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

Lab 7: Histogramming

Due Date: Monday April 13 Midnight at 11:59 PM
Note: This lab is required for ALL students.

1. Objective

The purpose of this lab is to implement an efficient histogramming algorithm for an input array of integers within a given range. Each integer will map into a single bin, so the values will range from 0 to (#bins - 1). The histogram bins will use unsigned 8-bit counters that must be saturated at 255 (i.e. no roll back to 0 allowed).

2. Procedure

Step 1: Download the lab 7 materials from blackboard to your home folder at Karpenski. Unzip it.

```
unzip lab7-histogram.assignment.zip
```

Step 2: Edit `kernel.cu` to implement host and device kernel code for the histogram. Remember that the resulting 8-bit counters must be saturated at 255. Begin with a naïve implementation then optimize it gradually. Keep a journal of every optimization you tried including the ones you abandoned because they limited you or worsened performance. This journal will be included in your report for this lab.

Step 3: Compile and test your code.

```
make

./histogram             # Uses default input size and default number of bins

./histogram <m>         # Uses input of size m and default number of bins

./histogram <m> <n>     # Uses input of size m and bin count of n
```

Step 4: Create a report in a new file named `<lab-directory>/report.txt` which describes all optimizations you tried regardless of whether you committed to them or abandoned them and whether they improved or hurt performance. For each optimization, include in your report:

- A description of the optimization
- Any difficulties you had with completing the optimization correctly
- The change in execution time after the optimization was applied
- An explanation of why you think the optimization helped or hurt performance

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

- `kernel.cu`
- `report.txt`

Compress the files and name them after your last name like so:

```
tar -cvf lab7_<your last name>.tar kernel.cu report.txt
```

Submit the tar file in blackboard.

3. Grading:

Your submission will be graded based on the following criteria.

- Functionality: 90 points
  - Correct code and output results
  - Correct handling of boundary cases
- Report: 10 points
  - Effort and thoughtfulness put into optimizing the algorithm/code
  - Completeness and accuracy of the report
  - Neatness and clarity