

# **ECED 3204 Microprocessor**

## **Midterm**

**Date: October 26 2016  
3:30PM-5:30PM**

**Room: Sexton Gym**

<b>Student name</b>	
<b>ID</b>	

- 1) Write an instruction sequence to add 35 to the two-byte value stored at data memory locations 0x2000~0x2001.

[10points]

- 2) Read following program and determine the value of r17, r18, r19 and r20, and the content at address buf, buf+1, buf+2, and buf+3 when the program is done.

[15points]

	r17	r18	r19	r20
binary value				
	buf+3	buf+2	buf+1	buf
binary value				

```

        .include    <m2560def.inc>
        .equ    bt3    = 0x79;
        .equ    bt2    = 0x86;
        .equ    bt1    = 0x53;
        .equ    bt0    = 0x42;
        .def    lpcent = r16
        .dseg
buf:    .org    0x200 ;
        .byte   4      ;
        .cseg
        .org    0x00
        rjmp   start
        .org    0xF6
start:  ldi    r17,bt3;
        ldi    r18,bt2;
        ldi    r19,bt1;
        ldi    r20,bt0;
        sts    buf+3,r17 ;
        sts    buf+2,r18 ;
        sts    buf+1,r19 ;
        sts    buf,r20;
        ldi    lpcent,4;
srloop: lsr    r17 ;
        ror    r18 ;
        ror    r19 ;
        ror    r20 ;
        dec    lpcent ;
        brne  srloop

        nop
        // end of program

```

3) Write a loop in C language to compute the sum of the square of the first one hundred odd numbers. [10 points]

4) Load your last two digit banner number in hexadecimal format to register Rd then execute each following instructions and write out the new Rd value. Assume K=0x53.

[15points]

Your Rd in Hexdecimal	Results
and Rd, Rd	
andi Rd, K	
ori Rd, K	
sbr Rd, K	
cbr Rd, K	
clr Rd	
set Rd	
com Rd	
neg Rd	
eor Rd, Rd	

5) What are the contents of PORTA after the following AVR program is assembled: [5points]

```

outPORTA,0x53
sbi    PORTA,2
cbi    PORTA,1

```

6) Write a subroutine that can divide a 24-bit unsigned integer into another 24-bit unsigned integer. Please also write a test program for the subroutine.

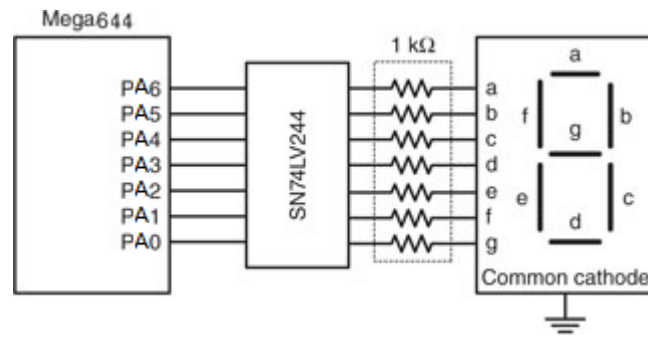
[15points]

7) Write a function to find numbers of odd integers from an array and store the results at 0x1100.

[10points]

8) Use the AVR Mega PORTA to drive a single seven-segment display. Please write assembling code to display decimal digits 2,0,1,6 with 100 ms delay between digits. Assume the subroutine for delay is available **delayby100ms**.

[10points]



- 9) Configure odd interrupt pins (INTn) to interrupt on the rising edge and the even interrupt pins to interrupt on the falling edge.

[10points]