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Binárne hodnoty 7 segmentoveho displaya

Digit	A	B	C	D	E	F	G	DP
0	0	0	0	0	0	0	1	1
1	1	0	0	1	1	1	1	1
2	0	0	1	0	0	1	0	1
3	0	0	0	0	1	1	0	1
4	1	0	0	1	1	0	0	1
5	0	1	0	0	1	0	0	1
6	0	1	0	0	0	0	0	1
7	0	0	0	1	1	1	1	1
8	0	0	0	0	0	0	0	1
9	0	0	0	0	1	0	0	1

Spoločná anóda: Segmenty na 7segmentovom displayi su zasvietene ked privedieme nulu na piny(a,b,c,d,e,f,g,dp)

Spoločná katóda: Segmenty na 7segmentovom displayi sú zasvietene keď privedieme jednotku na piny(a,b,c,d,e,f,g,dp)

Segment.c

```
/**************************************************************************
 *
 * Seven-segment display library for AVR-GCC.
 * ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2
 *
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 * Dept. of Radio Electronics, Brno University of Technology, Czechia
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 *
 **************************************************************************/

/* Includes ----------------------------------------------------------*/
#define F_CPU 16000000
#include <util/delay.h>
#include "gpio.h"
#include "segment.h"

/* Variables ---------------------------------------------------------*/
// Active-low digits 0 to 9
uint8_t segment_value[] = {
       // abcdefgDP
       0b00000011,      // Digit 0
       0b10011111,      // Digit 1
       0b00100101,      // Digit 2
       0b00001101,      // Digit 3
       0b10011001,       // Digit 4
```

```
       0b01001001,      // Digit 5
       0b01000001,      // Digit 6
       0b00011111,      // Digit 7
       0b00000001,      // Digit 8
       0b00011001};     // Digit 9


// Active-high position 0 to 3
uint8_t segment_position[] = {
       // p3p2p1p0....
       0b00010000,   // Position 0
       0b00100000,   // Position 1
       0b0100000,      // Position 2
       0b1000000};   // Position 3


/* Function definitions ----------------------------------------------*/
void SEG_init(void)
{
    /* Configuration of SSD signals */
    GPIO_config_output(&DDRD, SEGMENT_LATCH);
    GPIO_config_output(&DDRD, SEGMENT_CLK);
    GPIO_config_output(&DDRB, SEGMENT_DATA);
}

/*-------------------------------------------------------------------*/
void SEG_update_shift_regs(uint8_t segments, uint8_t position)
{
    uint8_t bit_number;
       segments = segment_value[segments];     // 0, 1, ..., 9
       position = segment_position[position];  // 0, 1, 2, 3
    // Pull LATCH, CLK, and DATA low
       GPIO_write_low(&PORTD,SEGMENT_LATCH);
       GPIO_write_low(&PORTD,SEGMENT_CLK);
       GPIO_write_low(&PORTD,SEGMENT_DATA);
    // Wait 1 us
       _delay_us(1);
    // Loop through the 1st byte (segments)
    // a b c d e f g DP (active low values)
    for (bit_number = 0; bit_number < 8; bit_number++)
    {
        // Output DATA value (bit 0 of "segments")
             if ((segments & 1) == 0)
             {
                    GPIO_write_low(&PORTB,SEGMENT_DATA);
             }
             else
             {
                    GPIO_write_high(&PORTB, SEGMENT_DATA);
             }
        // Wait 1 us
             _delay_us(1);
        // Pull CLK high
             GPIO_write_high(&PORTD,SEGMENT_CLK);
        // Wait 1 us
             _delay_us(1);
        // Pull CLK low
             GPIO_write_low(&PORTD,SEGMENT_CLK);

        // Shift "segments"
        segments = segments >> 1;
    }
```

```
    // Loop through the 2nd byte (position)
    // p3 p2 p1 p0 . . . . (active high values)
    for (bit_number = 0; bit_number < 8; bit_number++)
    {
        // Output DATA value (bit 0 of "position")
            if ((position & 1) == 0)
            {
                GPIO_write_low(&PORTB,SEGMENT_DATA);
            }
            else
            {
                GPIO_write_high(&PORTB, SEGMENT_DATA);
            }
        // Wait 1 us
            _delay_us(1);
        // Pull CLK high
            GPIO_write_high(&PORTD,SEGMENT_CLK);
        // Wait 1 us
            _delay_us(1);
        // Pull CLK low
            GPIO_write_low(&PORTD,SEGMENT_CLK);
        // Shift "position"
        position = position >> 1;
    }

    // Pull LATCH high
       GPIO_write_high(&PORTD,SEGMENT_LATCH);

    // Wait 1 us
       _delay_us(1);

}

/*-------------------------------------------------------------------*/
/* SEG_clear */

/*-------------------------------------------------------------------*/
/* SEG_clk_2us */
```

Main c

```
/*******************************************************************
 *
 * Decimal counter with 7-segment output.
 * ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2
 *
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 *
 *******************************************************************/

/* Includes ----------------------------------------------------------*/
#include <avr/io.h>         // AVR device-specific IO definitions
#include <avr/interrupt.h>  // Interrupts standard C library for AVR-GCC
#include "timer.h"          // Timer library for AVR-GCC
#include "segment.h"        // Seven-segment display library for AVR-GCC
```
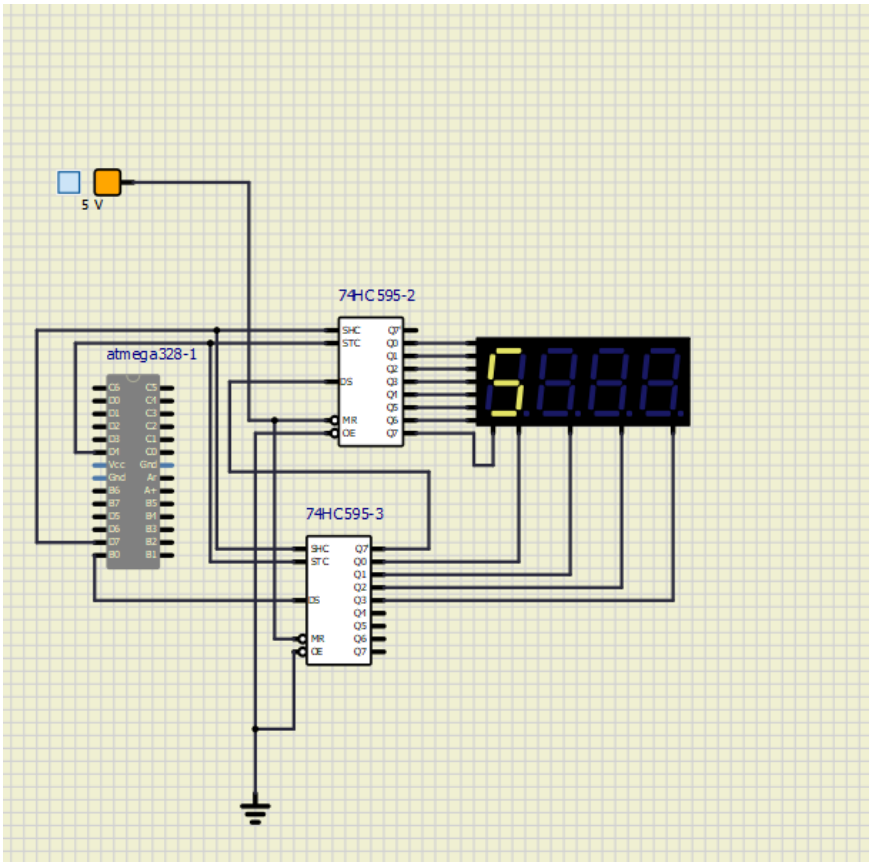

```c
uint8_t singles = 0;
uint8_t decimals = 0;

/* Function definitions ----------------------------------------------*/
/**
 * Main function where the program execution begins. Display decimal
 * counter values on SSD (Seven-segment display) when 16-bit
 * Timer/Counter1 overflows.
 */
int main(void)
{
    // Configure SSD signals
    SEG_init();



    /* Configure 8-bit Timer/Counter1
     * Set prescaler and enable overflow interrupt */
       TIM0_overflow_4ms();
       TIM0_overflow_interrupt_enable();
    // Enables interrupts by setting the global interrupt mask

    /* Configure 16-bit Timer/Counter1
     * Set prescaler and enable overflow interrupt */
       TIM1_overflow_262ms();
       TIM1_overflow_interrupt_enable();
    // Enables interrupts by setting the global interrupt mask
       sei();

    // Infinite loop
    while (1)
    {
        /* Empty loop. All subsequent operations are performed exclusively
         * inside interrupt service routines ISRs */
    }

    // Will never reach this
    return 0;
}
/* Interrupt service routines ----------------------------------------*/
/**
 * ISR starts when Timer/Counter0 overflows. Display value on SSD.
 */
ISR(TIMER0_OVF_vect)
{
       static uint8_t position = 0;
       if (position == 0 )
       {

              SEG_update_shift_regs(singles,0);
              position = 1;
       }
       else
       {
              SEG_update_shift_regs(decimals,1);
              position = 0;
       }

}

/* Interrupt service routines ----------------------------------------*/
/**
```

```
 * ISR starts when Timer/Counter1 overflows. Increment decimal counter display in on
SSD.
 */
ISR(TIMER1_OVF_vect)
{


	singles++;
	if (singles > 9)
	{
		singles = 0;
		decimals ++;
		if  (decimals > 5)
		{
			decimals = 0;
		}
	}
}
```

Displaying single digit



Snake Code

```
/*****************************************************************************
 *
 * Decimal counter with 7-segment output.
 * ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2
 *
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 *
 *****************************************************************************/

/* Includes ------------------------------------------------------------*/
#include <avr/io.h>         // AVR device-specific IO definitions
#include <avr/interrupt.h>  // Interrupts standard C library for AVR-GCC
#include "timer.h"          // Timer library for AVR-GCC
#include "segment.h"        // Seven-segment display library for AVR-GCC
//
uint8_t singles = 0;
uint8_t decimals = 0;
uint8_t snake = 0;


/* Function definitions ----------------------------------------------*/
```
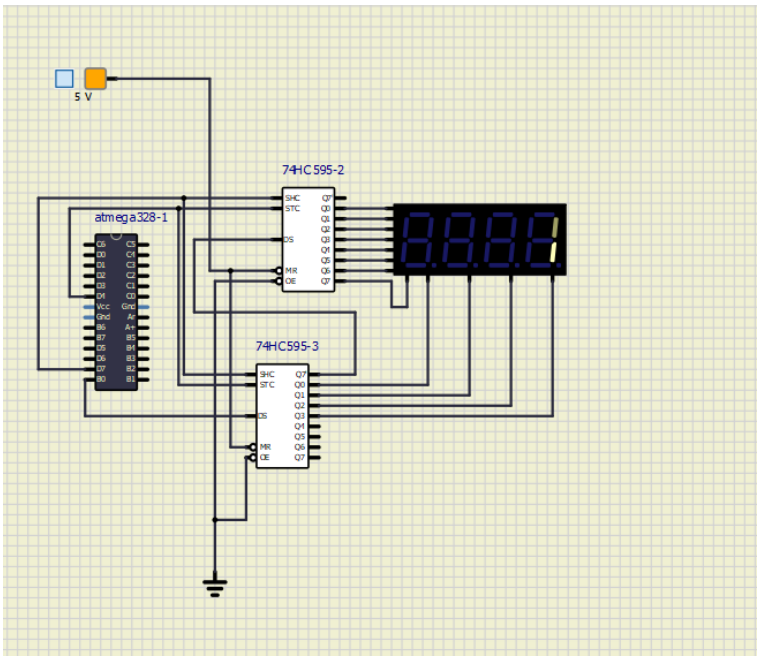
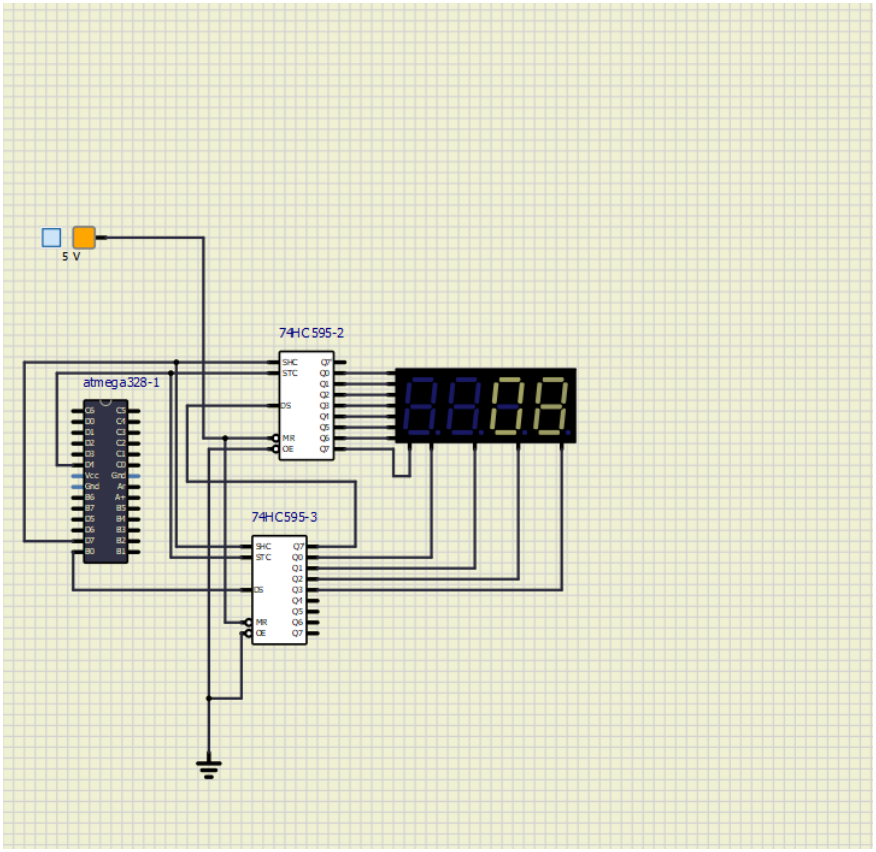

```c
/**
 * Main function where the program execution begins. Display decimal
 * counter values on SSD (Seven-segment display) when 16-bit
 * Timer/Counter1 overflows.
 */
int main(void)
{
    // Configure SSD signals
    SEG_init();
       //SEG_update_shift_regs(2,);



     /* Configure 8-bit Timer/Counter0
      * Set prescaler and enable overflow interrupt */
       TIM0_overflow_16us();
       TIM0_overflow_interrupt_enable();
     // Enables interrupts by setting the global interrupt mask

     /* Configure 16-bit Timer/Counter1
      * Set prescaler and enable overflow interrupt */
       TIM1_overflow_262ms();
       TIM1_overflow_interrupt_enable();
     // Enables interrupts by setting the global interrupt mask
       sei();

     // Infinite loop
     while (1)
     {
         /* Empty loop. All subsequent operations are performed exclusively
          * inside interrupt service routines ISRs */
     }

     // Will never reach this
     return 0;
 }
 /* Interrupt service routines ----------------------------------------*/
 /**
  * ISR starts when Timer/Counter0 overflows. Display value on SSD.
  */
 ISR(TIMER0_OVF_vect)
 {
       static uint8_t position = 0;
       if (position == 0 )
       {
              SEG_update_shift_regs(snake,0);
       }
}

 /* Interrupt service routines ----------------------------------------*/
 /**
  * ISR starts when Timer/Counter1 overflows. Increment decimal counter display in on
SSD.
  */
 ISR(TIMER1_OVF_vect)
 {

 snake++;
 if(snake>5)
 {
        snake = 0;
 }
```

```
        }
  /* Variables --------------------------------------------------------*/
// Active-low digits 0 to 9
uint8_t segment_value[] = {
        // abcdefgDP
        0b01111111,     // Segments we need for the snake to go around in position 0
        0b10111111,
        0b11011111,
        0b11101111,
        0b11110111,
        0b11111011};

// Active-high position 0 to 3
uint8_t segment_position[] = {
        // p3p2p1p0....
        0b00010000,   // Position 0
        0b00100000,   // Position 1
        0b01000000,     // Position 2
        0b10000000};  // Position 3
```

Snake





Count up