CSCE 496: Embedded Systems Design and Implementation
Midterm Examination and Project Description

The midterm will be on the use of embedded processor technologies to improve performance of compute intensive algorithms. It will require three steps to complete. The description of each step and the due date are provided below:

[100 pts] Midterm Examination (April 19, 11:59 pm)
In this step, you need to write a short proposal describing the algorithm you want to implement. This algorithm must be commonly used in domain specific problems or common run-time functions. In this stage, you need to provide the following:

- A description of the algorithm—you need to clearly describe your proposed algorithm. It is preferable that you pick an algorithm that aligns with your interested. However, try NOT TO choose common DSP algorithms as they have thoroughly been used in this type of optimization. Also provide the pseudo code of your algorithm. I will need to approve your proposal. My plan is to have individual meetings on Friday April 21. I will be available from 12:30 pm to 3:00 pm.
- An application of the proposed algorithm—who are the major users of this algorithm? How is it being used (in commercial software or purely academia)? In which domain is it used (embedded systems, servers, desktops)?
- An analysis of the algorithm—clearly specify why do you think it can take advantage of hardware optimization. You must be very thorough in your analysis. Remember, the algorithm that can take advantage of the Stretch or the Nios instruction extension should be compute intensive and not I/O intensive. You must also identify the software hotspot in the algorithm.
- Major benefits—clearly specify the benefits of hardware optimization. Is it purely speed? Are there other benefits (real-time, etc.)?

[40 pts] Project (Part 1): Software implementation of the algorithm (April 26, 11:59 pm)
Once the topic is approved, you will need to implement your proposed algorithm. In this stage, no hardware optimization is needed. Think about how the input is stored and retrieved. Confirm your hypothesis about the software hotspot (part of the exam).

[60 pts] Project (Part 2): Hardware optimization (May 4, 11:59 pm)
You need to create hardware optimization to improve the performance of your algorithm. Profile your new implementation with the implementation from step 2. Calculate the speed-up of the hardware algorithm. Did you achieve the benefits expected in your analysis?

Hints:
1. Make sure that you have a large data set. This can be synthetically generated but should be representative of the real world scenario.
2. Pick an algorithm that is related to your interest but don't pick a very easy algorithm. I will not approve your proposal. Part of the test is for you to do research in choosing the algorithm.

Submission Process:

Submission will be through hand-in. Create a zip file of the entire project. The categories will be Midterm-1, Project-1, and Project-2.