University of North Texas
Department of Electrical Engineering
EENG 2910 Project III – Digital System Design
Final Project

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Simple Processor

High Level Verbal Description

Design a **simple processor** with at **least 4 4-bit registers** and at **least 16- word memory with 8-bit words**. The processor should be able to display data from any of the **4 registers.** The **PC** will load code you configure to show that processor can complete any operation. Display the outputs of the operations performed by the processor (**Arithmetic Logic Unit**) through LEDs or the Seven Segment display (*major bonus points not required*).
The designed simple processor should perform basic operations – **add**, **subtract**, and **data movement operations** (**Shift, Compare**).
Your complete design will result in a system that executes all those instructions step by step.

You will need to design three types of instructions:

1. **Data handling** and **manipulation** (**clear**, **increment**, **move**, **add**, **subtract** *etc.*)
2. **Branch instruction** – Having comparisons in the ALU determine if you would want to set the PC to a certain location in your code... (Think about a loop?)
3. **Input/Output**

You will not be judged on efficency just on the approach you had taken to complete your processor. If you feel like you need to modify the instruction set this is fine as long as you explain why you made this modification. Please feel free to explore various methods to complete the task at hand as the best design is one that works.

Report and Presentation for Final Project

Both, the report and the presentation of the final project (**FPGA Design of an 8-bit Simple Processor**) are due **Wednesday, December 7th**.

Members of each team are **expected to participate on all activities** in approximately equal proportion, **wear business casual attire to the final presentation**, and receive the same grade **except in unusual circumstances**. The guidance for presentation and report should be followed augmented by the additional guidance given below.
The grading criteria will be discussed subsequently and posted on the home page of the course on Blackboard.
The report should contain the **architectural diagram** of the designed simple processor, the **state diagram** of the control unit – displaying the condition/state of the operations of the processor. A **flowchart** of some of the operations performed by the processor could also be added – this will be particularly beneficial when performing the demo. Finally, your **Xilinx schematics** and **simulation results** should also be included. Remember that it is **not** enough to just include these figures in your report without actually discussing them.

Report

Your report should be well organized and well written. All members of the team should **read and reread** the report to make sure that most (if not all) grammatical errors are corrected. It should have an Abstract, an Introduction, the Report itself, a Conclusion, and a Reference section. You could also have an Appendix section that will contain all the VHDL programs written. You are also required to **submit the full working program** on BlackBoard.

Presentation

Your team will have approximately 10 minutes to present and 2-3 minutes for the questions/answers session. **Practice the presentation!** It should be concise and contain only the main points. **It should also contain the architecture, the state diagram or the flowchart that you have designed**. Some advices on how to make a good presentation are available at the following links:
http://www.aresearchguide.com/3tips.html
http://rogerdarlington.me.uk/Presentation.html
http://www.cs.cmu.edu/~mihaib/presentation-rules.html

Each team member should talk about a part of the project and what he/she has done. You should also **include an actual demo of your working simple processor** at the end of the presentation.

Additional Guidance for the Report and Presentation

In addition to the templates already provided, here is a checklist that may help the team while working on the final project, writing the report and delivering the presentation.

Recall writing a clear and concise introduction

- State the purpose and scope of the project
- Characterize the problem and introduce the solution
- Provide basic concepts and theory when appropriate (i.e. for each of the main components of the processor)
- Discuss your bibliographic references

Solution description, system

- Basic performance criteria needed to develop the simple processor
- Are there constraints and/or standards that should be considered during development?
- Describe the creation and testing of the processor. Outline the preliminary analysis and changes made (if applicable).
- Include state diagram or flowchart to illustrate how your design works.

Discussion, conclusions, recommendations and references

- Present your conclusions and recommendations (arranged in descending order of importance)
- Describe what you have learned while implementing the simple processor and how skills gained could be applied in solving real world problems.