University of Arkansas
Department of Computer Science & Computer Engineering
CSCE4643/5693 – GPU Programming

Lab 6: Parallel Scan

Due Date: March 30 (Monday) at midnight 11:59 pm
Required for ALL students

1. Objective

The objective of this lab is to get you familiar with the parallel prefix scan algorithm. Please read Mark Harris's report "Parallel Prefix Sum (Scan) with CUDA" to learn the algorithmic background. We implement exclusive scan in this lab.

2. Procedure

Step 1: Download the lab 6 materials from blackboard to your home folder at Karpenski cluster. Unzip it.

```
unzip lab6-prefix-scan. assignment.zip
```

Step 2: Edit `kernel.cu` to implement the device kernel code for the exclusive parallel prefix scan algorithm. For both kernel functions, a thread block will deal with 2×BLOCK_SIZE items. You should use the work-efficient approach. You are expected to support an input array of any size that fits in the global memory and are not allowed to add up partial sums on the CPU. In other words, you must use the hierarchal scan approach.

Step 3: Compile and test your code.

```
make
./prefix-scan                 # Uses the default input size
./prefix-scan <m>             # Uses an input with size m
```

Step 4: Answer the following question in `answers.txt`:

- Describe how you handled arrays not a power of two in size and all performance-enhancing optimizations you added.

Step 5: Submit your assignment. You should only submit the following files:

- `kernel.cu`
- `answers.txt`

Compress the two files and submit the tar file in moodle.

```
tar -cvf lab6_<your last name>.tar kernel.cu answers.txt
```

3. Grading:

Your submission will be graded based on the following criteria (Total 100 points).

- Functionality/knowledge: 90 points
  - Correct code and output results

    - Correct usage of shared memory in the kernel to hide global memory access latencies
    - Correct handling of boundary cases
    - Check return values of CUDA APIs
- Answers to questions: 10 points
    - Correct answer to questions in Step 4
    - Sufficient work is shown
    - Neatness and clarity