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]:
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>debug 3a.exe
-u
13E5:0000 8CC8          MOV     AX,CS
13E5:0002 8ED8          MOV     DS,AX
13E5:0004 B82000        MOV     AX,0020
13E5:0007 8EC0          MOV     ES,AX
13E5:0009 BB0000        MOV     BX,0000
13E5:000C B91700        MOV     CX,0017
13E5:000F 8A07          MOV     AL,[BX]
13E5:0011 26            ES:
13E5:0012 8807          MOV     [BX],AL
13E5:0014 43            INC     BX
13E5:0015 E2F8          LOOP    000F
13E5:0017 B8004C        MOV     AX,4C00
13E5:001A CD21          INT     21
13E5:001C EC            IN      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  CX=001C  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=13D5  ES=13D5  SS=13E5  CS=13E5  IP=0002   NV UP EI PL NZ NA PO NC
13E5:0002 8ED8          MOV     DS,AX
-t

AX=13E5  BX=0000  CX=001C  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=13E5  ES=13D5  SS=13E5  CS=13E5  IP=0004   NV UP EI PL NZ NA PO NC
13E5:0004 B82000        MOV     AX,0020
-t

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

AX=0020  BX=0000  CX=001C  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=13E5  ES=0020  SS=13E5  CS=13E5  IP=0009   NV UP EI PL NZ NA PO NC
13E5:0009 BB0000        MOV     BX,0000
-t

AX=0020  BX=0000  CX=001C  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=13E5  ES=0020  SS=13E5  CS=13E5  IP=000C   NV UP EI PL NZ NA PO NC
13E5:000C B91700        MOV     CX,0017
-
```

```
AX=0020  BX=0000  CX=0017  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:0000=8C
-t

AX=008C  BX=0000  CX=0017  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:0000=8C
-t

AX=008C  BX=0000  CX=0017  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     BX
-t

AX=008C  BX=0001  CX=0017  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
-t

AX=008C  BX=0001  CX=0016  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:0001=C8
-
```

```
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:0001=C8
-t

AX=00C8  BX=0001  CX=0016  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     BX
-t

AX=00C8  BX=0002  CX=0016  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
-t

AX=00C8  BX=0002  CX=0015  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:0002=8E
-t

AX=008E  BX=0002  CX=0015  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:0002=8E
-
```

```
AX=008E  BX=0002  CX=0015  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     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
13E5:0015 E2F8          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
13E5:000F 8A07          MOV     AL,[BX]                       DS:0003=D8
-t

AX=00D8  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
13E5:0011 26            ES:
13E5:0012 8807          MOV     [BX],AL                       ES:0003=D8
-t

AX=00D8  BX=0003  CX=0014  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=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          LOOP    000F
-t

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
-t

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 26            ES:
13E5:0012 8807          MOV     [BX],AL                       ES:0004=B8
-t

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     BX
-t

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    000F
-
```

```
AX=00B8  BX=0005  CX=0012  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:0005=20
-t

AX=0020  BX=0005  CX=0012  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          MOV     [BX],AL                       ES:0005=20
-t

AX=0020  BX=0005  CX=0012  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
-t

AX=0020  BX=0006  CX=0012  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
-t

AX=0020  BX=0006  CX=0011  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:0006=00
-
```

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```
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          MOV    [BX],AL                      ES:0006=00
-t

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   NV 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   NV UP EI PL NZ NA PO NC
13E5:0015 E2F8          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]                      DS:0007=8E
-t

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  CX=0010  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    BX
-t

AX=008E  BX=0008  CX=0010  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
-t

AX=008E  BX=0008  CX=000F  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:0008=C0
-t

AX=00C0  BX=0008  CX=000F  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:0008=C0
-t

AX=00C0  BX=0008  CX=000F  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    BX
-
```

```
AX=00C0  BX=0009  CX=000F  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
-t

AX=00C0  BX=0009  CX=000E  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:0009=BB
-t

AX=00BB  BX=0009  CX=000E  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          MOV     [BX],AL                          ES:0009=BB
-t

AX=00BB  BX=0009  CX=000E  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
-t

AX=00BB  BX=000A  CX=000E  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=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:000A=00
-t

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            ES:
13E5:0012 8807          MOV     [BX],AL                          ES:000A=00
-t

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     BX
-t

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    000F
-t

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=000F    NV UP EI PL NZ NA PO NC
13E5:000F 8A07          MOV     AL,[BX]                          DS:000B=00
-
```

```
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:000B=00
-t

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     BX
-t

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    000F
-t

AX=0000  BX=000C  CX=000B  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:000C=B9
-t

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            ES:
13E5:0012 8807          MOV     [BX],AL                          ES: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=0014   NU UP EI PL NZ NA PE NC
13E5:0014 43              INC     BX
-t

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   NU UP EI PL NZ NA PO NC
13E5:0015 E2F8            LOOP    000F
-t

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   NU UP EI PL NZ NA PO NC
13E5:000F 8A07            MOV     AL,[BX]                      DS:000D=17
-t

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   NU UP EI PL NZ NA PO NC
13E5:0011 26              ES:
13E5:0012 8807            MOV     [BX],AL                      ES:000D=17
-t

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=0014   NU UP EI PL NZ NA PO NC
13E5:0014 43              INC     BX
-
```

```
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   NU UP EI PL NZ NA PO NC
13E5:0015 E2F8            LOOP    000F
-t

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   NU UP EI PL NZ NA PO NC
13E5:000F 8A07            MOV     AL,[BX]                      DS:000E=00
-t

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   NU UP EI PL NZ NA PO NC
13E5:0011 26              ES:
13E5:0012 8807            MOV     [BX],AL                      ES:000E=00
-t

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   NU UP EI PL NZ NA PO NC
13E5:0014 43              INC     BX
-t

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   NU UP EI PL NZ NA PE NC
13E5:0015 E2F8            LOOP    000F
-
```

```
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 8A07            MOV     AL,[BX]                      DS:000F=8A
-t

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=0011   NU UP EI PL NZ NA PE NC
13E5:0011 26              ES:
13E5:0012 8807            MOV     [BX],AL                      ES:000F=8A
-t

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   NU UP EI PL NZ NA PE NC
13E5:0014 43              INC     BX
-t

AX=008A  BX=0010  CX=000B  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 AC PO NC
13E5:0015 E2F8            LOOP    000F
-t

AX=008A  BX=0010  CX=0007  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 AC PO NC
13E5:000F 8A07            MOV     AL,[BX]                      DS:0010=07
-
```

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```
DS=13E5  ES=0020  SS=13E5  CS=13E5  IP=0011   NV UP EI PL NZ AC PO NC
13E5:0011 26                 ES:
13E5:0012 8807               MOV      [BX],AL                        ES:0010=07
-t

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                 INC      BX
-t

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
-t

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:0011=26
-t

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                 ES:
13E5:0012 8807               MOV      [BX],AL                        ES: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=0014   NV UP EI PL NZ NA PE NC
13E5:0014 43                 INC      BX
-t

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
-t

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
-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=0011   NV UP EI PL NZ NA PE NC
13E5:0011 26                 ES:
13E5:0012 8807               MOV      [BX],AL                        ES:0012=88
-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      BX
-
```

```
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
-t

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
-t

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                 ES:
13E5:0012 8807               MOV      [BX],AL                        ES:0013=07
-t

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=0014   NV UP EI PL NZ NA PO NC
13E5:0014 43                 INC      BX
-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               LOOP     000F
-
```

```
AX=0007  BX=0014  CX=0003  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:0014=43
-t

AX=0043  BX=0014  CX=0003  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          MOV     [BX],AL                             ES:0014=43
-t

AX=0043  BX=0014  CX=0003  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
-t

AX=0043  BX=0015  CX=0003  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
-t

AX=0043  BX=0015  CX=0002  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:0015=E2
-
```

```
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:0015=E2
-t

AX=00E2  BX=0015  CX=0002  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     BX
-t

AX=00E2  BX=0016  CX=0002  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
-t

AX=00E2  BX=0016  CX=0001  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:0016=F8
-t

AX=00F8  BX=0016  CX=0001  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:0016=F8
-
```

再次查看内存:

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。
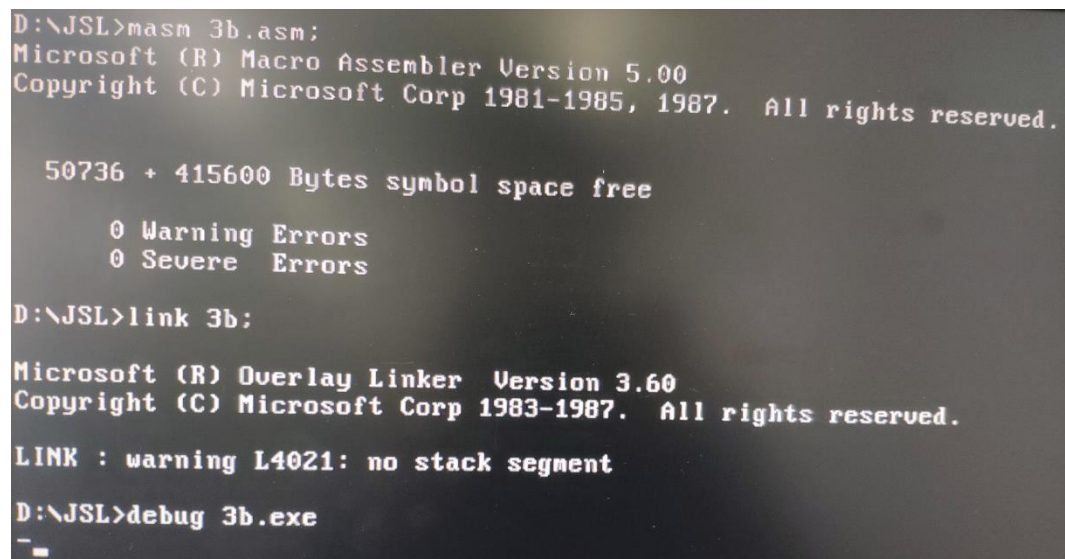
查看源代码，画出流程图:
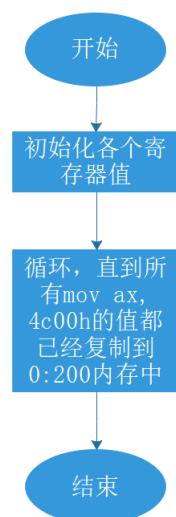
2. 任务 2

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：

使用首先使用 debug 的 U 命令查看程序：

```
D:\JSL>debug 3b.exe
-u
13E5:0000 BB0002          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 E2FA            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 55              PUSH     BP
13E5:001B 8BEC            MOV      BP,SP
13E5:001D 81EC9000        SUB      SP,0090
```

然后通过 d 命令查看内存中 0:200 的内容，发现都为 00:

```
D:\JSL>debug 3b.exe
-d 0:200
0000:0200  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0210  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0220  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0230  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0240  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0250  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0260  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0270  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 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
13E5:0003 B80000          MOV      AX,0000
-t

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
-t

AX=0000  BX=0200  CX=0016  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=0000  ES=13D5  SS=13E5  CS=13E5  IP=0008   NV UP EI PL NZ NA PO NC
13E5:0008 B94000          MOV      CX,0040
-t

AX=0000  BX=0200  CX=0040  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=0000  ES=13D5  SS=13E5  CS=13E5  IP=000B   NV UP EI PL NZ NA PO NC
13E5:000B 8807            MOV      [BX],AL                    DS:0200=00
-t

AX=0000  BX=0200  CX=0040  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=0000  ES=13D5  SS=13E5  CS=13E5  IP=000D   NV UP EI PL NZ NA PO NC
13E5:000D 43              INC      BX
-
```

```
13E5:000D 43                  INC        BX
-t

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
-t

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       000B
-p

AX=0040   BX=0240   CX=0000   DX=0000   SP=0000   BP=0000  SI=0000  DI=0000
DS=0000   ES=13D5   SS=13E5   CS=13E5   IP=0011   NV UP EI PL NZ AC PO NC
13E5:0011 B8004C              MOV        AX,4C00
-p

AX=4C00   BX=0240   CX=0000   DX=0000   SP=0000   BP=0000  SI=0000  DI=0000
DS=0000   ES=13D5   SS=13E5   CS=13E5   IP=0014   NV UP EI PL NZ AC PO NC
13E5:0014 CD21                INT        21
-p

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   ................
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 39 3A 3B 3C 3D 3E 3F   0123456789:;<=>?
0000:0240  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0250  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0260  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0000:0270  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
-
```

程序流程如下：

开始

初始化各个寄
存器值

循环，直到
0-63都已经复
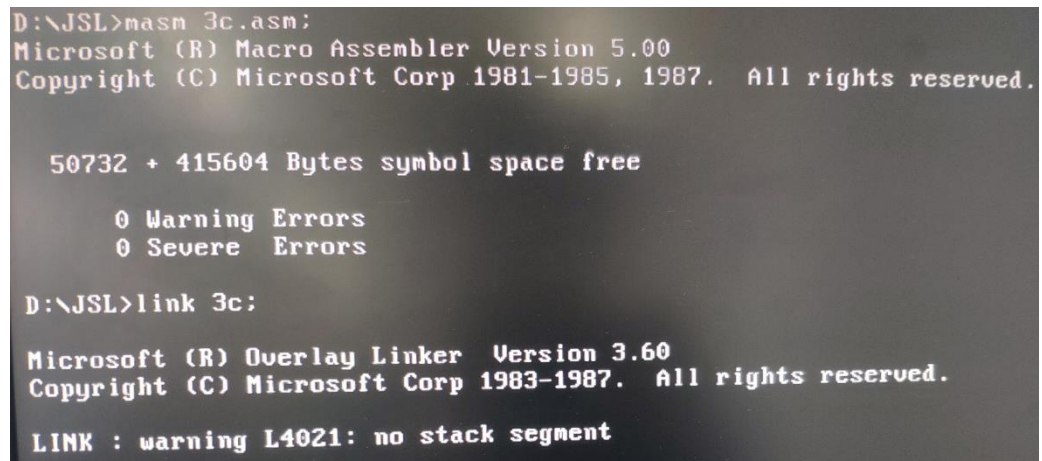制到0:200内
存中

结束

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：
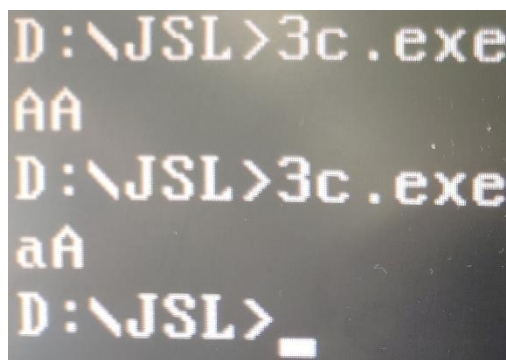
运行程序，结果如下：

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：
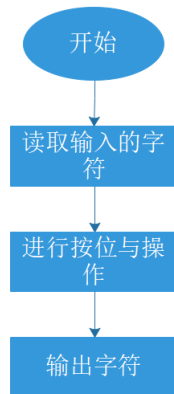
4. 补充任务

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
```
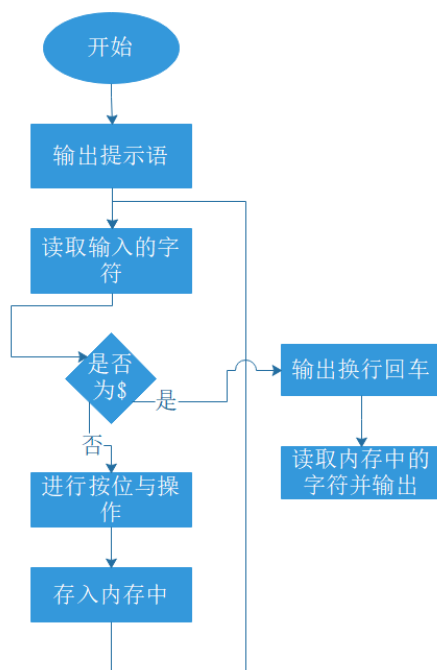
```
mov dl,al
int 21h
mov ah,2
mov al,0DH
mov dl,al
int 21h
mov bx,200h
jmp output

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。