Microcomputers

EEL 4746C

Assignment 2 –
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Solve the following problems:

Problem 1

Write a C program to count-up Port B from 0-99 continuously

```
#include <avr/io.h>
int main(void) {
        DDRB = 0xFF;
        unsigned char i = 0;
        while(i<=99) {
                PORTB = i;
                i++;
                if (i>99) {
                        i = 0;
                }
        }
return 0;
}
```

Problem 2

Write a C program that finds the number of zeros in an 8-bit data item.

```
#include <avr/io.h>
int main(void) {
    unsigned char count = 0;
    unsigned char test_number = 0b00000000;
        for(unsigned char i = 0; i<=7; i++) {
            if((test_number & (1<<i)) == 0) {
                count++;
            }
        }
    while(1) {}
    return 0;
}
```

Problem 3

Find the port value after each of the following:

1. PORTB=0x65>>2;
2. PORTB = 0xA7<<2;

0x65 = 0110 0101, >>2 means right-shifted 2, so output is **0001 1001**, which is **0x19**
0xA7 = 1010 0111, <<2 means left-shifted 2, so output is **1001 1100**, which is **0x9C**

Problem 4

Write an AVR C program to transfer the data from port D serially via port B. pin 2. The MSB should go out first .

```
#include <avr/io.h>
int main(void) {
        DDRB |= (1<<2);
        DDRD = 0x00;

        for(char i = 7; i>=0; i--) {
                if((PIND & (1<<i)) != 0) {
                        PORTB |= (1<<2);
                }
                else {
                        PORTB &= ~(1<<2);
                }
        }
        while(1) {}
        return 0;
}
```

Problem 5

Write a program to toggle PD3, PD7, and PC5 continuously without disturbing the rest of the bits.

```
#include <avr/io.h>
int main(void) {
    DDRD |= ((1<<3) | (1<<7));
    DDRC |= (1<<5);

    while(1) {
        PORTD ^= ((1<<3) | (1<<7));
        PORTC ^= (1<<5);
//note: if you were toggling these pins, you would need a delay to actually see it, like if you had LEDs connected to it.
    }
    return 0;
}
```

Problem 6

Write a program to get the status of PC3 and put it on PC4.

```
#include <avr/io.h>
int main(void) {
        DDRC &= ~(1<<3);
        DDRC |= (1<<4);

        if ( (PINC & (1<<3)) != 0 ) {
                  PORTC |= (1<<4);
        }
        else {
                  PORTC &= ~(1<<4);
        }
        return 0;
}
```

Problem 7

Write a C program to toggle pin3 and pin5 of PortB every 200 ms.

```
#define F_CPU 16000000UL

#include <avr/io.h>

#include <util/delay.h>

int main(void) {

        DDRB |=  ((1<<3) | (1<<5));

        while(1) {

                _delay_ms(200);

                PORTB ^=  ((1<<3) | (1<<5));

        }

        return 0;

}
```