

# CSE 433 EMBEDDED SYSTEMS PROJECT 1 – HARDWARE DESIGN CONTEST

Due Date: 03.05.2024

## PROJECT REQUIREMENTS

### 1. What Will You Design?

In this project, you will start with a C program, which you will convert into hardware that will be uploaded and executed on an actual FPGA. The FPGA you will use will be Cyclone V.

- A. Write your C code.
- B. Convert to hardware using Verilog on Quartus Prime Lite 23.1.
- C. Perform simulations on Questa Simulator.
- D. Upload and execute on an actual FPGA. (For that step you have to fulfill all the above steps.)



### 2. C Code

Your C code must have the following properties:

- An array of 256 integers.
- At least two loops.
- At least two if-else conditionals.
- Arithmetic expressions.
- The task is also important. The better the task of your C program is, the better grade you get.



### 3. Hardware

Your hardware must have the following properties:

- Use of Block Memory to hold the array and results.
- Datapath: Optimized for both delay and area.
- Control Unit: 3 always blocks (for state register, next state and output logic)
- Multiple modules with hierarchy.



### 4. Simulation

You must be able to perform simulation using Verilog testbench with Questa Simulator. The better your simulation is the better grade you get. It is better to write a simulator that not only applies inputs but also verifies the results. But at least your simulator should apply all test inputs and display the resultant outputs.



## 5. FPGA Upload

You will upload your design to an FPGA board, which has:

- At least 8 switches.
- 4 7-segment displays.
- At least 10 LEDs.
- UART connection to PC.

Use these properties in the best manner to prove that your design works flawlessly. The better your show is, the better grade you get.



DO NOT FORGET! THIS IS A DESIGN CONTEST. AT ANY POINT STARTING WITH THE TASK SELECTION TO YOUR BOARD DEMO STRATEGY; YOUR CHOICES MATTER AND DEFINE THE RESULTANT GRADE YOU GET. FOR SUPERIOR DESIGNS YOUR GRADE CAN BE AS HIGH AS 150 OVER 100.

(Project is about 10% of the total grade)



**Landing on the Moon:**



Small Step → One Man  
Giant Leap → Mankind

**Getting a Ph.D.:**



Giant Leap → One Person  
Tiny, Insignificant Step → Mankind