Computer Organization and Architecture Lab

Lab ASSIGNMENT-3

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CSE-F

1. Write a program in assembly language to perform subtraction of 8-bit data.

Code:

```
org 100h

num1 db 39h
num2 db 18h

start:
   mov al,num1   ;move num1 to the AL register
   sub al,num2    ;subtract the second number with AL

   mov bl,al

;convert the upper nibble(4 bits) of AL to characters
   mov ah,al
   and ah,0F0h    ;mask the lower nibble
   shr ah,4

   add ah,30h      ;convert the ASCHII digit (0-9)
   cmp ah,39h
   jle print_first_digit
   add ah,7          ;convert to ASCHII letter(A-F) if necessary

print_first_digit:
   mov dl,ah         ;move the first digit to DL for printing
   mov ah,02h      ;BIOS interrupt to display charater
   int 21h
```

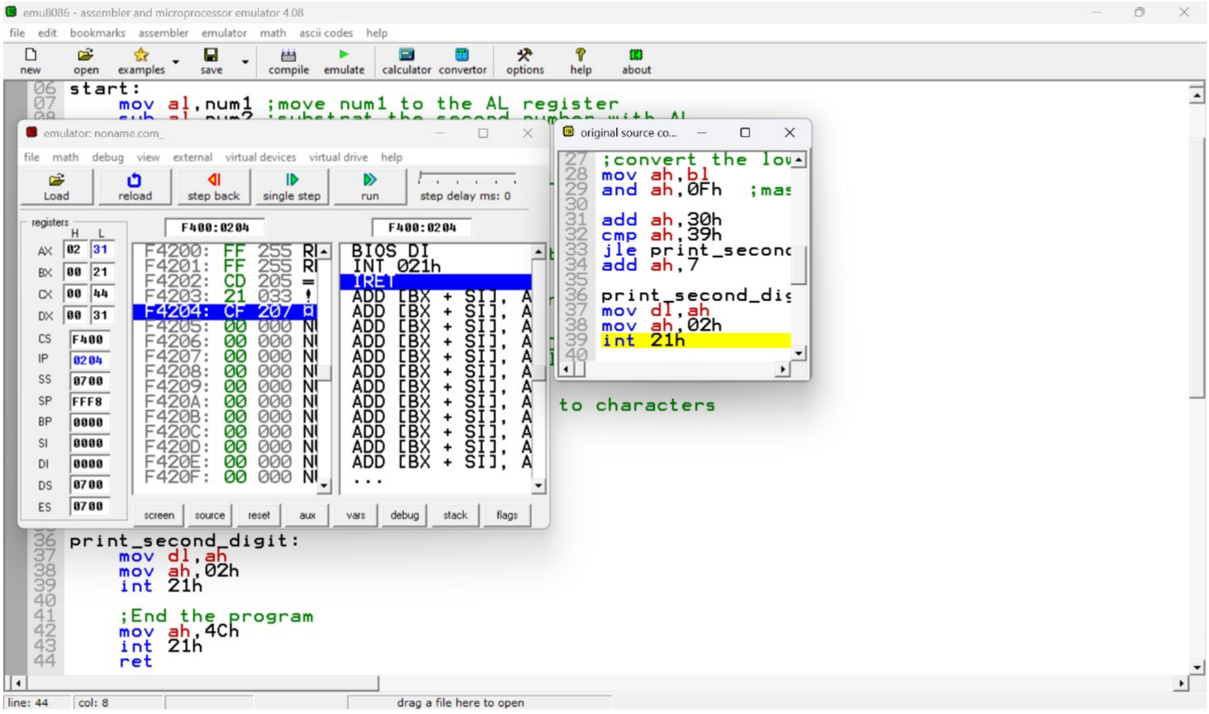
```
;convert the lower nibble (4 bits) of AL to characters
    mov ah,bl
    and ah,0Fh       ;mask the upper nibble

    add ah,30h
    cmp ah,39h
    jle print_second_digit
    add ah,7

print_second_digit:
    mov dl,ah
    mov ah,02h
    int 21h

    ;End the program
    mov ah,4Ch
    int 21h
    ret
```

Output: **21**



```
start:
        mov al,num1  ;move num1 to the AL register
```

registers	H	L
AX	02	31
BX	00	21
CX	00	44
DX	00	31
CS	F400	
IP	0204	
SS	0700	
SP	FFF8	
BP	0000	
SI	0000	
DI	0000	
DS	0700	
ES	0700	

```
F400:0204
F4200: FF 255 RI
F4201: FF 255 RI
F4202: CD 205 =
F4203: 21 033 !
F4204: CF 207 ¤
F4205: 00 000 NI
F4206: 00 000 NI
F4207: 00 000 NI
F4208: 00 000 NI
F4209: 00 000 NI
F420A: 00 000 NI
F420B: 00 000 NI
F420C: 00 000 NI
F420D: 00 000 NI
F420E: 00 000 NI
F420F: 00 000 NI
```

```
F400:0204
BIOS DI
INT 021h
IRET
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
...
```

```
;convert the low
mov ah,bl
and ah,0Fh    ;mas

add ah,30h
cmp ah,39h
jle print_seconc
add ah,7

print_second_dig
mov dl,ah
mov ah,02h
int 21h
```

```
to characters

print_second_digit:
        mov dl,ah
        mov ah,02h
        int 21h

        ;End the program
        mov ah,4Ch
        int 21h
        ret
```

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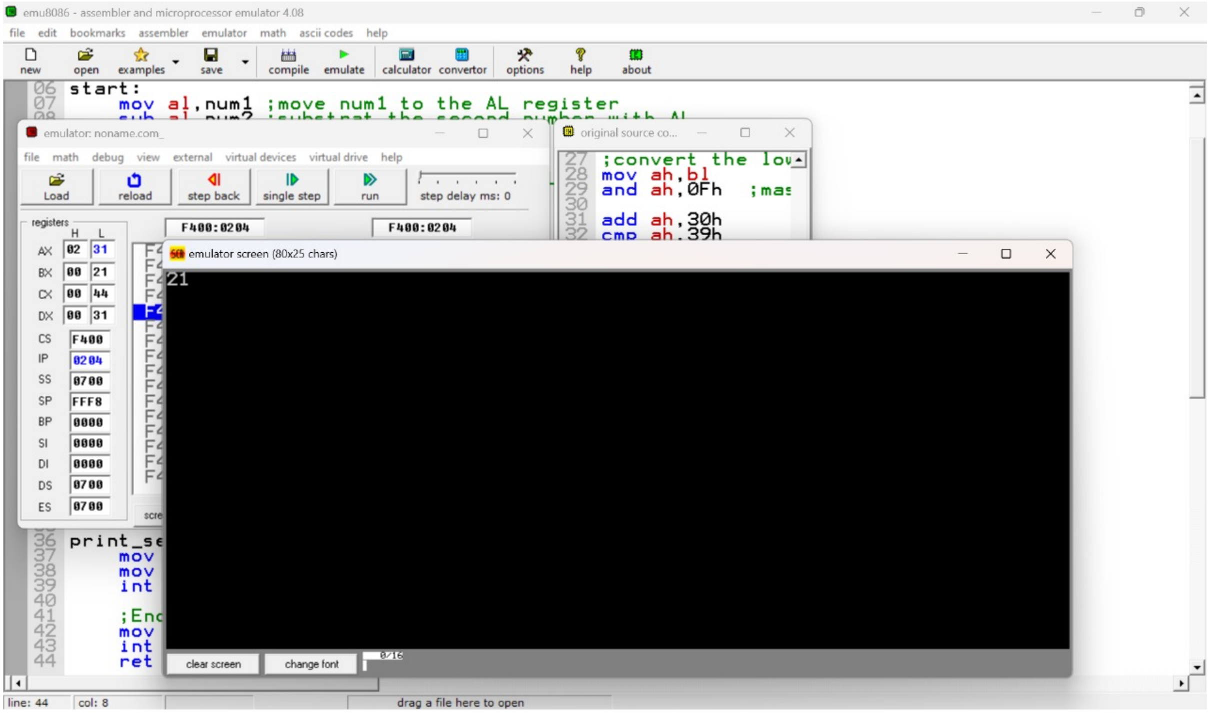
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```
start:
     mov al,num1 ;move num1 to the AL register
```

```
;convert the lov
mov ah,bl
and ah,0Fh   ;mas

add ah,30h
cmp ah,39h
```

```
print_se
     mov
     mov
     int

     ;Enc
     mov
     int
     ret
```

registers	H	L
AX	02	31
BX	00	21
CX	00	44
DX	00	31
CS	F400	
IP	0204	
SS	0700	
SP	FFF8	
BP	0000	
SI	0000	
DI	0000	
DS	0700	
ES	0700	

F400:0204 F400:0204

```
21
```

Practice set:

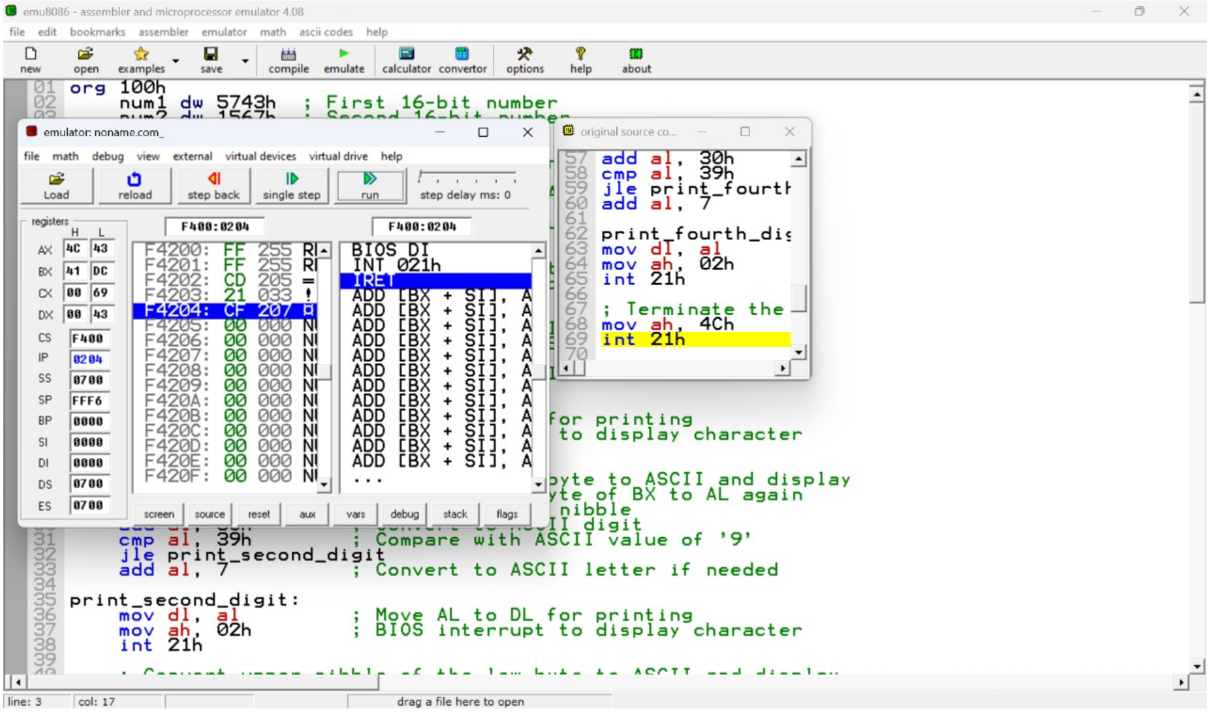
2. Write an assembly language program to perform subtraction of 16-bit data.

Code:

```
org 100h
    num1 dw 5743h  ; First 16-bit number
    num2 dw 1567h  ; Second 16-bit number


start:
    ; Load the lower bytes of num1 and num2
    mov ax, num1     ; Load num1 into AX (AX = 1234h)
    sub ax, num2     ; Add num2 to AX (AX = AX + num2)
    ; Store the result in BX for later use
    mov bx, ax         ; Copy AX to BX

    ; Convert upper byte (high 8 bits) to ASCII and display
    mov al, ah         ; Move the high byte of AX to AL
    and al, 0F0h       ; Mask the lower nibble
    shr al, 4          ; Shift right to get the upper nibble
    add al, 30h        ; Convert to ASCII digit
    cmp al, 39h        ; Compare with ASCII value of '9'
    jle print_first_digit
    add al, 7          ; Convert to ASCII letter if needed

print_first_digit:
    mov dl, al         ; Move AL to DL for printing
    mov ah, 02h        ; BIOS interrupt to display character
    int 21h

    ; Convert lower nibble of the high byte to ASCII and display
    mov al, bh         ; Move the high byte of BX to AL again
    and al, 0Fh        ; Mask the upper nibble
    add al, 30h        ; Convert to ASCII digit
    cmp al, 39h        ; Compare with ASCII value of '9'
    jle print_second_digit
    add al, 7          ; Convert to ASCII letter if needed
```

```
print_second_digit:
    mov dl, al          ; Move AL to DL for printing
    mov ah, 02h         ; BIOS interrupt to display character
    int 21h

    ; Convert upper nibble of the low byte to ASCII and display
    mov al, bl          ; Move the low byte of BX to AL
    and al, 0F0h        ; Mask the lower nibble
    shr al, 4           ; Shift right to get the upper nibble
    add al, 30h         ; Convert to ASCII digit
    cmp al, 39h         ; Compare with ASCII value of '9'
    jle print_third_digit
    add al, 7           ; Convert to ASCII letter if needed

print_third_digit:
    mov dl, al          ; Move AL to DL for printing
    mov ah, 02h         ; BIOS interrupt to display character
    int 21h

    ; Convert lower nibble of the low byte to ASCII and display
    mov al, bl          ; Move the low byte of BX to AL
    and al, 0Fh         ; Mask the upper nibble
    add al, 30h         ; Convert to ASCII digit
    cmp al, 39h        ; Compare with ASCII value of '9'
    jle print_fourth_digit
    add al, 7          ; Convert to ASCII letter if needed

print_fourth_digit:
    mov dl, al         ; Move AL to DL for printing
    mov ah, 02h        ; BIOS interrupt to display character
    int 21h

    ; Terminate the program
    mov ah, 4Ch
    int 21h
```

<u>Output:</u> 41DC



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```
org 100h
    num1 dw 5743h    ; First 16-bit number
    num2 dw 1567h    ; Second 16-bit number
```

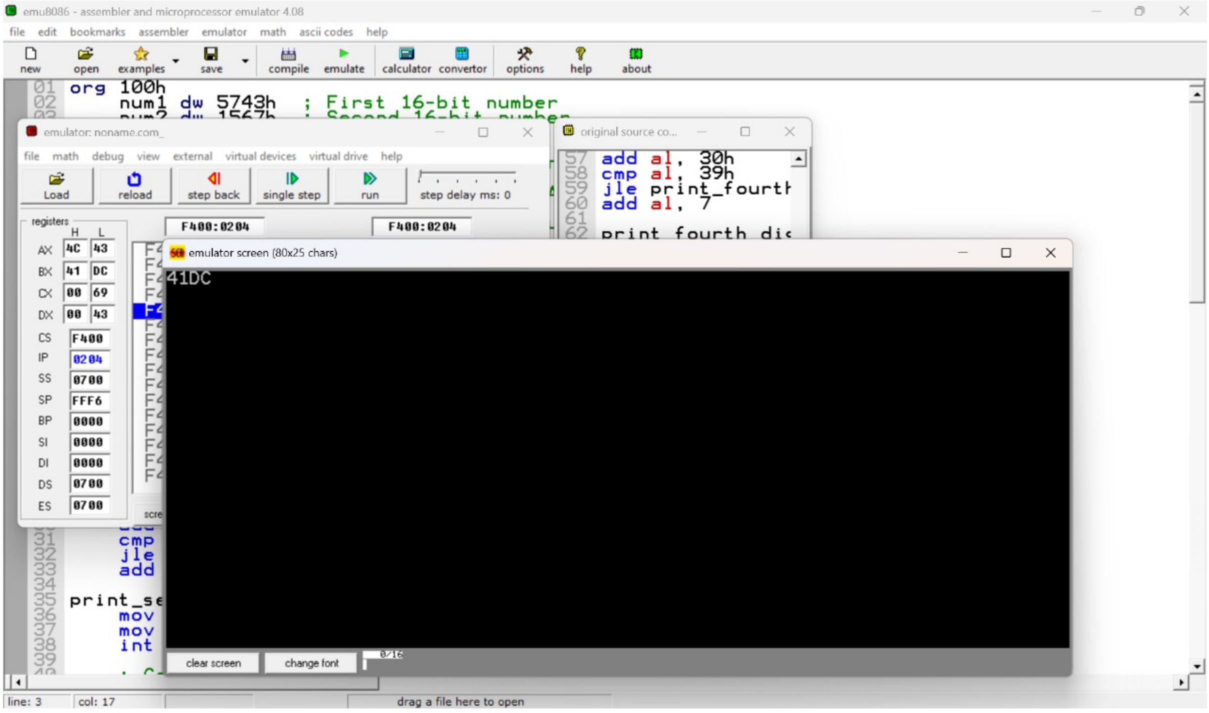
```
registers
     H   L
AX   4C  43
BX   41  DC
CX   00  69
DX   00  43
CS   F400
IP   0204
SS   0700
SP   FFF6
BP   0000
SI   0000
DI   0000
DS   0700
ES   0700
```

```
F400:0204
F4200: FF 255 RI
F4201: FF 255 RI
F4202: CD 205 =
F4203: 21 033 !
F4204: CF 207 ¤
F4205: 00 000 NI
F4206: 00 000 NI
F4207: 00 000 NI
F4208: 00 000 NI
F4209: 00 000 NI
F420A: 00 000 NI
F420B: 00 000 NI
F420C: 00 000 NI
F420D: 00 000 NI
F420E: 00 000 NI
F420F: 00 000 NI
```

```
F400:0204
BIOS DI
INT 021h
IRET
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
ADD [BX + SI], A
...
```

```
add al, 30h
cmp al, 39h
jle print_fourtł
add al, 7

print_fourth_di
mov dl, al
mov ah, 02h
int 21h

; Terminate the
mov ah, 4Ch
int 21h
```

```
                 for printing
                 to display character

                 byte to ASCII and display
                 yte of BX to AL again
                  nibble
                 II digit
    cmp al, 39h          ; Compare with ASCII value of '9'
    jle print_second_digit
    add al, 7            ; Convert to ASCII letter if needed

print_second_digit:
    mov dl, al           ; Move AL to DL for printing
    mov ah, 02h          ; BIOS interrupt to display character
    int 21h
```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Load reload step back single step run step delay ms: 0
original source co...
emulator screen (80x25 chars)
clear screen change font
registers
H L

```
org 100h
    num1 dw 5743h   ; First 16-bit number
    num2 dw 1567h   ; Second 16-bit number
```

```
add al, 30h
cmp al, 39h
jle print_fourth
add al, 7

print_fourth_dis
```

```
    cmp
    jle
    add

print_se
    mov
    mov
    int
```

```
41DC
```

	H	L
AX	4C	43
BX	41	DC
CX	00	69
DX	00	43

CS	F400
IP	0204
SS	0700
SP	FFF6
BP	0000
SI	0000
DI	0000
DS	0700
ES	0700

F400:0204 F400:0204

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