

# Lab 1: Martin Kousal

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Link to your **Digital-electronics-2** GitHub repository:

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

## Blink example

1. What is the meaning of the following binary operators in C?

- `|` - Bitwise OR
- `&` - Bitwise AND
- `^` - Bitwise XOR
- `~` - Bitwise NOT
- `<<` - Bit shift to the left
- `>>` - Bit shift to the right

2. Complete truth table with operators: `|`, `&`, `^`, `~`

<b>b</b>	<b>a</b>	<b>b or a</b>	<b>b and a</b>	<b>b xor a</b>	<b>not b</b>
0	0	0	0	0	1
0	1	1	0	1	1
1	0	1	0	1	0
1	1	1	1	0	0

## Morse code

1. Listing of C code with syntax highlighting which repeats one "dot" and one "comma" on a LED:

```
#define LED_GREEN    PB5 // AVR pin where green LED is connected
#define SHORT_DELAY 200 // Delay in milliseconds
#define LONG_DELAY  1000 // Delay in milliseconds

#ifndef F_CPU          // Preprocessor directive allows for conditional
                        // compilation. The #ifndef means "if not defined".
# define F_CPU 16000000 // CPU frequency in Hz required for delay
#endif                // The #ifndef directive must be closed by #endif

#include <util/delay.h> // Functions for busy-wait delay loops
#include <avr/io.h>     // AVR device-specific IO definitions
int main(void)
{
    // Set pin as output in Data Direction Register
    // DDRB = DDRB or 0010 0000
    DDRB = DDRB | (1<<LED_GREEN);
```

```
// Set pin LOW in Data Register (LED off)
// PORTB = PORTB and 1101 1111
PORTB = PORTB & ~(1<<LED_GREEN);

// Infinite loop
while (1)
{
    _delay_ms(SHORT_DELAY);    // Pause several milliseconds
    PORTB |= (1<<LED_GREEN);   // Set LED to on
    _delay_ms(SHORT_DELAY);    // Pause several milliseconds
    PORTB &= ~(1<<LED_GREEN);   // Set LED to off
    _delay_ms(SHORT_DELAY);    // Pause several milliseconds
    PORTB |= (1<<LED_GREEN);   // Set LED to on
    _delay_ms(LONG_DELAY);     // Pause for more milliseconds (LED is shining
now)
    PORTB &= ~(1<<LED_GREEN);   // Set LED to off
}

// Will never reach this
return 0;
}
```

2. Scheme of Morse code application, i.e. connection of AVR device, LED, resistor, and supply voltage. The image can be drawn on a computer or by hand. Always name all components and their values!



