

汇编语言第1次上机

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1. 熟悉汇编语言实验环境（masm、link、debug）

(1) 使用 masm 编译 demoadd.asm，同时生成 .lst、.crf 文件，给出运行结果截图。

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DOSBOX
DS=0776 ES=0766 SS=0775 CS=0777 IP=001C  NU UP EI PL NZ AC PO NC
0777:001C CB          RETF
-q

C:\LEARN\ASM>cd ..

C:\LEARN>tree
Directory PATH listing for Volume C_DRIVE
C:.
├──ASM

C:\LEARN>masm demoadd.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

Object filename [demoadd.OBJ]:
Source listing [NUL.LST]: demoadd
Cross-reference [NUL.CRF]: demoadd

50564 + 465884 Bytes symbol space free

0 Warning Errors
0 Severe Errors

C:\LEARN>S_
```

(2) 使用 link 编译 demoadd.obj，同时生成同名的 .map 文件，给出运行结果截图。

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

C:\LEARN>masm demoadd.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

Object filename [demoadd.OBJ]:
Source listing [NUL.LST]: demoadd
Cross-reference [NUL.CRF]: demoadd

50564 + 465884 Bytes symbol space free

0 Warning Errors
0 Severe Errors

C:\LEARN>link demoadd.obj

Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.

Run File [DEMOADD.EXE]:
List File [NUL.MAP]: demoadd
Libraries [.LIB]:
LINK : warning L4021: no stack segment

C:\LEARN>S
```

(3) 使用 debug 调试 demoadd.exe，按下面的要求分别给出结果截图。

(a) 反汇编指令 U

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

C:\LEARN>link demoadd.obj

Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.

Run File [DEMOADD.EXE]:
List File [NUL.MAP]: demoadd
Libraries [.LIB]:
LINK : warning L4021: no stack segment

C:\LEARN>debug demoadd.exe
-U
0777:0000 B87607      MOV     AX,0776
0777:0003 8ED8          MOV     DS,AX
0777:0005 A00000      MOV     AL,[0000]
0777:0008 02060100    ADD     AL,[0001]
0777:000C A20200      MOV     [0002],AL
0777:000F B8004C      MOV     AX,4C00
0777:0012 CD21          INT     21
0777:0014 FF00          INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00  MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0          SUB     AX,AX
0777:001D 50          PUSH    AX
0777:001E 8D86FBFE    LEA     AX,[BP+FEFB]
-S
```

(b) 显示寄存器指令 R

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

Run File [DEMOADD.EXE]:
List File [NUL.MAP]: demoadd
Libraries [.LIB]:
LINK : warning L4021: no stack segment

C:\LEARN>debug demoadd.exe
-U
0777:0000 B87607      MOV     AX,0776
0777:0003 8ED8        MOV     DS,AX
0777:0005 A00000      MOV     AL,[0000]
0777:0008 02060100    ADD     AL,[0001]
0777:000C A20200      MOV     [0002],AL
0777:000F B8004C      MOV     AX,4C00
0777:0012 CD21        INT     21
0777:0014 FF00        INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00  MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0        SUB     AX,AX
0777:001D 50          PUSH    AX
0777:001E 8D86FBFE      LEA     AX,[BP+FEFB]
-R
AX=FFFF BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0000  NU UP EI PL NZ NA PO NC
0777:0000 B87607      MOV     AX,0776
-S
```

(c) 单步调试指令 T, 执行2次 T 指令后的结果

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

0777:0005 A00000      MOV     AL,[0000]
0777:0008 02060100    ADD     AL,[0001]
0777:000C A20200      MOV     [0002],AL
0777:000F B8004C      MOV     AX,4C00
0777:0012 CD21        INT     21
0777:0014 FF00        INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00  MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0        SUB     AX,AX
0777:001D 50          PUSH    AX
0777:001E 8D86FBFE      LEA     AX,[BP+FEFB]
-R
AX=FFFF BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0000  NU UP EI PL NZ NA PO NC
0777:0000 B87607      MOV     AX,0776
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0003  NU UP EI PL NZ NA PO NC
0777:0003 8ED8        MOV     DS,AX
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0005  NU UP EI PL NZ NA PO NC
0777:0005 A00000      MOV     AL,[0000]
-S_
DS:0000=11
```

(d) 显示内存指令 **D** , 显示 数据段 前3的个字节的内容

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
0777:000C A20200      MOV     [0002],AL
0777:000F B8004C      MOV     AX,4C00
0777:0012 CD21      INT     21
0777:0014 FF00      INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00  MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0      SUB     AX,AX
0777:001D 50      PUSH    AX
0777:001E 8D86FBFE      LEA     AX,[BP+FEFB]
-R
AX=FFFF BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0000  NU UP EI PL NZ NA PO NC
0777:0000 B87607      MOV     AX,0776
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0003  NU UP EI PL NZ NA PO NC
0777:0003 8ED8      MOV     DS,AX
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0005  NU UP EI PL NZ NA PO NC
0777:0005 A00000      MOV     AL,[0000]                      DS:0000=11
-D 0776:0 2
0776:0000 11 22 00      .".
-S_
```

(e) 执行程序指令 **G** , 运行到 **add al, y** 行

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
0777:0008 02060100      ADD     AL,[0001]
0777:000C A20200      MOV     [0002],AL
0777:000F B8004C      MOV     AX,4C00
0777:0012 CD21      INT     21
0777:0014 FF00      INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00  MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0      SUB     AX,AX
0777:001D 50      PUSH    AX
0777:001E 8D86FBFE      LEA     AX,[BP+FEFB]
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0003  NU UP EI PL NZ NA PO NC
0777:0003 8ED8      MOV     DS,AX
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0005  NU UP EI PL NZ NA PO NC
0777:0005 A00000      MOV     AL,[0000]                      DS:0000=11
-G8
AX=0711 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0008  NU UP EI PL NZ NA PO NC
0777:0008 02060100      ADD     AL,[0001]                      DS:0001=22
-S_
```

(f) 执行程序指令 G

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
0777:0012 CD21      INT     21
0777:0014 FF00      INC     WORD PTR [BX+SI]
0777:0016 C682FBFE00 MOV     BYTE PTR [BP+SI+FEFB],00
0777:001B 2BC0      SUB     AX,AX
0777:001D 50          PUSH    AX
0777:001E 8D86FBFE      LEA     AX,[BP+FEFB]
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0766 ES=0766 SS=0775 CS=0777 IP=0003  NU UP EI PL NZ NA PO NC
0777:0003 8ED8      MOV     DS,AX
-T
AX=0776 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0005  NU UP EI PL NZ NA PO NC
0777:0005 A00000      MOV     AL,[0000]                      DS:0000=11
-G
AX=0711 BX=0000 CX=0024 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0008  NU UP EI PL NZ NA PO NC
0777:0008 02060100      ADD     AL,[0001]                      DS:0001=22
-G
Program terminated normally
-S_
```

2. 算术指令程序设计。在数据段分别定义stu, X,Y,Z,W变量。其中，将stu初始化为自己的学号，X,Y,W可以任意初始化。截图中stu的初始值和学号不相符的将判定为抄袭。（说明：为简化编程，除法运算后不考虑余数）

(1) 汇编、连接后的截图

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

C:\LEARN\ASM>masm arith
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

Object filename [arith.OBJ]:
Source listing [NUL.LST]:
Cross-reference [NUL.CRF]:

51628 + 464820 Bytes symbol space free

0 Warning Errors
0 Severe Errors

C:\LEARN\ASM>link arith
Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.

Run File [ARITH.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
LINK : warning L4021: no stack segment

C:\LEARN\ASM>S_
```

(2) 反汇编的截图

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.

Run File [ARITH.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
LINK : warning L4021: no stack segment

C:\LEARN\ASM>debug arith.exe
-U
0777:0000 1E          PUSH    DS
0777:0001 33C0        XOR     AX,AX
0777:0003 50          PUSH    AX
0777:0004 B87607      MOV     AX,0776
0777:0007 8ED8      MOV     DS,AX
0777:0009 33C0        XOR     AX,AX
0777:000B A00D00      MOV     AL,[000D]
0777:000E B305      MOV     BL,05
0777:0010 2A060A00   SUB     AL,[000A]
0777:0014 F6FB      IDIV    BL
0777:0016 F62E0B00   IMUL    BYTE PTR [000B]
0777:001A 25FF00      AND     AX,00FF
0777:001D D0E8      SHR     AL,1
0777:001F A20C00      MOV     [000C],AL
-S_
```

(3) 在进行计算前，显示变量stu、X、Y、Z、W的内存值的截图（只能显示这5个变量的内存值，多显示、少显示均扣分）

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
C:\LEARN\ASM>debug arith.exe
-U
0777:0000 1E          PUSH    DS
0777:0001 33C0          XOR     AX,AX
0777:0003 50          PUSH    AX
0777:0004 B87607       MOV     AX,0776
0777:0007 8ED8       MOV     DS,AX
0777:0009 33C0          XOR     AX,AX
0777:000B A00D00       MOV     AL,[000D]
0777:000E B305       MOV     BL,05
0777:0010 2A060A00     SUB     AL,[000A]
0777:0014 F6FB       IDIV    BL
0777:0016 F62E0B00     IMUL    BYTE PTR [000B]
0777:001A 25FF00       AND     AX,00FF
0777:001D D0E8       SHR     AL,1
0777:001F A20C00       MOV     [000C],AL
-GB
AX=0000 BX=0000 CX=0033 DX=0000 SP=FFFC BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=000B  NU UP EI PL ZR NA PE NC
0777:000B A00D00       MOV     AL,[000D]                      DS:000D=28
-D 0776:0 D
0776:0000 32 32 30 34 31 31 32 39-31 33 1E 14 00 28          2204112913...(
-S
```

(4) 执行完计算后，显示变量stu、X、Y、Z、W的内存值的截图（只能显示这5个变量的内存值，多显示、少显示均扣分）

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
0777:0014 F6FB IDIU BL
0777:0016 F62E0B00 IMUL BYTE PTR [000B]
0777:001A 25FF00 AND AX,00FF
0777:001D D0E8 SHR AL,1
0777:001F A20C00 MOV [000C],AL
-GB

AX=0000 BX=0000 CX=0033 DX=0000 SP=FFFC BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=000B NV UP EI PL ZR NA PE NC
0777:000B A00D00 MOV AL,[000D] DS:000D=28
-D 0776:0 D
0776:0000 32 32 30 34 31 31 32 39-31 33 1E 14 00 28 2204112913...(
-G 1F

AX=0014 BX=0005 CX=0033 DX=0000 SP=FFFC BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=001F NV UP EI PL NZ AC PE NC
0777:001F A20C00 MOV [000C],AL DS:000C=00
-T

AX=0014 BX=0005 CX=0033 DX=0000 SP=FFFC BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0022 NV UP EI PL NZ AC PE NC
0777:0022 CB RETF
-D 0776:0 D
0776:0000 32 32 30 34 31 31 32 39-31 33 1E 14 14 28 2204112913...(
-S_

```

(5) 源代码

```

; Arithmetic Instruction Programming

; Arithmetic instruction programming. Write a complete program to implement
;  $Z = ((W - X) / 5 * Y) / 2$ 
; where X, Y, Z, W are all 8-bit signed integers
; (For simplification, remainders are not considered after division)

name arith
title arithmetic instruction program design

data segment
    stu db '2204112913'
    X db 30
    Y db 20
    Z db ?
    W db 40
data ends

code segment
    assume cs: code, ds: data

    main proc far
        ; Prepare for return to DOS
        push ds
        xor ax, ax
        push ax

```



```

; Initialize data segment
mov ax, seg data
mov ds, ax
xor ax, ax
; Load value to register
mov al, W
mov bl, 5
; Calculate the result
sub al, X ; W - X
idiv bl   ; ( W - X ) / 5
imul Y    ; ( W - X ) / 5 * Y

and ax, 00FFh; If consider Overflow???
shr al, 1 ; ( ( W - X ) / 5 * Y ) / 2
mov Z, al

ret
main endp

code ends
end main

```

3. 寄存器使用程序设计。寄存器BL、CL的值根据需要进行初始化。（说明：为简化编程，除法运算后不考虑余数）

(1) 反汇编的截图

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
C:\LEARN\ASM>tree
Directory PATH listing for Volume C_DRIVE
C:.\
No sub-directories exist

C:\LEARN\ASM>debug register.exe
-U
0777:0000 1E          PUSH    DS
0777:0001 33C0        XOR     AX,AX
0777:0003 50          PUSH    AX
0777:0004 B87607       MOV     AX,0776
0777:0007 8ED8        MOV     DS,AX
0777:0009 32DB        XOR     BL,BL
0777:000B 8A1E0100    MOV     BL,[0001]
0777:000F 8A0E0000    MOV     CL,[0000]
0777:0013 8AC3        MOV     AL,BL
0777:0015 98          CBW
0777:0016 F6F9        IDIV    CL
0777:0018 D1E0        SHL     AX,1
0777:001A 8BD0        MOV     DX,AX
0777:001C CB          RETF
0777:001D D0E8        SHR     AL,1
0777:001F A20C00      MOV     [000C],AL
-S_
```

(2) 在进行计算前，显示寄存器的值截图

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
C:\LEARN\ASM>debug register.exe
-U
0777:0000 1E          PUSH    DS
0777:0001 33C0        XOR     AX,AX
0777:0003 50          PUSH    AX
0777:0004 B87607       MOV     AX,0776
0777:0007 8ED8        MOV     DS,AX
0777:0009 32DB        XOR     BL,BL
0777:000B 8A1E0100    MOV     BL,[0001]
0777:000F 8A0E0000    MOV     CL,[0000]
0777:0013 8AC3        MOV     AL,BL
0777:0015 98          CBW
0777:0016 F6F9        IDIV    CL
0777:0018 D1E0        SHL     AX,1
0777:001A 8BD0        MOV     DX,AX
0777:001C CB          RETF
0777:001D D0E8        SHR     AL,1
0777:001F A20C00      MOV     [000C],AL
-G16
AX=0010 BX=0010 CX=0008 DX=0000 SP=FFFC BP=0000 SI=0000 DI=0000
DS=0776 ES=0766 SS=0775 CS=0777 IP=0016  NU UP EI PL ZR NA PE NC
0777:0016 F6F9        IDIV    CL
-S
```

(3) 执行完计算后，显示寄存器的值截图

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
0777:000B 8A1E0100      MOV     BL,[0001]
0777:000F 8A0E0000      MOV     CL,[0000]
0777:0013 8AC3          MOV     AL,BL
0777:0015 98            CBW
0777:0016 F6F9          IDIV    CL
0777:0018 D1E0          SHL     AX,1
0777:001A 8BD0          MOV     DX,AX
0777:001C CB          RETF
0777:001D D0E8          SHR     AL,1
0777:001F A20C00      MOV     [000C],AL
-G16

AX=0010  BX=0010  CX=0008  DX=0000  SP=FFFC  BP=0000  SI=0000  DI=0000
DS=0776  ES=0766  SS=0775  CS=0777  IP=0016  NU UP EI PL ZR NA PE NC
0777:0016 F6F9          IDIV    CL
-R
AX=0010  BX=0010  CX=0008  DX=0000  SP=FFFC  BP=0000  SI=0000  DI=0000
DS=0776  ES=0766  SS=0775  CS=0777  IP=0016  NU UP EI PL ZR NA PE NC
0777:0016 F6F9          IDIV    CL
-G 1C

AX=0004  BX=0010  CX=0008  DX=0004  SP=FFFC  BP=0000  SI=0000  DI=0000
DS=0776  ES=0766  SS=0775  CS=0777  IP=001C  NU UP EI PL NZ AC PO NC
0777:001C CB          RETF
-S_
```

(4) 源代码

```
; 寄存器使用程序设计。编写完整程序，
;   要求把BL中的数除以CL中的数，并把其商乘以2，
;   最后结果存入DX寄存器中

; 寄存器使用程序设计。
; 寄存器BL、CL的值根据需要进行初始化。
; （说明：为简化编程，除法运算后不考虑余数）

NAME REGISTER
TITLE arithmetic instruction program design

data segment
    cl_number db 8
    bl_number db 16
data ends

code segment
    assume cs: code, ds: data

    main proc far
        ; Prepare for return to DOS
        push ds
        xor ax, ax
        push ax

        ; Initialize data segment
```

```
    mov ax, seg data
    mov ds, ax
    xor bl, bl
    ; Load data
    mov bl, bl_number
    mov cl, cl_number
    ; calcualte
    mov al, bl
    cbw
    idiv cl
    shl ax, 1
    mov dx, ax

    ret
main endp

code ends
end main
```