

CS 179 Spring 2021

Project Information

You will be given four weeks to design and implement a GPU-accelerated project of your choice, working alone or in pairs. Teams of three must be approved by a TA and must be proposing a substantially-sized project. If you do choose to work with others, we will expect a proportional increase in the project's scope. A general rule of thumb is to have at least one CUDA module per person. For example, a two-person team can create a raytraced visualization of an N-body simulation. In this case, one person will write a CUDA based raytracer and the other person will write a CUDA based N-body simulator.

Due Dates

Below are the due dates for the components of the final project. Items should be turned in no later than 11:59 PM Pacific on the day listed.

- May 4, 2021: Proposal due
- May 21, 2021: CPU Demo due
- June 4, 2021: Project due for seniors and grad students
- June 11, 2021: Project due for everyone else

Project Inspiration

There are essentially no restrictions on what you can do for your project, so to get you thinking about what you could do, here are a few projects that have been done in the past:

- SHA-1 Hash Fixpoint
 - Found a SHA-1 hash fixpoint given a set of input files that allowed for relatively fast computation of a hash fixpoint. The program was then used to create a git commit where a file contained the hash of the commit.
- Elasticity Simulation
 - Ran a mass-spring system-based simulation of an elastic material. Included an OpenGL-based GUI that allowed for user interaction.
- Terrain Renderer
 - Procedurally generated terrain heightmaps using fractals and stochastic noise. Rendered the terrain using a raymarching-based renderer.

Proposal

The proposal should include the following information:

- Summary (1-3 sentences)
 - Provide a short summary of the project
- Information (1-3 paragraphs)
 - Provide background information
 - Explain the project in some detail
- Questions (1-3 paragraphs)
 - Has it been done before?
 - What challenges will you face?
 - What problems need to be solved?/What do you need to figure out?
- Deliverables
 - Describe deliverables and/or goals
 - If for a group, describe how work will be split
- Timeline
 - Provide week-by-week timeline of what will be done

Your project proposal should be submitted to all of the TAs via email (please include all 4 TAs), and we will respond with feedback on the proposal and approve the project if the proposal meets requirements. Do not start working on your project until your proposal is approved. Proposals should be sent to TAs by *May 4, 2021*.

CPU Demo

Since debugging on a GPU can be challenging, we are requiring that you provide a CPU-based version that can serve as a proof-of-concept or baseline. Depending on the project, your CPU demo could be one of several things:

If you are building something from scratch, the CPU demo should have all of the features of the GPU version so that they can be compared against each other. Your CPU code should be commented to include information on how the code will be parallelized.

If you are creating a GPU version of an existing CPU-only library/application, your CPU demo should include tests to verify results from the GPU code you implement. The tests should be commented to describe what they verify.

In either case, you should also include instructions for how the demo can be run and what result is expected.

The CPU demo should be turned in by zipping the code and instructions into a file named `cpu_demo_2021_submission.zip` in your home directory. The CPU demo will be due on *May 21, 2021*. If you need more time, contact a TA.

Project Turn-In

The project turn in should include all code that was written for the project (i.e. both CPU and GPU), as well as a comprehensive readme file that outlines everything the TAs need to know about the program. The readme should have the following information:

- Usage Instructions
 - What installation steps are necessary (if any)?
 - How do we run the program and see output?
- Project Description
 - What does the program do?
- Results
 - What do we expect to see?
- Performance Analysis
 - How much better is the GPU version?
 - Are there things that could be improved?

The project should be turned in by zipping the code and readme into a file named `final_project_2021_submission.zip` in your home directory. The project and writeup will be due on *June 4, 2021* for seniors and grad students and on *June 11, 2021* for everyone else. Extensions cannot be granted for these due dates.

Resources

Starting on May 11, office hours will be held by appointment *only*. If you would like to work with a TA, you can either contact a TA directly to schedule a time, or you can email all of the TAs with your availability, and the one who is available soonest will schedule a time with you.

You will likely find the [CUDA Programming Guide](#) useful as you work on your project. The [CUDA Documentation](#) will also be useful for answering questions about the various CUDA libraries.