Lab 11: Serial Communication

Task 2: Implement a UART in software

Most microcontrollers have a dedicated UART for serial communication. But you may still come across an MCU that does not have a built-in UART. On other occasions you might need more than one UARTs but your choice of microcontroller might have only one built-in UART. In these cases, it helps a lot of you can use a software based UART (soft-UART or sometime called a bit-banging UART).

A soft-UART uses a digital IO pin for transmitting and receiving data serially. In the absence of dedicated hardware, the CPU (user program) must do all the processing necessary for serial data communication. Two separate functions for transmission and reception may be written. The transmission function is straightforward and requires following steps:

1. Receive data to be sent in the form of a single byte.
2. Pull the Tx (IO pin which will serve as the transmitter) low (for 1 bit duration) to signal the start bit.
3. Start the transmission of data byte from the LSB.
4. In a loop test the bit to be sent, set the IO pin for Tx to 1 if the test bit is one, 0 otherwise.
5. Wait for 1 bit-duration after transmitting each bit.
6. Optionally compute and send a parity bit.
7. Pull the Tx pin high for 1(2) bit-durations to signal stop bit(s).

You will have to configure the Tx pin (IO pin for Tx of soft-UART) as output using DDRXn bit. The prototype for this function can be as follows.

```
void soft_UART_send(unsigned char data);
```

The receive function is a bit more complicated. It will have to keep on testing the Rx pin (IO pin to be used as Rx for soft-UART) and start reception once it detects the **Start** bit.