TECHNISCHE UNIVERSITÄT WIEN

Institut für Computertechnik
Institute of Computer Technology

MELODI

Mass E-Learning of design, test, and prototyping DIgital hardware

LEVEL 4

LCD - Send symbols via UART

In this task, you need to implement a UART protocol that sends data to a LCD display that displays it in the form of ASCII characters. Create an endless loop in which two symbols are sent alternately. First send the symbol **0b11111111** (which clears the display) and then the symbol **'A'**. Note that after each symbol there must be a pause between **500ms** (minimum) and **1000ms** (maximum). Thus, you will see the character 'A' appearing and disappearing on the display. The details of the protocol can be found in the description below.

Important Note: The loop has to start with a pause.

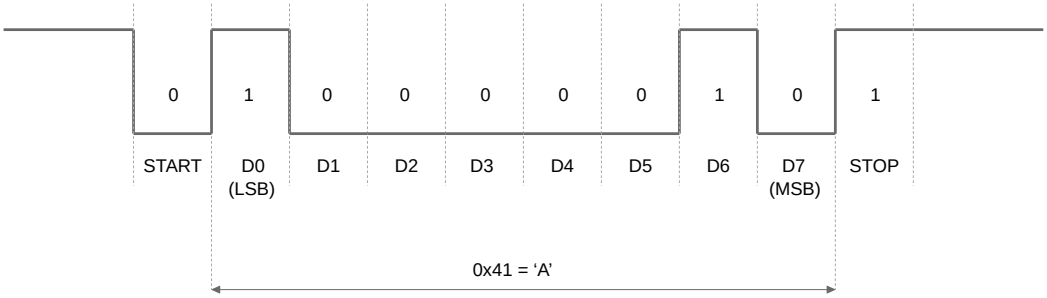


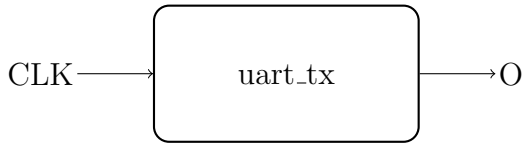
Figure 1: Details of the UART protocol.

Each symbol transmission consists of a START bit (LOW = logic '0') - followed by 8 data bits (LSB first) - and ends with a STOP bit (HIGH = logic '1'). According to ASCII standard, you have to send the data bits 0b01000001=0x41 to display the character 'A'. The **baud-rate** must be **9599.69** (˜9600).

Entity

Your task is to program the behavior of an entity called “uart_tx”. This entity is declared in the attached file “uart_tx.vhdl” and has the following properties:

- Input: CLK (100MHz) with type std_logic
- Output: O with type std_logic



Do not change the file “uart_tx.vhdl”.

This behavior has to be programmed in the attached file “uart_tx_beh.vhdl”.

To turn in your solution write an email to vhdlabgabe+e384@tuwien.ac.at with subject “Result Task 4” and attach your behavior file(s):

- “uart_tx_beh.vhdl”

Good Luck and May the Force be with you.