实验报告 计算机数制,内存读写

Hollow Man

一、实验环境

一台带有 MASM 软件的装有 Windows XP 系统的实验室计算机。

二、实验准备

用 Win+R 键打开"运行",输入 cmd 并回车,打开"命令提示符"窗口程序。 在命令行中输入" cd /d D:\"切换到 D 盘根目录。

输入"MD JSL"创建 JSL 工作文件夹。

输入"cd JSL"切换到 JSL 工作目录

输入" copy C:\MASM*."将程序文件拷贝进工作目录。

三、实验内容

1. 任务1

将实验材料中所示代码敲入计算机, 保存为 3a.asm, 使用 masm 和 link 进行编译链接:

```
D:\JSL>masm 3a.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

Object filename [3a.OBJ]:
Source listing [NUL.LST]:
Cross-reference [NUL.CRF]:

50660 + 415676 Bytes symbol space free

0 Warning Errors
0 Severe Errors

D:\JSL>link 3a

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

Run File [3A.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
Libraries [.LIB]:
LINK: warning L4021: no stack segment

D:\JSL>debug 3a.exe_
```

首先使用 debug 中的 u 指令查看机器码:

D:\JSL>del -u 13E5:0000 13E5:0002	8008	MOV	AX,CS
13E5:0002	8ED8 B82000	MOV MOV	DS,AX AX,0020
13E5:0007	8EC0	MOV	ES, AX
13E5:0009 13E5:000C		MOV	BX,0000
13E5:000F		MOV MOV	CX,0017 AL,[BX]
13E5:0011	The second secon	ES:	
13E5:0012 13E5:0014	43	MOV	[BX],AL BX
13E5:0015	EZF8	LOOP	000F
13E5:0017 13E5:001A	B8004C CD21	MOV	AX,4C00
13E5:001C	EC	IN	21 AL,DX
13E5:001D	81EC9000	SUB	SP,0090
-			

然后使用 d 0020:0 查看内存 执行程序:

AX=13E5 BX=0000 DS=13D5 ES=13D5 13E5:0002 BED8 -t	CX=001C DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0002 MOV DS,AX	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=13E5 BX=0000 DS=13E5 ES=13D5 13E5:0004 B82000 -t	CX=001C DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0004 MOV AX,0020	BP-0000 SI-0000 DI-0000 NV UP EI PL NZ NA PO NC
AX=0020 BX=0000 DS=13E5 ES=13D5 13E5:0007 8EC0 -t	CX=001C DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0007 MOV ES,AX	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=0020 BX=0000 DS=13E5 ES=0020 13E5:0009 BB0000 -t	CX=001C DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0009 MOV BX,0000	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=0020 BX=0000 DS=13E5 ES=0020 13E5:000C B91700	CX=001C DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000C MOV CX,0017	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC

DS=13E5 ES=0020 13E5:0011 26 13E5:0012 8807 -t	SS=13E5 CS=13E5 IP=0011 ES: MOV [BX],AL	NV UP EI PL NZ NA PO NC ES:0001=C8
AX=00C8 BX=0001 DS=13E5 ES=0020 13E5:0014 43 -t	CX=0016 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0014 INC BX	
AX=00C8 BX=0002 DS=13E5 ES=0020 13E5:0015 EZF8 -t	CX=0016 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0015 LOOP 000F	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=00C8 BX=0002 DS=13E5 ES=0020 13E5:000F 8A07 -t	CX=0015 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000F MOV AL,[BX]	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC DS:000Z=8E
AX=008E BX=0002 DS=13E5 ES=0020 13E5:0011 26 13E5:0012 8807	CX=0015 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0011 ES: MOV [BX],AL	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC ES:0002=8E

```
AX=008E BX=0002 CX=0015 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DI=0000 SS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PO NC INC BX

-t

AX=008E BX=0003 CX=0015 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC ISES:0015 EZF8 LOOP 000F

-t

AX=008E BX=0003 CX=0014 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PE NC ISES:000F BA07 HOV AL,[BX] DS:0003=D8

-t

AX=0008 BX=0003 CX=0014 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC ISES:0011 26 ES:
13E5:0012 8807 HOV [BX],AL ES:0003=D8

-t

AX=0008 BX=0003 CX=0014 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC ISES:0012 8807 HOV [BX],AL ES:0003=D8

-t

AX=0008 BX=0003 CX=0014 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC ISES:0014 43 INC BX
```

AX=00D8 BX=0004 CX=0014 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PO NC 13E5:0015 E2F8 000F AX=00D8 BX=0004 CX=0013 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC 13E5:000F 8A07 MOV AL,[BX] DS:0004=B8 AX=00B8 BX=0004 CX=0013 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC 13E5:0011 Z6 ES: 13E5:0011 26 13E5:0012 8807 MOV [BX],AL ES:0004=R8 AX=00B8 BX=0004 CX=0013 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PO NC 13E5:0014 43 INC AX=00B8 BX=0005 CX=0013 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC 13E5:0015 E2F8 LOOP OOOF

AX=00B8 BX=0005 DS=13E5 ES=0020 13E5:000F 8A07 -t	CX=0012 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000F MOV AL,[BX]	
AX=0020 BX=0005 DS=13E5 ES=0020 13E5:0011 26 13E5:0012 8807 -t	CX=0012 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0011 ES: MOV [BX],AL	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PE NC ES:0005=20
AX=0020 BX=0005 DS=13E5 ES=0020 13E5:0014 43 -t	CX=0012 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0014 INC BX	
AX=0020 BX=0006 DS=13E5 ES=0020 13E5:0015 E2F8 -t	CX=0012 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0015 LOOP 000F	
AX=0020 BX=0006 DS=13E5 ES=0020 13E5:000F 8A07	CX=0011 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000F MOV AL,[BX]	BP-0000 SI-0000 DI-0000 NV UP EI PL NZ NA PE NC DS:0006-00

```
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NU UP EI PL NZ NA PE NC
13E5:0011 26 ES:
13E5:0012 8807 MOV [BX],AL ES:0006=00

AX=0000 BX=0006 CX=0011 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NU UP EI PL NZ NA PE NC
13E5:0014 43 INC BX

-t

AX=0000 BX=0007 CX=0011 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NU UP EI PL NZ NA PO NC
13E5:0015 EZF8 LOOP 000F

-t

AX=0000 BX=0007 CX=0010 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC
13E5:000F 8A07 MOV AL,[BX]

AX=008E BX=0007 CX=0010 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC
13E5:0011 26 ES:
13E5:0012 8807 MOV [BX],AL ES:0007=8E
```

AX=008E BX=0007 DS=13E5 ES=0020 13E5:0014 43 -t	CX=0010 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0014 INC BX	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=008E BX=0008 DS=13E5 ES=0020 13E5:0015 E2F8 -t	CX=0010 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0015 LOOP 000F	BP=0000 SI=0000 DI=0000 NU UP EI PL NZ NA PO NC
AX=008E BX=0008 DS=13E5 ES=0020 13E5:000F BA07 -t	CX=000F DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000F MOV AL,[BX]	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC DS:0008=C0
AX=00C0 BX=0008 DS=13E5 ES=0020 13E5:0011 26 13E5:0012 8807 -t	CX=000F DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0011 ES: MOV [BX],AL	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC ES:0008=C0
AX=00C0 BX=0008 DS=13E5 ES=0020 13E5:0014 43	CX=000F DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0014 INC BX	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC

AX=00BB BX=000A CX=000D DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PE NC 13E5:000F 8A07 MOV AL,[BX] DS:0 DS:000A=00 AX=0000 BX=000A CX=000D DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC 13E5:0011 26 13E5:0012 8807 [BX],AL ES:000A=00 AX=0000 BX=000A CX=000D DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PE NC 13E5:0014 43 INC AX=0000 BX=000B CX=000D DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PO NC 13E5:0015 E2F8 LOOP OOOF AX=0000 BX=000B CX=000C DX=0000 SP=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F BP=0000 SI=0000 DI=0000 NU UP EI PL NZ NA PO NC AL,[BX] 13E5:000F 8A07 MOV DS:000R=00

DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC 13E5:0011 26 13E5:0012 8807 MOU [BX],AL ES: AAAR=AA AX=0000 BX=000B CX=000C DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PO NC 13E5:0014 43 INC RX AX=0000 BX=000C CX=000C DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC 13E5:0015 E2F8 LOOP MARE AX=0000 BX=000C CX=000B DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 EX=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PE NC 13E5:000F 8A07 MOV AL,[BX] DS:0 DS:000C=B9 AX=00B9 BX=000C CX=000B DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC 13E5:0011 26 13E5:0012 8807 ES: ES:000C=B9 [BX],AL

```
AX=00B9 BX=000C CX=000B DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PE NC
13E5:0014 43 INC BX
AX=00B9 BX=000D CX=000B DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PO NC
13E5:0015 E2F8
                                                 000F
AX=00B9 BX=000D CX=000A DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC
13E5:000F 8A07
                                                 AL,[BX]
                                   MOU
                                                                                                            DS:000D=17
AX=0017 BX=000D CX=000A DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC
13E5:0011 26
                                   ES:
13E5:0012 8807
                                                   [BX],AL
                                      MOV
                                                                                                           ES:000D=17
AX=0017 BX=000D CX=000A DX=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5
                                                       SP=0000 BP=0000 SI=0000 DI=0000
IP=0014 NV UP EI PL NZ NA PO NC
13E5:0014 43
                                      INC
```

```
AX=0017 BX=000E CX=000A DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PO NC
13E5:0015 EZF8
AX=0017 BX=000E CX=0009 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC
13E5:000F 8A07 MOV AL,[BX] DS:0
                                                                                                                   DS:000E=00
AX=0000 BX=000E CX=0009 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC
13E5:0011 26
13E5:0012 8807
                                        ES:
                                                       [BX],AL
                                                                                                                   ES:000E=00
                                         MOU
AX=0000 BX=000E CX=0009 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PO NC
                                          INC
13E5:0014 43
AX=0000 BX=000F CX=0009 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC
                                                       000F
                                         LOOP
13E5:0015 E2F8
```

AX=0000 BX=000F CX=0008 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NU UP EI PL NZ NA PE NC 13E5:000F BA07 MOV AL,[BX] DS:0 DS:000F=8A AX=00BA BX=000F CX=0008 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC 13E5:0011 Z6 ES: 13E5:0011 26 13E5:0012 8807 ES:000F=8A [BX1,AL MOU AX=008A BX=000F CX=0008 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PE NC INC 13E5:0014 43 -t AX=008A BX=0010 CX=0008 DX=0000 SP=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 BP=0000 SI=0000 DI=0000 NU UP EI PL NZ AC PO NC OOOF LOOP 13E5:0015 E2F8 AX=008A BX=0010 CX=0007 DX=0000 SP=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F 13E5:000F 8A07 MOV AL,[BX] BP=0000 SI=0000 DI=0000 NV UP EI PL NZ AC PO NC DS:0010=07

```
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ AC PO NC
13E5:0011 26
13E5:0012 8807
                                                                                                              ES:0010=07
                                                     [BX1,AL
AX=0007 BX=0010 CX=0007 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ AC PO NC
13E5:0014 43
AX=0007 BX=0011 CX=0007 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC
13E5:0015 E2F8
                                      LOOP 000F
AX=0007 BX=0011 CX=0006 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PE NC 13E5:000F 8A07 MOV AL,[BX] DS:0
                                                                                                               DS:0011=26
 AX=0026 BX=0011 CX=0006 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC
 13E5:0011 26
13E5:0012 8807
                                        ES:
                                                                                                               ES:0011=26
                                                      [BX1,AL
                                        MOV
AX=0026 BX=0011 CX=0006 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PE NC
13E5:0014 43 INC BX
```

AX=0026 BX=0012 CX=0006 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC 13E5:0015 E2F8 LOOP 000F AX=0026 BX=0012 CX=0005 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PE NC 13E5:000F 8A07 MOV AL,[BX] DS:0012=88 AX=0088 BX=0012 CX=0005 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PE NC 13E5:0011 26 ES: 13E5:0012 8807 [BX],AL ES:0012=88 MOV -t AX=0088 BX=0012 CX=0005 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0014 NV UP EI PL NZ NA PE NC 13E5:0014 43 INC

AX=0088 BX=0013 CX=0005 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PO NC 13E5:0015 E2F8 LOOP 000F 000F AX=0088 BX=0013 CX=0004 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC 13E5:000F 8A07 MOV AL,[BX] DS:0013=07 AX=0007 BX=0013 CX=0004 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0011 NV UP EI PL NZ NA PO NC 13E5:0011 26 13E5:0012 8807 ES: MOU [BX],AL ES:0013=07 AX=0007 BX=0013 CX=0004 DX=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 SP=0000 BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC IP=0014 13E5:0014 43 INC -t AX=0007 BX=0014 CX=0004 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC 13E5:0015 E2F8 000F LOOP

```
AX=0007 BX=0014 CX=0003 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 SI=0000 DI=0000 DI=0000 DI=0000 SI=0000 DI=0000 DI=000
```

DS=13E5 ES=0020 13E5:0011 26	SS=13E5 CS=13E5 IP=0011 ES:	NU UP EI PL NZ NA PO NC
13E5:0012 8807 -t	MOV [BX],AL	ES:0015=E2
AX=00E2 BX=0015 DS=13E5 ES=0020 13E5:0014 43 -t		BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
AX=00E2 BX=0016 DS=13E5 ES=0020 13E5:0015 E2F8 -t	CX=0002 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0015 LOOP 000F	
AX=00E2 BX=0016 DS=13E5 ES=0020 13E5:000F 8A07 -t	CX=0001 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=000F MOV AL,[BX]	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC DS:0016=F8
AX=00F8 BX=0016 DS=13E5 ES=0020	CX=0001 DX=0000 SP=0000 SS=13E5 CS=13E5 IP=0011	BP=0000 SI=0000 DI=0000 NV UP EI PL NZ NA PO NC
13E5:0011 26 13E5:0012 8807	ES: MOV [BX],AL	ES:0016=F8

```
13E5:0012 8807
                                              [BX],AL
                                                                                                  ES:0016=F8
AX=00F8 BX=0016 CX=0001 DX=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5
13E5:0014 43 INC BX
                                                    SP=0000 BP=0000 SI=0000 DI=0000
                                                    IP=0014
                                                                 NV UP EI PL NZ NA PO NC
AX=00F8 BX=0017 CX=0001 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0015 NV UP EI PL NZ NA PE NC
13E5:0015 EZF8 LOOP 000F
AX=00F8 BX=0017 CX=0000 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=13E5 ES=0020 SS=13E5 CS=13E5 IP=0017 NV UP EI PL NZ NA PE NC
13E5:0017 B8004C
                                  MOV
                                             AX,4C00
-t
AX=4C00 BX=0017 CX=0000 DX=0000
DS=13E5 ES=0020 SS=13E5 CS=13E5
                                                    SP=0000 BP=0000 SI=0000 DI=0000
                                                                  NV UP EI PL NZ NA PE NC
                                                    IP=001A
13E5:001A CD21
                                   INT
                                              21
Program terminated normally
```

再次查看内存:

```
-d 0020:0
     8C C8 8E D8 B8 20 00 8E-C0 BB 00 00 B9 17 00 8A 07 26 88 07 43 E2 F8 00-00 00 00 00 00 00 00
0020:0000
                                  .å..C.....
0020:0010
     0020:0020
0020:0030
     0020:0040
0020:0050
     00
                              00
                             00 00
```

可以看到程序成功将 mov ax.4c00h 之前的指令复制到内存 0:200 处。

由运行调试结果可以看到,每次执行完指令后,CS:IP 自动指向了下一个命令地址,并且每次将一个字节的保存在内存中的机器码复制到另外一个从0:200 开始的内存地址。

查看源代码, 画出流程图:



任务 2

代码如下: assume cs:code code segment

```
mov bx,200h
mov ax,0
mov ds,ax
mov cx,64
s:mov [bx],al
inc bx
inc ax
loop s
mov ax,4c00h
int 21h
code ends
end
保存为 3b.asm,使用 masm 和 link 进行编译链接:
```

```
D:\JSL>masm 3b.asm;
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

50736 + 415600 Bytes symbol space free

0 Warning Errors
0 Severe Errors

D:\JSL>link 3b;

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

LINK: warning L4021: no stack segment

D:\JSL>debug 3b.exe

--
```

使用首先使用 debug 的 U 命令查看程序:

D:\JSL>del	bug 3b.exe		
-u			
13E5:0000	BB000Z	MOV	BX,0200
13E5:0003	B80000	MOV	AX,0000
13E5:0006	8ED8	MOV	DS, AX
13E5:0008	B94000	MOV	CX,0040
13E5:000B	8807	MOV	[BX],AL
13E5:000D	43	INC	BX
13E5:000E	40	INC	AX
13E5:000F	EZFA	LOOP	000B
13E5:0011	B8004C	MOV	AX,4C00
13E5:0014	CD21	INT	21
13E5:0016	E55D	IN	AX,5D
13E5:0018	C3	RET	
13E5:0019	90	NOP	
13E5:001A		PUSH	BP
13E5:001B		MOV	BP.SP
13E5:001D	81EC9000	SUB	SP,0090
			95 10030

然后通过 d 命令查看内存中 0:200 的内容,发现都为 00:

使用 t 和 p 命令执行程序:

```
AX=0000 BX=0200 CX=0016 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13D5 ES=13D5 SS=13E5 CS=13E5 IP=0003 NV UP EI PL NZ NA PO NC
                                             AX,0000
AX=0000 BX=0200 CX=0016 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=13D5 ES=13D5 SS=13E5 CS=13E5 IP=0006 NV UP EI PL NZ NA PO NC
13E5:0006 8ED8
                                   MOV
                                             DS,AX
AX=0000 BX=0200 CX=0016 DX=0000 SP=0000 DS=0000 ES=13D5 SS=13E5 CS=13E5 IP=0008
                                                                BP=0000 SI=0000 DI=0000
                                                                 NU UP EI PL NZ NA PO NC
 13E5:0008 B94000
                                  MOV
                                             CX,0040
 -t.
 AX=0000 BX=0200
DS=0000 ES=13D5
                         CX=0040 DX=0000 SP=0000
SS=13E5 CS=13E5 IP=000B
                                                               BP=0000 SI=0000 DI=0000
                                                                 NU UP EI PL NZ NA PO NC
 13E5:000B 8807
                                   MOV
                                             [BX],AL
                                                                                             DS:0200=00
 -t
                         CX=0040 DX=0000
SS=13E5 CS=13E5
 AX=0000 BX=0200
BS=0000 ES=13D5
                                                  SP=0000
                                                               BP=0000 SI=0000 DI=0000
                                                    IP=000D
                                                                 NU UP EI PL NZ NA PO NC
                                              BX
  13E5:000D 43
                                   INC
```

```
13E5:000D 43
                                 INC
                                            BX
AX=0000 BX=0201 CX=0040 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=0000 ES=13D5 SS=13E5 CS=13E5 IP=000E NV UP EI PL NZ NA PO NC
13E5:000E 40
                                 INC
                                            AX
AX=0001 BX=0201 CX=0040 DX=0000 SP=0000 BP=0000 SI=0000 DI=0000 DS=0000 ES=13D5 SS=13E5 CS=13E5 IP=000F NV UP EI PL NZ NA PO NC
13E5:000F E2FA
                                 LOOP
AX=0040 BX=0240 CX=0000 DX=0000 SP=0000 DS=0000 ES=13D5 SS=13E5 CS=13E5 IP=0011
                                                             BP=0000 SI=0000 DI=0000
                                                              NV UP EI PL NZ AC PO NC
13E5:0011 B8004C
                                 MOV
                                           AX,4C00
-p
                       CX=0000 DX=0000
SS=13E5 CS=13E5
                                                             BP=0000 SI=0000 DI=0000
AX=4C00 BX=0Z40
                                                 SP=0000
                                                              NU UP EI PL NZ AC PO NC
DS=0000 ES=13D5
                                                  IP=0014
                                 INT
                                            21
13E5:0014 CD21
 Program terminated normally
```

再次通过 d 命令查看内存中 0:200 的内容,可见成功实现了题目的要求:

```
-d 0:200
0000:0200
      00 01 02 03 04 05 06 07-08 09 0A 0B 0C 0D 0E 0F
0000:0210
      10 11 12 13 14 15 16 17-18 19 1A 1B 1C 1D 1E 1F
                                      !"#$z&'()*+,-./
0000:0220
      20 21 22 23 24 25
                  26 27-28 29 2A 2B 2C 2D 2E 2F
0000:0230
      30 31 32 33 34 35 36 37-38
                         3A
                           3B 3C 3D 3E 3F
                       39
                                      0123456789:;<=>?
0000:0240
      0000:0250
      0000:0260
0000:0270
```

程序流程如下:



3. 任务3

代码如下: stack segment db 200 dup(0) stack ends
code segment
assume cs:code,ss:stack
begin:
mov ah,1
int 21h
and al,11011111B
mov dl,al
mov ah,2
int 21h
mov ah,4ch
int 21h

code ends end begin

保存为 3c.asm,使用 masm 和 link 进行编译链接:

```
D:\JSL>masm 3c.asm;
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.

50732 + 415604 Bytes symbol space free

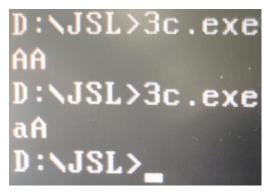
0 Warning Errors
0 Severe Errors

D:\JSL>link 3c;

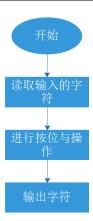
Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.

LINK: warning L4021: no stack segment
```

运行程序, 结果如下:



此程序通过读取输入的字符,然后进行按位与运算变成大写字母,最后输出。 程序流程图如下:



4. 补充任务

代码如下:

data segment

msg db 'Please input a string:',0AH,0DH,'\$'

data ends

code segment

assume cs:code,ds:data

begin:

mov ax,data

mov ds,ax

mov dx,offset msg

mov ah,9

int 21h

mov bx,0

mov es,bx

mov bx,200h

input:

mov ah,1

int 21h

cmp al,'\$'

jz space

and al,11011111B

mov es:[bx],al

inc bx

jmp input

space:

mov cx,bx

mov ah,2

mov al,0AH

mov dl,al

int 21h

mov ah,2

mov al,0DH

mov dl,al

int 21h

mov bx,200h

jmp output

output:

mov ah,2

cmp bx,cx

jz exit

mov al,es:[bx]

inc bx

mov dl,al

int 21h

jmp output

exit:

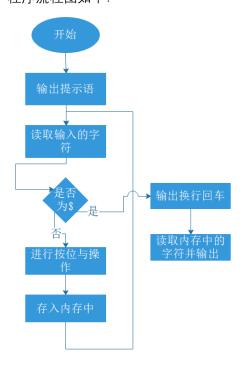
mov ah,4ch

int 21h

code ends

end begin

此程序首先给出提示语: 'Please input a string:', 然后读取输入的字符串存入内存, 以 \$结束, 然后进行按位与运算变成大写字母, 最后从内存中读取数据输出字符串。程序流程图如下:



源代码中,begin 段程序是用来输出提示语,并且初始化寄存器值的,input 是用来读取输入的字符串并将其转化为大写字母的,space 是用来输出换行符的,output 是用来输出字符串的。exit 退出程序。

四、实验总结

通过这次实验课,我了解到了计算机的数制 ASCII 码特点,内存读写的编程特点,能够熟练地做到编写类似的程序,收获颇丰。

在实验中,我修改了任务三中的小写字母转大写字母的代码,将通过直接用减法进行大小写转换改为用按位与进行转换,这样做避免了输入大写字母时转换错误的问题。