

## Project 6

**Due:** *Thursday, April 25 at 2:00 PM*

**Goal:** execute and present your own hybrid parallelism study

All projects in CS 4378T / CS 5351 are due at the beginning of lecture on the due date. You have to hand in a typed project report and submit an electronic version on TRACS. Handwritten reports are not acceptable. Multiple pages have to be stapled together. Your report must include your name and NetID, the results of your measurements, and one or more concise paragraphs that explain the data, answer the questions, point out curiosities, and draw conclusions. Please avoid restating the problem and do not include unnecessary text or code. All modified files have to be submitted on TRACS (see the end of this handout). If either the hardcopy of the project report, the electronic copy of the report, or the files are missing, you will receive zero points for the entire project. This project can be done individually or in pairs.

## Final Project

Execute the final project as described in Homework 6. The project has to combine CUDA with one other form of parallelization in a meaningful manner. The code must be non-trivial and you should validate that it computes the correct output. Moreover, you have to measure the speedup on Stampede. The project deliverables include the code you write, an up to 2-page project report, and an in-class presentation of your work if you are a graduate student.

## Compiling and running heterogeneous parallel programs on Stampede

As the CUDA compiler does not support MPI, you need to write separate source files for the MPI/OpenMP/Pthreads code and the CUDA code. Then use the following commands to generate a combined executable:

```
mpicc -xhost -openmp -O3 -c code.c -o Ccode.o
nvcc -O3 -arch=sm_35 -c code.cu -o CUcode.o
mpicc -xhost -openmp -O3 Ccode.o CUcode.o -lcudart
-L$(TACC_CUDA_LIB) -o exe
rm -f Ccode.o CUcode.o
```

Replace `-openmp` with `-pthread` if you want to use pthreads instead of OpenMP. You do not have to use MPI. Include the commands to compile and build your code in the readme file.

Select the most appropriate queue, number of nodes, and number of tasks in the job submission script. For jobs requiring more than four nodes or more than 10 minutes of runtime, please contact the instructor first to obtain permission.

## 6.1 Report

Start with one concise paragraph that summarizes your project. Then describe the background information upon which your project is based, including what we have covered in class if applicable. Next describe your project and its goals. Explain what and how you measured, any important machine parameters, etc. Graphically present or tabulate your results and provide a detailed discussion of them. Provide insights, not just data. Finally, summarize the main results of your work and draw conclusions. You can also mention possible directions for future work.

## 6.2 In-Class Presentation

**[CS 5351 students only]** Create a 3-minute PowerPoint presentation of your project. You will have to present your slides in class on April 25.

## Code Requirements

- Make sure your code is well commented.
- Make sure your code does not produce unwanted output such as debugging messages.
- Make sure your code's runtime does not exceed the preset limit.
- Make sure your code is correctly and consistently indented.
- Make sure you use a consistent coding style.
- Make sure your code does not exceed array bounds.
- Make sure your code does not include unused variables, unreachable code, etc.

## Code Submission

- Delete all files that you do not need anymore such as core and \*.o files.
- Make sure your code complies with the above code requirements before you submit it.
- Do not submit any unnecessary files (e.g., files generated during compilation or execution).
- For a group submission, create and submit a file called "group" that contains the names and NetIDs of the group members. Do not include any other information in this file.
- Any special instructions or comments to the grader should be included in a "README" file.
- Upload all the files you want to submit onto TRACS. Please follow the instructions at <http://tracsfacts.its.txstate.edu/trainingvideos/submitassignment/submitassignment.htm> for submitting files. The files are only submitted if TRACS indicates a successful submission.
- Upload each file separately and do not compress them.

You can submit your files as many times as you want before the deadline. Only the last submission will be graded. Be sure to submit at least once before the deadline.

April 18, 2013