TE3059 Embedded Systems Design

Primer Parcial

September 7, 2020

1. **(30 points)** Perform a research on the following items:
    a. What does FPGA mean? Why was that name given to this type of devices?
    b. Describe the general architecture of a FPGA. Describe its main components.
        i. Logic elements
        ii. ALMs
        iii. Memory blocks
        iv. DSP blocks
    c. Make a detailed description of the Cyclone V FPGA/SoC
        i. Variants and main features of each variant
        ii. Describe the programmable logic (PL) section of the SoC variants
        iii. How many PLLs and what features they have
        iv. Describe the Hard Processor System (HPS) and how it interconnects to the PL side of the SoC
2. **(Odd-numbered teams)** Design and implement up to simulation stage an I2C controller using Verilog HDL. Deliverables:
    a. **(20 points)** Specifications document
        i. Goals of the project
        ii. High level block diagram
        iii. Overall functionality
    b. **(30 points)** Design document
        i. All the intricacies of the I2C controller
        ii. Hardware architecture at signal level
        iii. FSM controllers
        iv. Synthesis results
        v. Simulation results with different test cases
    c. **(20 points)** HDL code and test benches runnable in Quartus Prime
3. **(Even-numbered teams)** Design and implement up to simulation stage a SPI controller using Verilog HDL. Deliverables:
    a. **(20 points)** Specifications document
        i. Goals of the project
        ii. High level block diagram
        iii. Overall functionality
    b. **(30 points)** Design document

i. All the intricacies of the I2C controller
ii. Hardware architecture at signal level
iii. FSM controllers
iv. Synthesis results
v. Simulation results with different test cases

c. **(20 points)** HDL code and test benches runnable in Quartus Prime