Week1

Suppose a data is 376a8d43h in Hexadecimal, how to place it from the address that 20000h by little endian and big endian?

答：小端存储（little endian）20000H 到 20003H 地址分别存放的是 43H, 8DH,6AH 和 37H 大端存储（big endian）20000H 到 20003H 地址分别存放的是 37H,6AH, 8DH 和 43H

Convert the follow decimal integer into BCD and packed BCD number. a) 9 b)76 c)251

答：BCD 码：a)09H b)0706H c)020501H 或 a)00001001 b)0000011100000110 c)000000100000010100000001 packed BCD: a)09H b)76H c)0251H 或 a)00001001 b)01110110 c)0000001001010001

Convert the follow packed BCD number into decimal number: a) 10001001 b) 00001001 c) 00110010 d)00000001

答：a) 89 b) 9 c) 32 d) 1

Convert the follow binary number into signed decimal number: a)10000001 b)00110011 c)10010010 d)10001001

答：a) -127 b) 51 c) -110 d) -119

Week2

Which mode can run the "real-address mode" software in protected environment?

A.Real-address mode	B.Protected mode
C.Virtual-8086 mode	D.64-bit mode

Right Answer is: C

The following registers which one has nothing to do with the stack?

A.SS	B.BP
C.SP	D.BX

Right Answer is: D

The data stored in the IP register is _____

A.Address of current instruction	B.Address of the next instruction that will be executed
C.The next instruction that will be executed	D.The address of operand

Right Answer is: B

The IP register can be accessed directly by software.

Right Answer is: Wrong

There are no instructions that allow the whole FLAGS register to be examined or modified directly.

Right Answer is: Right

OF will be set if an arithmetic operation generates a carry or a borrow out of the most-significant bit of the result

Right Answer is: Wrong

How many 8-bit, 16-bit and 32bit general-purpose registers are there in the IA-32 CPU? What are them?

Right Answer is:

8 位通用寄存器有 AL,AH,BL,BH,CL,CH,DL,DH 共 8 个 16 位通用寄存器有 AX,BX,CX,DX,SI,DI,BP,SP 共 8 个 32 位通用寄存器有 EAX,EBX,ECX,EDX,ESI,EDI,EBP,ESP 共 8 个

In the real mode, find the memory address of the next instruction executed by the microprocessor for the following CS:IP combinations: a) CS = 1000H and IP = 2000H b) CS = 1900H and IP = 0200H c) CS = 1900H and IP = 1000H D) CS = 5679H and IP = CDEFH Please give the physical memory address.

Right Answer is:

Physical memory address is： a) 12000H b) 19200H c) 1A000H d) 6357FH

Will an overflow occur when signed FFH is added to a signed 01H? How about signed 70H add a singed 40H?

Right Answer is:

FFH+1， OF=0，不产生溢出 70H+40H 会产生溢出，OF=1

Week3

Suppose the data declared as follow:
NUM1 BYTE 2, 3, 4, 5, '67'
NUM2 BYTE 10
LIT EQU NUM2-NU1
Question: LIT = ?

◉ A.5	○ B.6
○ C.10	○ D.12

Right Answer is: B

Which following name are valid?

☑ A.tart	☐ B._buff
☑ C.3abc	☑ D.a_@?

Right Answer is: A B D

Which following name are not valid?

☑ A.a2*a1	☐ B.EAX
☑ C.kaishi	☐ D.Windows

Right Answer is: A B

Is "MOV [BX], AL" right?

Right Answer is: Right

Is "MOV AX,[BX][SI]" right?

Right Answer is: Right

Is "MOV CX,[DX]" right?

Right Answer is: Wrong

Is "MOV AX,[SI][DI]" right?

Right Answer is: Wrong

Suppose that (DS)=2000H, (ES)=2100H, (SS)=1500H, (SI)=00A0H, (BX)=0100H, (BP)=0010H, the offset address of VAL is 0050H。Determine the physical address accessed by each of the following instructions, assuming real mode operation.

（1）MOV AX，[100H]
（2）MOV VAL，BH
（3）MOV AX，[BX]
（4）MOV AX，ES：[BX]
（5）MOV AX，[BP]
（6）MOV AX， [SI]
（7）MOV AX，[BX+50H]
（8）MOV VAL[BX]，BP
（9）MOV AH，[BX+SI]
（10）MOV AL，VAL[BX][SI]

Right Answer is:

（1）20100H （2）20050H （3）20100H （4）21100H （5）15010H （6）200A0H （7）20150H （8）20150H （9）201A0H （10）201F0H

Write the directive to define the following variable: 1) Declare an word array named buff which has 800 elements without initial. 2) Declare a string named STRING with initial value “MASM”,”1024”

Right Answer is:

buff word 800 dup(?) 或 buff dw 800 dup(?)
STRING byte “MASM”, “1024” 或 STRING db “MASM”, “1024”

What’s different between the EQU operator and = operator?

Right Answer is:

EQU 定义的常量不能再赋值，=定义的可以再次定义

Week4

What segment registers may not be popped from the stack?

- A.CS
- B.DS
- C.ES
- D.SS

Right Answer is: A

What is the purpose of the .386, .486p, .model directive?

Right Answer is:

.386 表示该程序使用 386 指令 .486p 表示该程序使用 486 保护模式指令

What's wrong with the following instructions:

（l）MOV　　AH，BX
（2）MOV　　[BX]，[SI]
（3）MOV　　AX，[SI][DI]
（4）MOV　　MYDAT[BX][SI]，ES:AX
（5）MOV　　BL，1000
（6）MOV　　2000，BX
（7）MOV　　CS，AX

Right Answer is:

1）目的操作数与源操作数不等宽
2）两个操作数不能都是存储器操作数
3）不能两个都是变址寄存器
4）寄存器不能用段超越
5）1000 超出 8 位数范围
6）立即数不能做目的操作数
7）CS 不能作为 MOV 的目的操作数

Write a short sequence of instructions that load the data segment register with 1000H

Right Answer is:

MOV AX, 1000H
MOB DS, AX

What is the difference between the LEA SI, NUMB instruction and the MOV SI, OFFSET NUMB instruction?

Right Answer is:

LEA 指令的源操作数可以是任意寻址方式的存储器操作数，OFFSET 形式的语句只能是变量名或标号名。OFFSET 形式是立即数寻址，速度快。

Suppose the data declared as follow:

ORG 26H
NUM1　BYTE　12H,13H
NUM2　WORD　$+3
ORG $+4
NUM3　WORD　325AH, 5A6BH

Question: How do the data store in memory? Please draw the memory map.

Right Answer is:

按存储地址顺序从低到高，各字节分别是: 12H,13H,2BH,00,-,-,-,-,5AH,32H,6BH,5AH,

Suppose the data declared as follow:

ORG 100H NUM1

DB 7, 43H, ‘AB’
NUM2 DW 1, ?
NUM3 DB 2 DUP(1, 2 DUP(5))
Question: How do the data store in memory? Please draw the memory map.
Right Answer is:

按存储地址顺序从低到高，各字节分别是: 7,43H,’A’,’B’, 1,0,-,-,1,5,5,1,5,5

Week5

The Physical address of source operand in MOV AX, [BX+SI] is

◉ A.(DS)X16+(BX)+(SI)	○ B.(ES)X16+(BX)+(SI)
○ C.(SS)X16+(BX)+(SI)	○ D.(CS)X16+(BX)+(SI)

Right Answer is: A

The Physical address of source operand in MOV AX, [BP+SI] is

○ A.(DS)X16+(BP)+(SI)	○ B.(ES)X16+(BP)+(SI)
◉ C.(SS)X16+(BP)+(SI)	○ D.(CS)X16+(BP)+(SI)

Right Answer is: C

The Physical address of source operand in MOV AX, ES:[BP+SI] is

○ A.(DS)X16+(BP)+(SI)	◉ B.(ES)X16+(BP)+(SI)
○ C.(CS)X16+(BP)+(SI)	○ D.(SS)X16+(BP)+(SI

Right Answer is: B

INC not affect _____

○ A.OF	◉ B.CF
○ C.SF	○ D.ZF

Right Answer is: B

Which of the following instruction is WRONG

◉ A.MOV WORD PTR [SI], [BX]	○ B.IN A;L, DX
○ C.JMP WORD PTR [BX+4]	○ D.PUSH WORD PTR 20[BX+SI]

Right Answer is: A

If AX=1001H and DX=20FFH, list the sum and the contents of each flag register bit (CF, AF, SF, ZF and OF).

Right Answer is:

SUM= 3100H, CF=0，AF=1，OF=0，SF=0，ZF=0

Explain the difference between the SUB and CMP, AND and TEST.

Right Answer is:

CMP 和 SUB 做同样操作，但不保存结果；TEST 和 AND 做同样操作，但不保存结果

Programming in 16-bit assembly language
1) Add the data in AL, BL and CL, let the result in the DX
2) Add the data in AL and a BYTE data in memory which symbol address is *NUM*using Base-Plus-Index addressing. The result in the next address of *NUM*.

Right Answer is:

1） MOV DX,0
ADD DL, AL
ADC DH,0
ADD DL, BL
ADC DH,0
ADD DL, CL
ADC DH,0
2) MOV BX, OFFSET NUM (或 LEA BX, NUM)
MOV SI, 0
ADD AL, [BX][SI]
INC SI
MOV [BX][SI], AL

Week6

How many way you know to clear the AX with 0? Please give the way.

Right Answer is:

1）MOV AX,0
2) AND AX,0
3) SUB AX,AX
4) XOR AX,AX
5) MOV BL,0

MUL BL

Programming in 16-bit assembly language

1) Use shift instruction to calculate DX=3×AX＋7×BX， suppose the data are assigned and no carry.

2) Use logic instruction to implement the conversion from ASCII of 0~9 to unpacked BCD, and from unpacked BCD to ASCII.

3) Implement DX.AX shift right 4 bits.

Right Answer is:

```
1) MOV CX, AX
SHL    AX, 1   ;   AX*2
ADD    AX, CX   ; AX*3
MOV DX, BX
MOV CL, 3
SHL    DX, CL   ; BX*8
SUB    DX, BX   ; BX*7
ADD    DX, AX

2)  MOV     AL, ’0’
LOP:  AND   AL, 0FH
INC       AL
CMP     AL, 0AH
JNE   LOP
MOV   AL, 0
LOP1: OR     AL, 30H
INC       AL
CMP   AL, ‘:’
JNE   LOP1

3) MOV CL， 4
SHR          AX，CL
MOV   BL，  DL
SHR   DX，  CL
SHL   BL，  CL
OR    AH，  BL
```

Suppose DS=2000H. BX=1256H, SI=528FH, displacement TABLE=20A1H，[232F7H]=3280H, [264E5H]=2450H, after run follow near indirect jump instructions, IP=?

i. JMP BX
ii. JMP TABLE[BX]
iii. JMP [BX][SI]

Right Answer is:

i. 1256H

ii. 3280H

iii. 2450H

Determine the jump conditions of the following program.

（1） XOR AX, 1E1EH

JE EQUAL

（2） TEST AL, 10000001B

JNZ THERE

（3） CMP CX, 64H

JB THERE

Right Answer is:

(1) AX=1E1EH

(2) AL 的最高位和/或最低位为 1

(3) (CX)<64H

If the target address in short jump beyond range of -128~127, how to handle? Give an example.

Right Answer is:

可以把跳转条件做一些调整，利用无条件跳转的跳转范围大，来达到目的，如：

```
    CMP   AX, 33
    JE   LONG
    ……       ;大于 127 字节
LONG:
```

改为：

```
    CMP AX, 33
    JNE   SHOET
    JMP   LONG
SHORT:……; 大于 127 字节
      ……
         LONG:
```

What is A10 and A20 in the follow short jump instruction?（in hexadecimal）

	address	Instruction code	Assembly statement
（1）	0110H	EB F7	JMP A10
（2）	0110H	EB 09	JMP A20

Right Answer is:

（1）A10=0109H

（2）A20=011BH

Week7

How many times does the following instruction sequence execute repeatedly?

```
      mov   cx, 0
delay:  loop   delay
```

Right Answer is:

65536 次

What's the function of the following instruction sequence?

```
              MOV     CX，100；
              MOV     SI，0FFFFH；
NEXT：  INC          SI；
              CMP     BYTE PTR [SI]，'A'；
              LOOPNZ      NEXT；
              EXIT：
```

The function is _____。

Right Answer is:

从 DS:0000 开始在连续的 100 个字节中查找字符'A'

Put the follow statement in the parentheses

（1） LOOP L20

（2） LOOPNE L20

（3） LOOPE L20

when the follow program is executed, AX= ?,BX= ? CX= ? DX= ?

```
      MOV   AX, 01
      MOV   BX, 02
      MOV   CX, 03
      MOV   DX, 04
L20:    INC   AX
      ADD   BX,   AX
      SHR   DX, 1
      (          )
      RET
```

Right Answer is:

（1） AX=4, BX=11, CX=0, DX=0

（2） AX=4, BX=11, CX=0, DX=0

（3） AX=2, BX=4, CX=2, DX=2

Fill in the blank：

Change 8 16-bits packed BCD numbers addressing from *PACKED* in memory to 16 unpacked BCD numbers, and store them in memory, addressing from*UNPACKED*.

```
                    MOV     DX，_____________；
                    MOV     CL，_____________
                    MOV     SI，0；
                    MOV     DI，_______________；
CONVERT：  MOV     AL，[SI+PACKED]；
```

```
                MOV     AH，AL；
                AND     AL，0FH；
                _____________________；
                MOV     [DI+UNPACKED]，_____________；
                ADD     DI，_____________；
                _____________；
                DEC     DX；
                JNZ         CONVERT；
                HLT；
```

Right Answer is:

```
        MOV    DX，__8_____；
            MOV    CL，__4_____
            MOV    SI，0；
            MOV    DI，_0_____；
CONVERT：     MOV    AL，[SI+PACKED]；
             MOV    AH，AL；
             AND    AL，0FH；
            _SHR  AH,  CL_____；
             MOV    [DI+UNPACKED]，____AX__；
             ADD     DI，_____2_____；
            INC   SI ；
             DEC     DX；
             JNZ         CONVERT；
                    HLT；
```

What's the function of the following instruction sequence?

1） mov si, 600h
mov di, 601h
mov ax, ds
mov es, ax
mov cx, 256
std
rep movsb

2） cld
mov ax, 0fefh
mov cx, 5
mov bx, 3000h
mov es, bx
mov di, 2000h
rep stows

Right Answer is:

1）从 DS:600H 开始将向低地址方向的 256 字节向高地址移动一个字节位置。

2）从 3000:2000h 开始连续存放 5 个 0fefh

Week8（略）

Week9

How interrupt-driven I/O do for output?

Right Answer is:

1. The processor issues a WRITE command and a word of data to I/O module, then goes off and does something else.
2. The I/O module gets the data from the CPU and transfers them to device, then interrupt the processor to require service.
3. The processor saves the context of the current program and process the interrupt to write the next word of data to the I/O module.
4. The processor restores the context of the program it was working on and resumes execution.

List advantages and disadvantages of memory I/O and isolated I/O.

Right Answer is:

I/O 独立编址的优点：不占用存储空间；I/O 指令单列市的程序容易读

I/O 独立编址的缺点：电路相对复杂，需要有相应的信号支持。

I/O 混合编址的优点：可以用所有的对存储器操作所用的寻址方式；无需专门的电路和信号

I/O 混合编址的缺点：占用存储器地址空间。

By the four kinds of I/O techniques, which one let the CPU busiest? Which one transfer the data without needing the processor?

Right Answer is:

软件查询方式耗费 CPU 资源最多，I/O 通道和处理机方式以及 DMA 方式不需要 CPU 传送数据。

A general bus cycle in 8088/8086 is to clocking _____ periods. Briefly describe the purpose of each T state listed:

(1) T_1

(2) T_2

(3) T_3

(4) T_4

(5) T_W

Right Answer is:

4

T1：AD 线输出地址，ALE 线输出锁存信号，I/O/MEM#有效。

T2：读写线有效（RD 或 WR）AD 线转为传送数据

T3：数据有效

T4：所有信号撤销

TW：在 T3 和　T4 之间如果外设没准备好，插入一个 TW 等待。

Programming with conditional transfer, transfer 128 bytes data from BUFFER in memory to CRT terminal. The data port address of CRT is 0008H, status port address is 0020H, D_7 is status bit, its value is 0 when output buffer is null.

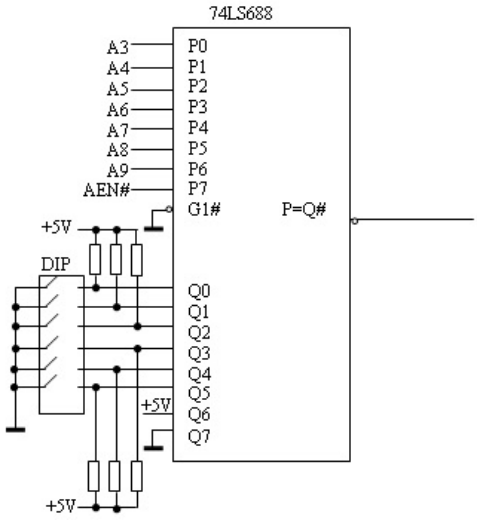
Right Answer is:

……

```
        MOV     SI, OFFSET BUFFER
        MOV     CX, 128
WAIT:   IN      AL, 20H
        TEST    AL, 80H
        JNZ     WAIT        ；  输出缓冲不空
        MOV     AL, [SI]
        OUT     08H, AL
        DEC     CX
        JNZ     WAIT
```

……

A address decoding circuit is shown in Figure 3.1.　Now we hope the range of address is 240~247h, how to set the DIP?



Right Answer is:

应该关闭的开关有 Q0、Q1、Q2、Q4、Q5

Design a port address decoding circuit by 138 decoder, let the 4 rang of addressing is：
①0280~0287H，②0288~028FH，③0290~0297H，④0298~029FH.

Right Answer is:
分析，从四段地址的低位来看，显然地址的低 3 位作为地址低位，不参与到译码电路中，而四段地址范围为 1010000XXX～1010001XXX～1010010XXX～1010011XXX，显然我们可以将 A5A4A3 作为 74LS138 的输入，这样得到的电路是

Week10

Why do interrupts free time for the microprocessor?

Right Answer is:
因为采用中断方式，处理器可以不用一直查询外设状态，可以去做别的事情，外设出现状况会主动中断 CPU 的执行，从而做到了外设和 CPU 并行工作。

What is the interrupt priority? What is the purpose of set interrupt priority? How to set the priority?

Right Answer is:
中断优先级是指在多个中断请求到来的时候，处理器先处理哪一个的选择级别。设置中断优先级，可以使重要的中断及时得到响应。可以是软件决定，可以是菊花链法，也可以是有专门的总线仲裁或中断控制器来决定优先级。

How many 8259As are required to have 64 interrupt inputs? How to connect them?

Right Answer is:
需要 9 片 8259，将一片作为主片，其他 8 个作为从片，将从片的 INT 分别接到主片的某个 IR 脚上，主片 INT 接 CPU 的 INTR。主从片的 CAS 一对一的接起来。

In a single 8259A system, if the interrupt vector number of IR7 is 2FH， what's the value of ICW2?

Right Answer is:
ICW2=28H

Explain priority rotation and special priority rotation in the 8259A.

Right Answer is:
优先级轮转，刚被服务的中断的中断优先级自动变成最低
指定优先级轮转：当前中断服务结束后，指定的中断级别的优先级变成最低

Week11

What is the interrupt vector? Where are the interrupt vectors located in the microprocessor's memory?

Right Answer is:
中断向量就是中断处理程序的入口地址。中断向量存放在内存 0 段 0 地址开始的连续存储位置。

In a single 8259A system, if the interrupt vector number of IR7 is 2FH， what's the value of ICW2?

Right Answer is:
ICW2=28H

How many kinds of interrupt in x86 system? What are them?

Right Answer is:
有 4 种类型，可屏蔽中断（外部硬件中断），不可屏蔽中断，软件中断，内部异常

How to set or clear the IF and DF?

Right Answer is:
We can use CLI to clear IF, STI to set IF; CLD to clear DF, STD set DF

Week12

Each counter in the 8254 functions in how many different modes? If a 16-bit count is programmed into 8254, which byte of the count is programmed first?

Right Answer is:
每个定时器都有 6 种工作方式，16 位计数初始值先写的是低字节

Suppose a T/C in 8254 work on mode 2, initial count is 2K, binary counter, the frequency of input signal is 5 MHz. How much is the cycle of the output pulse (microseconds)?

Right Answer is:
所谓时间片是指输出脉冲的周期，由题可知，fOUT＝fCLK÷计数初值＝5M/2K＝2.5K。时间片（周期）＝1/fOUT＝400 微秒。

Suppose the address of 8254 is 50h, 52h, 54h, 56h, how to read the current count of CNT1 and CNT2 in the same time? Please write the sequence of the instructions.

Right Answer is:

```
MOV   AL，11011100B   ; T/C1 and T/C2
OUT   56H，AL
IN    AL，52H；
MOV   AH，AL
IN    AL，52H
XCHG  AH，AL          ; AX is current count of CT1
MOV   BX，AX          ；
IN    AL，54H；
```

```
MOV   AH，AL
IN    AL，54H
XCHG  AH，AL          ; AX is current count of CT2
```

Now use an 8254 as timer in a data acquisition system, it read a byte from 60H port into a round-robin queue *BUFF* every 50ms by interrupt, the BUFF has 20 bytes. The frequency of input clock is 10MHz, and the 8259 port address is 120 ~ 121H, the interrupt vector Number is 28H, 8254 port address is 160H ~ 163 H, design a circuit diagram of 138,8254 and 8259, and programming 16 assembly complete program (including 8259 and 8254 initialization routine, the interrupt handler and program fragment to modify the interrupt vector table).

Right Answer is:

分析： 8254 的中断请求的中断类型号为 28H，则显然初始化 8259 的 ICW2 的值为 28H（中断类型号的高 5 位），而中断引脚显然用的是 IR0。8254 的输入时钟频率为 10MHz，需要输出 50ms 周期（频率 20）的方波，作为中断请求信号，可以考虑用方式 2 或 3，初始值为 10M/20=500000, 因此要级联，假设用 CT0 和 CT1 级联。

答：

```
.8086
.MODEL SMALL
.DATA
  BUFF BYTE 20 DUP(?);
  IDX   WORD 0
.CODE
START:
   MOV   AX,@DATA
   MOV   DS,AX
   ;8259 初始化
   MOV    AL, 00010011B    ; 边沿触发，单片使用，要 ICW4
   MOV DX,120H
   OUT     DX, AL          ; ICW1
   MOV    AL, 28H          ; 中断类型号高位
   INC DX
   OUT     DX, AL          ; ICW2
   MOV    AL, 00000001B    ; 非总线缓冲方式，全嵌套，正常的中断结束
   OUT     DX, AL          ; ICW4
   ;对 8254 的初始化
   MOV    AL, 00110110B    ; 计数器 0 方式 3，先低后高，二进制计数
   MOV DX,163H
   OUT     DX, AL
   MOV DX,160H
   MOV    AX,5000              ; 计数初始值
   OUT     DX, AL
   MOV AL,AH
   OUT DX,AL
   MOV AL, 01010110B     ; 计数器 1 方式 3，先低 8 位，二进制计数
```

```
    MOV DX,163H
    OUT     DX, AL
    MOV DX,161H
    MOV AL,100              ; 计数初始值
    OUT     DX, AL
    ; 初始化中断向量表
    CLI
    MOV AX,0
    MOV ES,AX
    MOV SI,28H*4
    MOV BX,OFFSET SERVICE
    MOV ES:[SI],BX
    MOV BX,SEG SERBICE
    MOV ES:[SI+2],BX
    STI
    JMP $
SERVICE PRO FAR
    PUSH SI
    PUSH AX
    PUSH DX
    PUSH DS
    MOV AX,@DATA
    MOV DS,AX
    STI
    MOV SI,IDX
    IN AL,60H
    MOV BYTE PTR BUFF[SI],AL
    INC SI
    CMP SI,20
    JB EXIT
    MOV SI,0
EXIT:MOV IDX,SI
     MOV DX,120H
     MOV AL,20H
     OUT DX,AL
     CLI
     POP DS
     POP DX
     POP AX
     POP SI
     IRET
SERVICE ENDP
    END START
```

How is the interrupt request pin(INTR) enabled in the strobed input mode of operation of the 8255?

Right Answer is:

The INTR pin is enabled by setting the INTE bit in PC4(port A) and PC2(port B)

What is the purpose of the STB# signal in strobed input operation of the 8255?

Right Answer is:

The strobe input latches the input data and set the buffer full flag and interrupt request.

When 8255 work on mode 1 output, how to design its handshake signals? Explain the timing between the handshake signals.

Right Answer is:

对于方式 1 输出，CPU 输出数据，发出 WR#信号。WR#信号的下降沿将微处理器数据送到输出数据锁存器。WR#的上升沿起着三个作用：一是将数据输出到 8255 的端口线上；二是使 OBF#信号有效，表明输出缓冲区已满，通知外设来取数据；三是清除中断请求信号。外设接受数据后发出 ACK#信号，它一方面使 OBF#无效，另一方面 ACK#上升沿使 INTR 有效，发出新的中断请求信号，让 CPU 输出新的数据。

Why only 8255 port A can work on mode 2, but port B can't?

Right Answer is:

由于 PC 口只有 8 个引脚，作为方式 2 的控制字，输入和输出各要两根应答线，两个口的话就要 8 根线了，这样一来，中断请求线就无法安排。因此只能保证 A 口工作方式 2，双向传输，B 口只能作为单向的输入或输出。

Suppose a 4x4 matrix keyboard connected to microcomputer via a parallel interface chip 8255. 8255 port A set as output port and connect with row lines of keyboard, port B as a input port and connect with column lines of keyboard （as shown in Figure 6.1）. 8255 port A address is 60H, port B address is 61H, control register address 63H. The method of Non-coding keyboard scanning is as follows: let all of row lines is 0, then read column lines. If one of the column lines is 0, it indicates that one key is pressed. Now from row 0 to row 3, one time for one row, let the row line is 0, others are 1, then read the column lines, if one of the column lines is 0, the key at this row and this column is pressed. If no column line is 0, then examine the next line. The key number, starting from the top left corner, this key's number is 0, from left to right, top to bottom are numbered, and the lower-right corner is number 15. Please program the keyboard scanning.

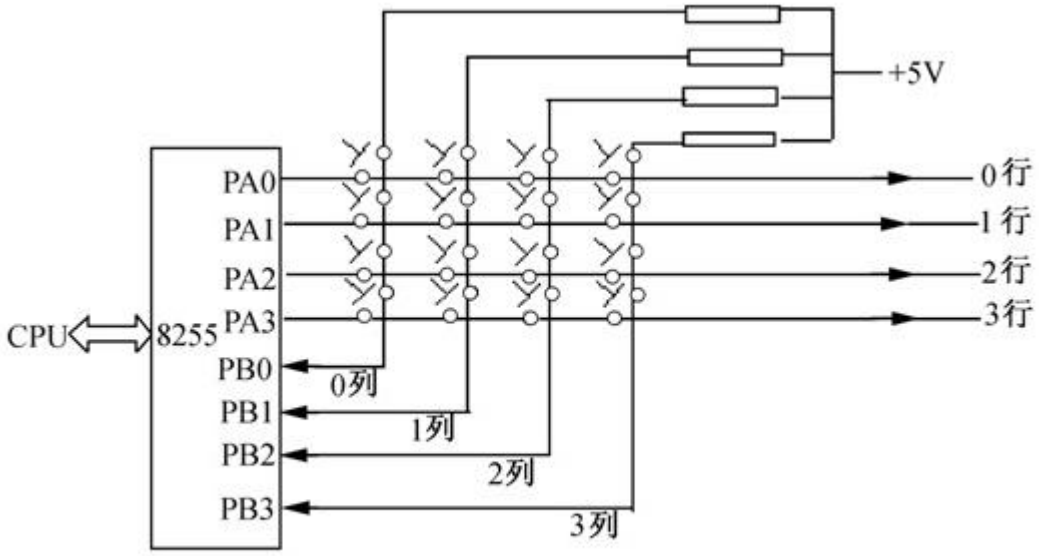


图 6.1　8255 连接非编码键盘接口

Right Answer is:

```
        mov     al,82h          ；方式 0，A 口输出，B 口输入
        out     63h,al
begin:  mov     al,0            ；检查看是否有键按下
        out     60h,al
wait:   in      al,61h
        and     al,0fh
        cmp     al,0fh
        jz      wait            ；无键按下则转上去等待
sm:     mov     dl,4            ；行数送 dl
        mov     al,0feh         ；扫描码，0 行为 0
        mov     ch,0            ；键号初值为 0
srow:   out     60h,al          ；扫描一行
        rcl     al,1            ；修改扫描行
        mov     ah,al           ；保存下次要扫描的扫描码
        in      al,61h          ；读列线状态
        and     al,0fh
        cmp     al,0fh          ；检查是否有列线为 0
        jnz     scol            ；有列线为 0 转到
        add     ch,4            ；否则键号+4，指向下一行的第一个键的键号
        mov     al,ah           ；取回行扫描码
        dec     dl              ；行数减 1
        jnz     srow            ；行没扫描完则转去扫描下一行
        jmp     begin
scol:   rcr     al,1
        jnc     proce           ；该列为 0，转处理程序，此时 ch 中是键号
```

```
        inc     ch              ；如果该列不为 0，键号+1，继续查找列线
        jmp     scol
proce:  ……                      ；键处理程序
```

An 1us pulse signal source link to the 8254 as CLK1, and using the counter to generates interrupt which period is 50ms, in the handler of this interrupt, read a set of switch from the 8255 PA port and send data to PB port to drive the LED display **per second**, suppose that the port address of 8253 is 40H~43H and that of 8255 is 60H ~63H, and only 10 of the address lines (A0~A9) for port decoding. Please complete:

① the hardware connection.

② the initialization of 8253 counter 1 (50ms only)

③ the program to initial 8255 and the handler of the interrupter.

Right Answer is:

分析：题目中要求用软件方式将 1us(1MHz)的脉冲扩大定时到 1 秒，题目第二问又明确 8253 的计数器 1 输出脉冲周期是 50ms（20Hz），显然，向系统提出的中断频率是每秒 20 次，在中断处理程序中，用软件的方法使用变量计数到 20 次后读 PA 口开关状态，并同时向 PB 口输出。

答：

1）　电路图如图 6-2：

注意在上图中的译码电路将 A0~A9 10 根线全部使用，使得各个芯片的地址范围被严格限制。

2）8253 的初始化程序：

```
        MOV     AL, 01110110B    ; 计数器 1 方式 3，二进制
        OUT      43H, AL
        MOV     AX, 50000
        OUT      41H, AL
        MOV     AL, AH
        OUT      41H, AL
```

3）8255 初始化

```
MOV     AL, 10011000B   ；A 口方式 0 输入，B 口方式 0 输出
OUT      63H, AL
```

中断处理程序如下：

```
……
TIMES   DB   0
……
SERVICE      PROC
     PUSHA
     PUSH     DS
    STI
    MOV AX, @DATA
    MOV DS, AX
MOV    AL, TIMES
```

```
    INC     AL
    MOV     TIMES, AL
    CMP     AL, 20
    JNZ     EXIT        ; 没有计数到 20 次，说明 1 秒没到，退出中断处理程序
    IN      AL, 60H
    NOT     AL
    OUT     61H, AL
  MOV AL, 0
  MOV TIMES, AL
EXIT: MOV  AL,20H
OUT        20H,AL
CLI
POP DS
POPA
IRET
SERVICE    ENDP
```