Cesar Martinez

Josh Stewart

Julian Welge

Merge Sort CUDA (Naïve/Binary Search)

Run the Program:

1. Navigate to the project folder.
2. Type ‘make’ into the command prompt and hit ‘Enter’.
3. The project should compile and create .o files.
4. Type ‘./project <arraySize>’ into the command prompt and hit ‘Enter’ to run the program.
5. Optional: Type ‘p’ after the array size to print output arrays to the console.
6. Type ‘diff <file1> <file2>’ to print the differences between the CPU and GPU output.
7. The files will be populated and in the project folder after the first execution.

Purpose:

1. ‘./project’ – Calls the executable to run the program
2. ‘<arraySize>’ – Gives the user the ability to specify data size. Also helps with capturing program performance of larger data sets.
3. ‘p’ – Prints program output to the console. This makes the difference between CPU and GPU output, with smaller data sets, easier to understand and debug.
4. ‘diff <file1> <file2>’ – Assists with the debugging of code and correct capture of output.

Text

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Description automatically generated         b)  Sample Run / Screenshots

**A picture containing calendar

Description automatically generatedArraySize 2048 GPU** **ArraySize 2048 CPU**

         c) Speedups of Merge Sort

* Times with not offloading last merge onto CPU

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Input size | 2,048 | 1,048,576 | 8,388,608 | 16,777,216 | 33,554,432 |
| Block Dimensions | 1 x 512 | 1 x 512 | 1 x 512 | 1 x 512 | 1 x 512 |
| T1:time cost for GPU (sec) | .000675 | .627788 | 4.715045 | 9.442738 | 18.891363 |
| T2:time cost for CPU (sec) | .001092 | .164468 | 1.427419 | 2.888026 | 5.982103 |
| Speedup = T2 / T1 | 1.6178 | .26198 | .30273 | .30584 | .31665 |

* Times with offloading last merge onto CPU

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Input size | 2,048 | 1,048,576 | 8,388,608 | 16,777,216 | 33,554,432 |
| Block Dimensions | 1 x 512 | 1 x 512 | 1 x 512 | 1 x 512 | 1 x 512 |
| T1:time cost for GPU (sec) | .000023 | .326090 | 2.393490 | 4.790324 | 9.567669 |
| T2:time cost for CPU (sec) | .000266 | .159490 | 1.409835 | 2.910260 | 5.932908 |
| Speedup = T2 / T1 |  |  |  |  |  |