Cairo University
Faculty of Engineering
Electronics and Electrical Communications Engineering Department

Fall Semester 2021

Course Code: ELC3030
Course Title: Advanced Microprocessor Architecture

Term Project: Due Thursday, November 25th, 2021 at 11:59 PM

UART & USB Emulator

Using MATLAB, write a code to emulate the USB and UART protocols in the transmitting state. You can implement this either as code or using MATLAB GUI.

The code reads 2 files based on the user request:

- **A Configuration File:** which is a JSON file that contains the protocol name and parameters (like bit rate, number of stop bits, … etc.). You will create one configuration file (conf.json) containing an array of 2 objects: one for UART and the other for USB. Please, refer to the attached configuration files samples (uartconf.json & usbconf.josn) to get familiar with the structure of the JSON object used to describe each protocol. Your code then should decode the provided configuration file to determine the protocol names as either "USB" or "UART". Any other protocol name should result in an error message to the user. For each case, your code should decode the following information from the provided configuration file:
  - For the case of UART:
    - The number of data bits per packet (either **7** or **8** bits).
    - The number of stop bits (**1** or **2** bits).
    - The parity used (**even**, **odd**, or **none**).
    - The bit duration.
  - For the case of USB:
    - The synchronization pattern (**8** bits: **7 zeros** followed by **a one**).
    - The length of the packet identifier (**8** bits for PID).

      (Note that PID of the first packet is 1 and is incremented by **1** for every new packet).
    - The destination address (**11** bits) (assume any 11 bit address).
    - The size of the payload (assume it **128** bytes).
    - The bit duration.

- **An Input Data File**: which is an ASCII text file that contains the data to be transmitted by the protocol specified by the user. Please use the attached file (inputdata.txt).

Procedure/Output:

- Plot a sample of the bit sequence to be transmitted by both protocols (the first **2 bytes** in UART and the first **2 packets** in USB).
- In case of having equal bit duration for both protocols, report back to the user the total time required to transmit the input data file, the percentage overhead, and the efficiency of each protocol in a JSON file. Please, refer to the attached output file sample (output.josn) to get familiar with the structure of the output required.
- In case of having equal bit duration for both protocols, plot the increase of the percentage overhead of both protocols versus the file size. (Hint: you can use the input data file over and over instead of creating bigger files)
- In case of having equal bit duration for both protocols, plot the increase of the transmission time of both protocols versus the file size. (Hint: you can use the input data file over and over instead of creating bigger files).
- To receive full credit, you need to explain and comment on any observed outputs/trends/….

Logistics:

- Any case of **cheating** will result in a **ZERO** project grade to **ALL** involved students.
- Each group should consist of **3** students. Submit the group members using the following spreadsheet:

  https://docs.google.com/spreadsheets/d/1Lnrz392eQhUW4qBKwLykkgl-QpEfFT0xL79VqD1MTVs/edit?usp=sharing
- Deadline for submitting group members is **November 13th , 2021** at **11:59 PM**.
- Entering an incorrect section or BN will result in a **ZERO** grade for that student.
- Each group should submit the following:
  - A **.pdf** file of a report having at most 8 pages.
  - A **.json** file containing the required output.
  - A **.zip** file containing all of your work/code files.
- The files should be called **ELC3030_[Group Number]** where [Group Number] should be replaced by your group number. For example, Group 25 should submit the three files **ELC3030_25.pdf**, **ELC3030_25.json** and **ELC3030_25.zip**. Please note that the naming criteria is **case sensitive**.
- Groups that do not follow the correct naming criteria will **lose 50% of the project's maximum grade**.
- Only **one** member of the team is needed to submit the required files on Blackboard.

- The project is worth **10 points**.
- Deadline for the project submission is on **Thursday, November 25th, 2021 at 11:59 PM**.
- Groups that **miss the deadline** will get a **ZERO** for the project's grade.

Useful Material:

- Before working in GUI, see this quick tutorial:
  - https://www.mathworks.com/videos/creating-a-gui-with-guide-68979.html
- The following links would be helpful while working with JSON files:
  - https://www.mathworks.com/help/matlab/ref/jsonencode.html
  - https://www.mathworks.com/help/matlab/ref/jsondecode.html