

```
//Modified eg 12.5.4 Mazidi 8 pin mode 2 ports
// different from the textbook*****
```

```
#define F_CPU 16000000UL
```

```
#include <avr/io.h>
```

```
#include <util/delay.h>
```

```
#define LCD_DPRT PORTD          // configuring PortD for data
```

```
#define LCD_DDDR DDRD
```

```
#define LCD_DPIN PIN_D
```

```
#define LCD_CPRT PORTB          // utilizing PortB pins for the control.
```

```
#define LCD_CDDR DDRB
```

```
#define LCD_CPIN PINB
```

```
#define LCD_RS 0
```

```
#define LCD_RW 1
```

```
#define LCD_EN 2
```

```
//*****
```

```
void delay_us(unsigned int d)
```

```
{
    _delay_us(d);
}
```

```
//*****
```

```
void lcdCommand( unsigned char cmnd )
```

```
{
    LCD_DPRT = cmnd;
    LCD_CPRT &= ~(1<<LCD_RS); // LCD_RS pin of PortB is cleared.
    LCD_CPRT &= ~(1<<LCD_RW); // LCD_RW pin of PortB is cleared.
    LCD_CPRT |= (1<<LCD_EN); // LCD_EN pin of PortB is set.
    delay_us(1);
    LCD_CPRT &= ~(1<<LCD_EN); // LCD_EN pin of PortB is cleared.
    delay_us(100);
}
```

```
//*****
```

```
void lcdData( unsigned char data )
```

```
{
    LCD_DPRT = data;
    LCD_CPRT |= (1<<LCD_RS); //LCD_RS pin of PortB is set.
    LCD_CPRT &= ~(1<<LCD_RW); //LCD_RW pin of PortB is cleared.
    LCD_CPRT |= (1<<LCD_EN); //LCD_EN pin of PortB is set.
    delay_us(1);
    LCD_CPRT &= ~(1<<LCD_EN); //LCD_EN pin of PortB is cleared.
    delay_us(100);
}
```

```
//*****
```

```
void lcd_init()          // Equivalent to void InitializeComputerBoard (void).
```

```
{
    // ...exception: the delay btwn clear display and entry mode.
    LCD_DDDR = 0xFF;      // Port D is configured as output.
    LCD_CDDR = 0xFF;      // Port B is configured as output.
```

```
    LCD_CPRT &= ~(1<<LCD_EN); // LCD_EN pin of PortB is cleared.
```

```

delay_us(2000);
lcdCommand(0x38);      // Function set command.
lcdCommand(0x0E);      // Display on with blinking cursor
lcdCommand(0x01);      // Display clear
delay_us(2000);
lcdCommand(0x06);      // Entry mode set
}

//*****
void lcd_gotoxy(unsigned char x, unsigned char y)
{
    unsigned char firstCharAdr[]={0x80,0xC0,0x94,0xD4}; //table 12-5
    lcdCommand(firstCharAdr[y-1] + x - 1);
    delay_us(100);
}

//*****
void lcd_print( char * str )
{
    unsigned char i = 0 ;
    while(str[i]!=0)
    {
        lcdData(str[i]);
        i++ ;
    }
}

//*****
int main(void)
{
    lcd_init();
    lcd_gotoxy(1,1);
    lcd_print("The world is but");
    lcd_gotoxy(1,2);
    lcd_print("one country");
    while(1);
    return 0;
}

```