**REQUIREMENTS NOT MET**

N/A

**PROBLEMS ENCOUNTERED**

N/A

**FUTURE WORK/APPLICATIONS**

<insert a brief paragraph describing how the topics covered in this lab could potentially be used for other applications>

THE ABOVE SHOULD BE LIMITED TO THE FIRST PAGE, AND NOTHING ELSE SHOULD BE INCLUDED, WHICH ALSO IMPLIES THAT THIS SENTENCE OF TEXT SHOULD BE REMOVED.

**PRE-LAB EXERCISES**

**i. The sampling rate of a UART receiver is usually faster than the baud rate of the overall system. Why is this so?   
 The receivers needs to be able to read data at any time since its asynchronous. In addition, 3 samples need to be taken in order for the clock synchronizer to determine if it’s a legitimate start bit or just noise. This requires a faster sampling rate on the receiver.**

**ii. What is the maximum possible baud rate for asynchronous communication within the USART system of the ATxmega128A1U, assuming that the microcontroller has a system clock frequency of 2 MHz and that the USART “double-speed mode” is disabled (i.e., the relevant bit CLK2X is set to 0)? In addition to the maximum rate, provide the values of the relevant registers used to configure that rate. Whenever appropriate, support your answer with calculations.   
 BAUDCTRLA would need to be 0b00000000  
 BAUDCTRLB would need to be 0b00000000** A picture containing text, font, handwriting, white

Description automatically generated **Figure 1: Baud rate calculations**

**iii. In the context of the USART system within the ATxmega128A1U, how many buffers (i.e., memory locations that store temporary data) are used by a transmitter? How many are used by a receiver? Additionally, for both transmitters and receivers, explain how the use of buffers provides greater flexibility to an application involving these components.**

**Both transmitter and receiver contain 2 registers:  
1: The shift register, which is used for transmitting and receiving data  
2. The data register, which is used for holding data while the shift register receives or transmits data  
The buffers allow data to be received/transmitted while being written to/read from by the microcontroller.**

**iv. If an asynchronous serial communication protocol of 7 data bits, one start bit, one stop bits, odd parity, and baud rate of 15.6 kHz was chosen, calculate how many seconds it would take to transmit the ASCII character string “Dr. Schwartz saw seven slick slimy snakes slowly sliding southward.” (This string has 67 characters.) Note that ASCII is a 7-bit (not an 8-bit) code. Show all work.**

A picture containing text, font, handwriting, screenshot

Description automatically generated

**Figure 2: Baud rate calculations**

**PSEUDOCODE/FLOWCHARTS**

**SECTION X (1, 2, etc.)**

<insert easily readable pseudocode/flowcharts, when applicable, clearly distinguishing between each part of the lab (write “N/A” if there are none)>

THE ABOVE SHOULD BE FOLLOWED BY A PAGE BREAK (ALREADY INCLUDED), AND THIS SENTENCE OF TEXT SHOULD BE REMOVED.

**PROGRAM CODE**

**SECTION X (1, 2, etc.)**

<insert copy of all required *main* program code, clearly distinguishing between each part of the lab (write “N/A” if there are none)>

THE ABOVE SHOULD BE FOLLOWED BY A PAGE BREAK (ALREADY INCLUDED), AND THIS SENTENCE OF TEXT SHOULD BE REMOVED.

**APPENDIX**

<insert copy of all *supporting* ASM or C program code, e.g., header files referenced within your programs, as well as any other relevant information, e.g., screenshots (with meaningful captions), when applicable (if not applicable, write “N/A”)>