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## *Micro : Assembly : Lab3*

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### Problem one :

The program adds the 2 numbers using the traditional method starting from the right adding two bytes and stores them in "AX" then stores the "AL" in the result and sets the "AH" as the carry for the next iteration .

★ As not mentioned to ignore the carry or not .

I reserved 11 byte for the result to store every byte starting from the end "300A" to the start "3001". the address "3000" contains the last carry or "00" if no carry exists .

### The CODE :

- MOV DX,0
- MOV BX,9
- MOV AL,[1000+BX]
- ADD AX,DX
- MOV DL,[2000+BX]
- ADD AX,DX
- MOV [3001+BX],AL
- MOV DL,AH
- MOV AX,0
- SUB BX,1
- CMP BX,0
- JGE 106
- MOV [3000],DL
- INT 3

### The program :

- Set the carry **DX** equals zero .
- Set the counter **BX** = 9 to iterate reversely on the 2 numbers .
- Read one byte from the first number and store it in **AL** .
- Add this byte to the previous carry **Dx** and store in **AX**.
- Read one byte from the second number and store it in **DL**.
- Add this byte to **AX** .
- Store the **AL** in the index [3001+BX] .
- Store the **AH** in **DL** to be used as a carry in the next iteration .

```
073F:0100 MOV DX,0
073F:0103 MOV BX,9
073F:0106 MOV AL,[1000+BX]
073F:010A ADD AX,DX
073F:010C MOV DL,[2000+BX]
073F:0110 ADD AX,DX
073F:0112 MOV [3001+BX],AL
073F:0116 MOV DL,AH
073F:0118 MOV AX,0
073F:011B SUB BX,1
073F:011E CMP BX,0
073F:0121 JGE 106
073F:0123 MOV [3000],DL
073F:0127 INT 3
073F:0128
```

- Empty the **AX** register .
- Decrement the counter **BX** with 1.
- Compare the counter **BX** with zero .
- If the counter is still greater than or equal to zero , back to the loop "106" .
- If the loop ends , set the address **3000** equals to the last carry .
- End the program .

Sample run :

•

|    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|
| C  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
| N1 |    | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF |
| N2 |    | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF |
| =  | 01 | FF | FF | FF | FF | FF | FF | FF | FF | FF | FE |

```
D:\>debug.exe
-E 1000 FF FF FF FF FF FF FF FF FF FF
-E 2000 FF FF FF FF FF FF FF FF FF FF
-A 100
073F:0100 MOV DX,0
073F:0103 MOV BX,9
073F:0106 MOV AL,[1000+BX]
073F:010A ADD AX,DX
073F:010C MOV DL,[2000+BX]
073F:0110 ADD AX,DX
073F:0112 MOV [3001+BX],AL
073F:0116 MOV DL,AH
073F:0118 MOV AX,0
073F:011B SUB BX,1
073F:011E CMP BX,0
073F:0121 JGE 106
073F:0123 MOV [3000],DL
073F:0127 INT 3
073F:0128
```

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=0000 BX=0000 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0103  NU UP EI PL NZ NA PO NC
073F:0103 BB0900      MOV     BX,0009
-T

AX=0000 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0106  NU UP EI PL NZ NA PO NC
073F:0106 8A870010     MOV     AL,[BX+1000]    DS:1009=FF
-T

AX=00FF BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010A  NU UP EI PL NZ NA PO NC
073F:010A 01D0      ADD     AX,DX
-T

AX=00FF BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010C  NU UP EI PL NZ NA PE NC
073F:010C 8A970020     MOV     DL,[BX+2000]    DS:2009=FF
-T

AX=00FF BX=0009 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0110  NU UP EI PL NZ NA PE NC
073F:0110 01D0      ADD     AX,DX

```

DX=0  
 BX =9  
 AL=[1009] = FF  
 AX=FF+0=FF  
 DL= [2009] =FF

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=01FE BX=0009 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0112  NU UP EI PL NZ AC PO NC
073F:0112 8B870130     MOV     [BX+3001],AL    DS:300A=00
-T

AX=01FE BX=0009 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0116  NU UP EI PL NZ AC PO NC
073F:0116 8BE2      MOV     DL,AH
-T

AX=01FE BX=0009 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0118  NU UP EI PL NZ AC PO NC
073F:0118 B80000     MOV     AX,0000
-T

AX=0000 BX=0009 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011B  NU UP EI PL NZ AC PO NC
073F:011B 83EB01     SUB     BX,+01
-T

AX=0000 BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011E  NU UP EI PL NZ NA PO NC
073F:011E 83FB00     CMP     BX,+00

```

AX=FF+FF=01FE  
 [300A] = FE  
 DX=carry=01  
 AX=0  
 BX=9-1=8

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=0000 BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0121 NU UP EI PL NZ NA PO NC
073F:0121 7DE3 JGE 0106
-T

AX=0000 BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0106 NU UP EI PL NZ NA PO NC
073F:0106 8A870010 MOV AL,[BX+1000]
-T

AX=00FF BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010A NU UP EI PL NZ NA PO NC
073F:010A 01D0 ADD AX,DX
-T

AX=0100 BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010C NU UP EI PL NZ AC PE NC
073F:010C 8A970020 MOV DL,[BX+2000]
-T

AX=0100 BX=0008 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0110 NU UP EI PL NZ AC PE NC
073F:0110 01D0 ADD AX,DX

```

BX >=0 complete loop

AX = [1008]=FF

DX=01 "prev. Carry"

AX=FF+01=0100

DL=[2008]=FF

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=01FF BX=0008 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0112 NU UP EI PL NZ NA PE NC
073F:0112 88870130 MOV [BX+3001],AL
-T

AX=01FF BX=0008 CX=0000 DX=00FF SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0116 NU UP EI PL NZ NA PE NC
073F:0116 88E2 MOV DL,AH
-T

AX=01FF BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0118 NU UP EI PL NZ NA PE NC
073F:0118 B80000 MOV AX,0000
-T

AX=0000 BX=0008 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011B NU UP EI PL NZ NA PE NC
073F:011B 83EB01 SUB BX,+01
-T

AX=0000 BX=0007 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011E NU UP EI PL NZ NA PO NC
073F:011E 83FB00 CMP BX,+00

```

AX=100+FF=01FF

[3009]=FF

DL=01

AX=0

BX=8-1=7

And so on the next 7 iterations with the same results .

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=0000 BX=0000 CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011B  NU UP EI PL NZ NA PE NC
073F:011B 83EB01      SUB     BX,+01
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011E  NU UP EI NG NZ AC PE CY
073F:011E 83FB00      CMP     BX,+00
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0121  NU UP EI NG NZ NA PE NC
073F:0121 7DE3        JGE     0106
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0123  NU UP EI NG NZ NA PE NC
073F:0123 8B160030     MOV     [3000],DL      DS:3000=00
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0127  NU UP EI NG NZ NA PE NC
073F:0127 CC          INT     3
```

BX=0-1=FFFF

BX<0 then the  
loop is ended .

Last carry =DL=01  
[3000]=01

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0121  NU UP EI NG NZ NA PE NC
073F:0121 7DE3        JGE     0106
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0123  NU UP EI NG NZ NA PE NC
073F:0123 8B160030     MOV     [3000],DL      DS:3000=00
-T
AX=0000 BX=FFFF CX=0000 DX=0001 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0127  NU UP EI NG NZ NA PE NC
073F:0127 CC          INT     3
-D 3000
073F:3000 01 FF FF FF FF FF FF FF-FE 00 00 00 00 00 .....
073F:3010 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3020 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3030 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3040 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3050 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3060 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
073F:3070 00 00 00 00 00 00 00 00-00 00 00 00 00 00 .....
```

The RESULT

|    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|
| C  | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 1  | 0  | 0  |    |
| N1 |    | 01 | 32 | 20 | 66 | FF | CD | BC | 05 | 10 | 40 |
| N2 |    | 06 | 12 | 11 | 40 | 05 | DF | 02 | FF | 0E | 05 |
| =  | 00 | 07 | 44 | 31 | A7 | 05 | AC | BF | 04 | 1E | 45 |

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0

```

Z:\>mount d d:\
Drive D is mounted as local directory d:\

Z:\>d:

D:\>debug.exe
-E 1000 01 32 20 66 FF CD BC 05 10 40
-E 2000 06 12 11 40 05 DF 02 FF 0E 05
-A 100
073F:0100 MOV DX,0
073F:0103 MOV BX,9
073F:0106 MOV AL,[1000+BX]
073F:010A ADD AX,DX
073F:010C MOV DL,[2000+BX]
073F:0110 ADD AX,DX
073F:0112 MOV [3001+BX],AL
073F:0116 MOV DL,AH
073F:0118 MOV AX,0
073F:011B SUB BX,1
073F:011E CMP BX,0
073F:0121 JGE 106
073F:0123 MOV [3001],DL
073F:0127 INT 3
073F:0128
_

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program...

```

AX=0000 BX=0000 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0103  NU UP EI PL NZ NA PO NC
073F:0103 BB0900      MOV     BX,0009
-T
AX=0000 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0106  NU UP EI PL NZ NA PO NC
073F:0106 8A870010    MOV     AL,[BX+10001]
-T
AX=0040 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010A  NU UP EI PL NZ NA PO NC
073F:010A 01D0      ADD     AX,DX
-T
AX=0040 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010C  NU UP EI PL NZ NA PO NC
073F:010C 8A970020    MOV     DL,[BX+20001]
-T
AX=0040 BX=0009 CX=0000 DX=0005 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0110  NU UP EI PL NZ NA PO NC
073F:0110 01D0      ADD     AX,DX
_

```

BX=9

DX=0

AL=[1009]=40

AX=40+0=40

DL=[2009]=05



```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=0040 BX=0009 CX=0000 DX=0005 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0110 NU UP EI PL NZ NA PO NC
073F:0110 01D0 ADD AX,DX
-T
AX=0045 BX=0009 CX=0000 DX=0005 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0112 NU UP EI PL NZ NA PO NC
073F:0112 88B70130 MOV IBX+30011,AL DS:300A=00
-T
AX=0045 BX=0009 CX=0000 DX=0005 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0116 NU UP EI PL NZ NA PO NC
073F:0116 88E2 MOV DL,AH
-T
AX=0045 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0118 NU UP EI PL NZ NA PO NC
073F:0118 B80000 MOV AX,0000
-T
AX=0000 BX=0009 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011B NU UP EI PL NZ NA PO NC
073F:011B 83EB01 SUB BX,+01

```

$AX=40+5=45$   
 $[300A]=45$   
 $DL=CARRY=00$   
 $AX=0$

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
AX=0000 BX=0008 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=011E NU UP EI PL NZ NA PO NC
073F:011E 83FB00 CMP BX,+00
-T
AX=0000 BX=0008 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0121 NU UP EI PL NZ NA PO NC
073F:0121 7DE3 JGE 0106
-T
AX=0000 BX=0008 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0106 NU UP EI PL NZ NA PO NC
073F:0106 8A870010 MOV AL,[BX+1000] DS:1008=10
-T
AX=0010 BX=0008 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010A NU UP EI PL NZ NA PO NC
073F:010A 01D0 ADD AX,DX
-T
AX=0010 BX=0008 CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=010C NU UP EI PL NZ NA PO NC
073F:010C 8A970020 MOV DL,[BX+2000] DS:2008=0E

```

$BX=9-1=8$   
 $AL=[1008]=10$   
 $DL=[2008]=0E$

AND SO ON .....



THE RESULT :

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
-T
AX=0000 BX=FFFF CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0123  NU UP EI NG NZ NA PE NC
073F:0123 8B160030      MOV     [3000],DL      DS:3000=00
-T
AX=0000 BX=FFFF CX=0000 DX=0000 SP=00FD BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=073F IP=0127  NU UP EI NG NZ NA PE NC
073F:0127 CC          INT     3
-T
AX=0000 BX=FFFF CX=0000 DX=0000 SP=00F7 BP=0000 SI=0000 DI=0000
DS=073F ES=073F SS=073F CS=01A3 IP=13B1  NU UP DI NG NZ NA PE NC
01A3:13B1 55          PUSH    BP
+D 3000
073F:3000 00 07 44 31 A7 05 AC BF-04 1E 45 00 00 00 00 00  ..D1.....E.....
073F:3010 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3020 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3030 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3040 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3050 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3060 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
073F:3070 00 00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 .....
```