

# Lab 4: Pavlo Shelemba

Link to my Digital-electronics-2 GitHub repository:

<https://github.com/xshele01/Digital-electronics-2>

## Overflow times

1. Overflow times in seconds for three Timer/Counter modules that contain ATmega328P if CPU clock frequency is 16 MHz:

Module	Number of bits	1	8	32	64	128	256	1024
Timer/Counter0	8	16u	128u	--	1024u	--	4128u	16384u
Timer/Counter1	16	4096u	32768u	--	262144u	--	1056768u	4194304u
Timer/Counter2	8	16u	128u	512u	1024u	2048u	4128u	16384u

## Timer library

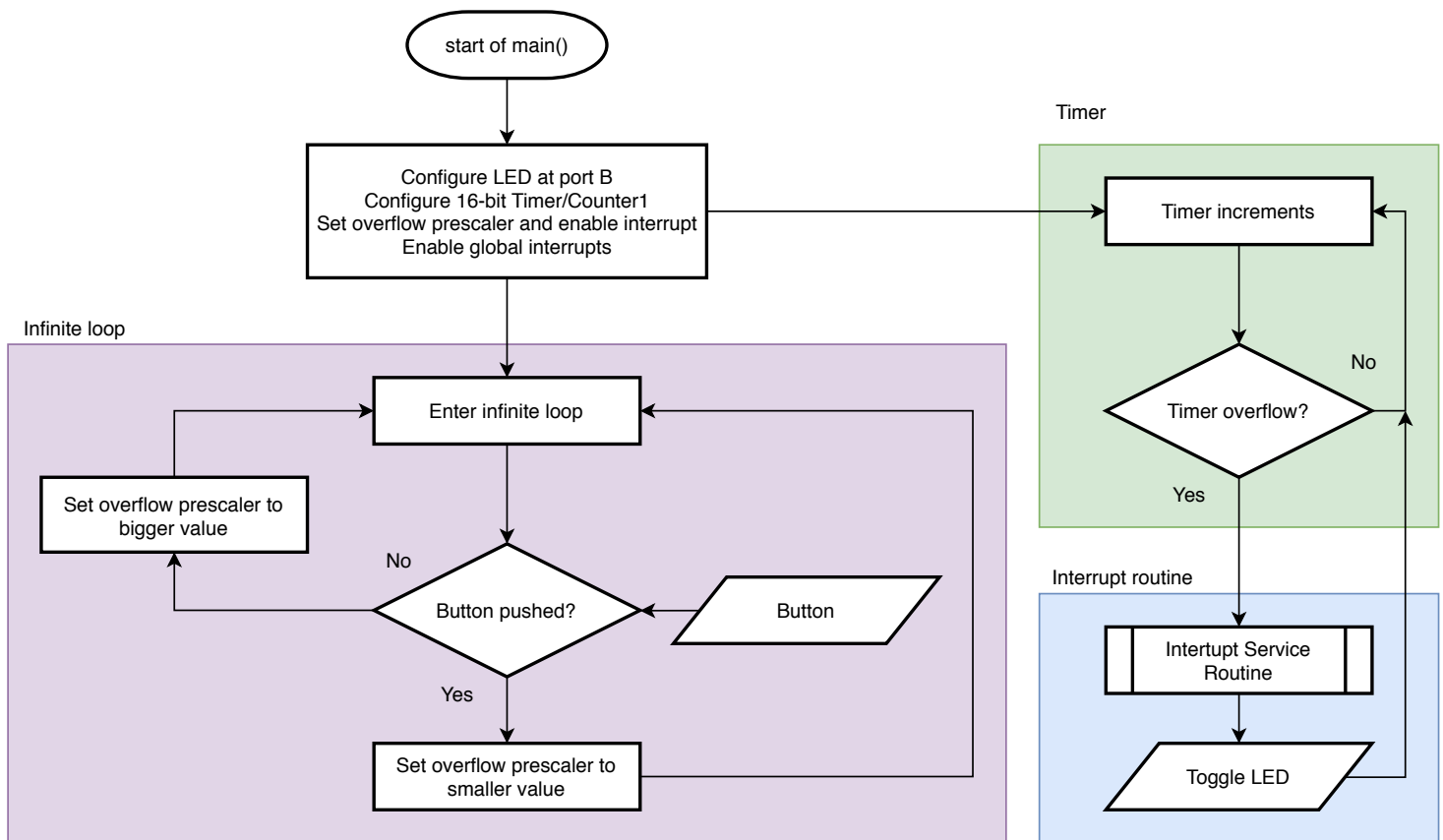
1. In your words, describe the difference between common C function and interrupt service routine.
  - Function is a reusable sequence of statements that is invoked by a function call. Upon execution, current function is interrupted and instructions inside a called function are executed. After completion program returns back to the point right after the function call.
  - Interrupt is a special condition, that is initiated by an internal or external signal. It results in execution of Interrupt Service Routine, which suspends execution of a program and carries out a special set of instructions. Upon completion the program is resumed.
2. Part of the header file listing with syntax highlighting, which defines settings for Timer/Counter0:

```

/**
 * @name Definitions of Timer/Counter0
 * @note F_CPU = 16 MHz
 */
/** @brief Stop timer, prescaler 000 --> STOP */
#define TIM0_stop() TCCR0B &= ~(1<<CS02) | (1<<CS01) | (1<<CS00));
/** @brief Set overflow 4ms, prescaler 001 --> 1 */
#define TIM0_overflow_4ms() TCCR0B &= ~(1<<CS02) | (1<<CS01); TCCR0B |= (1<<CS00);
/** @brief Set overflow 33ms, prescaler 010 --> 8 */
#define TIM0_overflow_33ms() TCCR0B &= ~(1<<CS02) | (1<<CS00); TCCR0B |= (1<<CS01);
/** @brief Set overflow 262ms, prescaler 011 --> 64 */
#define TIM0_overflow_262ms() TCCR0B &= ~(1<<CS02); TCCR0B |= (1<<CS01) | (1<<CS00);
/** @brief Set overflow 1s, prescaler 100 --> 256 */
#define TIM0_overflow_1s() TCCR0B &= ~(1<<CS01) | (1<<CS00); TCCR0B |= (1<<CS02);
/** @brief Set overflow 4s, prescaler // 101 --> 1024 */
#define TIM0_overflow_4s() TCCR0B &= ~(1<<CS01); TCCR0B |= (1<<CS02) | (1<<CS00);
/** @brief Enable overflow interrupt, 1 --> enable */
#define TIM0_overflow_interrupt_enable() TIMSK0 |= (1<<TOIE0);
/** @brief Disable overflow interrupt, 0 --> disable */
#define TIM0_overflow_interrupt_disable() TIMSK0 &= ~(1<<TOIE0);

```

1. Flowchart figure for function `main()` and interrupt service routine `ISR(TIMER1_OVF_vect)` of application that ensures the flashing of one LED in the timer interruption. When the button is pressed, the blinking is faster, when the button is released, it is slower:



## Knight Rider

1. Scheme of Knight Rider application with four LEDs and a push button, connected according to [Multi-function shield](#):

