07</td><td>00</td></tr></tbody></table> <p>flags</p> <table><tbody><tr><td>CF</td><td>1</td></tr><tr><td>ZF</td><td>0</td></tr><tr><td>SF</td><td>0</td></tr><tr><td>OF</td><td>0</td></tr><tr><td>PF</td><td>1</td></tr><tr><td>AF</td><td>0</td></tr><tr><td>IF</td><td>1</td></tr><tr><td>DF</td><td>0</td></tr></tbody></table> <p>analyse</p> <p>screen source</p>		H	L	AX	00	01	BX	00	00	CX	00	06	DX	00	1A	CS	07	00	IP	01	09	SS	07	00	SP	FF	FE	BP	00	00	SI	00	00	DI	00	00	DS	07	00	ES	07	00	CF	1	ZF	0	SF	0	OF	0	PF	1	AF	0	IF	1	DF	0	 <p>registers</p> <table><thead><tr><th></th><th>H</th><th>L</th></tr></thead><tbody><tr><td>AX</td><td>00</td><td>04</td></tr><tr><td>BX</td><td>00</td><td>00</td></tr><tr><td>CX</td><td>00</td><td>00</td></tr><tr><td>DX</td><td>00</td><td>00</td></tr><tr><td>CS</td><td>F4</td><td>00</td></tr><tr><td>IP</td><td>01</td><td>54</td></tr><tr><td>SS</td><td>07</td><td>00</td></tr><tr><td>SP</td><td>FF</td><td>FA</td></tr><tr><td>BP</td><td>00</td><td>00</td></tr><tr><td>SI</td><td>00</td><td>00</td></tr><tr><td>DI</td><td>00</td><td>00</td></tr><tr><td>DS</td><td>07</td><td>00</td></tr><tr><td>ES</td><td>07</td><td>00</td></tr></tbody></table> <p>flags</p> <table><tbody><tr><td>CF</td><td>0</td></tr><tr><td>ZF</td><td>1</td></tr><tr><td>SF</td><td>0</td></tr><tr><td>OF</td><td>0</td></tr><tr><td>PF</td><td>1</td></tr><tr><td>AF</td><td>0</td></tr><tr><td>IF</td><td>0</td></tr><tr><td>DF</td><td>0</td></tr></tbody></table> <p>analyse</p> <p>screen source</p>		H	L	AX	00	04	BX	00	00	CX	00	00	DX	00	00	CS	F4	00	IP	01	54	SS	07	00	SP	FF	FA	BP	00	00	SI	00	00	DI	00	00	DS	07	00	ES	07	00	CF	0	ZF	1	SF	0	OF	0	PF	1	AF	0	IF	0	DF	0
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<p>When the first loop is over, the number is shifted. CF equals 0 and AX Register becomes 1.</p> <p>(AX=1, CF=0)</p>	<p>When the second loop is over, the number is shifted. CF equals 1 and AX Register does not change because when CF=1 condition jump does not occur for JNC command.</p> <p>(AX=1 CF=1)</p>	<p>When CX Register equal to 0, code jump to <u>Finish</u> position. Then, the codes end. AX Register shows us how many 0's are in the DX Register.</p> <p>(AX=4 CF=0)</p> <p>Carry Flag 0 because last bit of the number is 0.</p>																																																																																																																																																																														

## COMMENT

I placed the number into DX Register. I use SHR command to shift the bits right one by one. Each rotation happens in a loop. Actually this is not a loop but it behaves like a loop. I used the JNC and SHR command together to check the status of the digit one by one. JNC command moves according to CF. If CF is 0, it can jump to Find label. Every CF=1, it can not jump. When every jumping in the Find label, AX Register increases. CX Register is decreased in every situation, When CX=0, JCXZ Command jump to Finish label and program is ends.

The AX Register shows how many 0's are in the DX Register.  
 00101001b → AX = 5h