

# Lab 5: Jiří Navrátil

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Link to your [Digital-electronics-2](#) GitHub repository:

<https://github.com/GeorgeNavratil/Digital-electronics-2>

## 7-segment library

1. In your words, describe the difference between Common Cathode and Common Anode 7-segment display.
  - CC SSD - has all the cathodes of the 7-segments connected directly together controlled by a logical 1 and connected to ground
  - CA SSD - has all the anodes of the 7-segments connected together controlled by a logical 0 and connected to a voltage supply
2. Code listing with syntax highlighting of two interrupt service routines (`TIMER1_OVF_vect`, `TIMER0_OVF_vect`) from counter application with at least two digits, ie. values from 00.00 to 59.59:

```
/* *****  
 * Function: Timer/Counter1 overflow interrupt  
 * Purpose: Increment counter value from 00 to 59.  
 * ***** */  
ISR(TIMER1_OVF_vect)  
{  
    dis[0]++;  
  
    if (dis[0] == 10)  
    {  
        dis[1]++;  
        dis[0] = 0;  
    }  
    else if (dis[1] == 6)  
    {  
        dis[2]++;  
        dis[1] = 0;  
    }  
    else if (dis[2] == 10)  
    {  
        dis[3]++;  
        dis[2] = 0;  
    }  
    else if (dis[3] == 6)  
    {  
        dis[] = 0;  
    }  
}
```

```

/*****
 * Function: Timer/Counter0 overflow interrupt
 * Purpose: Display tens and units of a counter at SSD.
 *****/
ISR(TIMER0_OVF_vect)
{
    static uint8_t posit = 0;

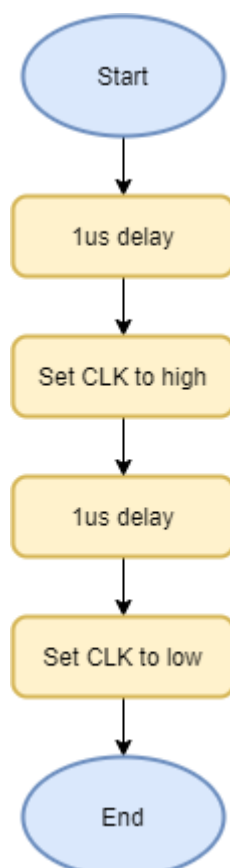
    if (posit == 2)
    {
        SEG_update_shift_regs(dis[posit], posit, 1);
    }
    else
    {
        SEG_update_shift_regs(dis[posit], posit, 0);
    }

    posit++;

    if (posit == 3)
    {
        posit = 0;
    }
}

```

3. Flowchart figure for function `SEG_clk_2us()` which generates one clock period on `SEG_CLK` pin with a duration of 2 us. The image can be drawn on a computer or by hand. Use clear descriptions of the individual steps of the algorithms.



Consider a kitchen alarm with a 7-segment display, one LED and three push buttons: start, +1 minute, -1 minute. Use the +1/-1 minute buttons to increment/decrement the timer value. After pressing the Start button, the countdown starts. The countdown value is shown on the display in the form of mm:ss (minutes.seconds). At the end of the countdown, the LED will start blinking.

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- The diagram illustrates the hardware setup for the Arduino Uno R3. The microcontroller is connected to two 74HC595 shift registers (U1 and U2) and a 4-digit 7-segment display (U2). The Arduino's GND is connected to the common ground of the shift registers and the display. The +5V pin of the Arduino is connected to the VCC of the shift registers and the +5V pin of the display. The shift registers are configured in a daisy-chain manner. The first shift register (U1) receives data from the Arduino's digital pins 10 (SER), 11 (SRCLK), and 12 (RCLK). Its QA pin (pin 15) is connected to the first digit of the display (U2). The second shift register (U2) receives data from the first register's QH pin (pin 9) and the Arduino's digital pins 11 (SRCLK) and 12 (RCLK). Its QA pin (pin 15) is connected to the second digit of the display. The display's pins are labeled QA through QH (pins 15, 1, 2, 4, 5, 6, 7, 9) and DP1 through DP4 (pins 11, 12, 13, 14). The display is a common anode type, with the anode connected to +5V. The segments are labeled a through g (pins 1, 2, 4, 5, 6, 7, 9) and the decimal point is labeled DP1 through DP4 (pins 11, 12, 13, 14).

