CS516: Parallelization of Programs

Assignment-1

Due date: January 30, 2024 11:59 pm

Question-1: [100 Points]

Consider a Vector A of size N having integer elements. Write a program under the following scenarios that takes input N and radius R to compute output vector B (size N) as defined below

$$B[i] = \sum_{r=r}^{R} A[i+r] + \sum_{r=r}^{R} A[i-r] \text{ for } 0<=i<N$$

Assume that A[i] = 0 if i<0 or i>=N

1. Implement a sequential version of the program using C/C++ language.
2. Implement a parallel version of the program using CUDA by having N_THREADS per thread block and N/N_THREADS thread blocks. Verify that the output of the sequential program is the same as the parallel program.

Submission Instructions:

1. Prepare your solutions in a zip file.
2. The zip file should contains 4 files:
    a. File named as "***seq.c***", which is the sequential version of your program
    b. File named as "***parallel.cu***", which is the parallel version of your program
    c. A ***README*** file containing the instructions to execute both programs **(README carries 5 Marks)**
    d. A report named "***report.pdf***", which is described below.
3. You should prepare a report, as shown in Table 1 that compares the execution time of the CUDA kernel with that of an equivalent function in sequential implementation. To measure the execution time, you can use the *gettimeofday* function; an example of usage is listed here.

N	R	N_THREADS	Number of Thread Blocks	Sequential Execution Time (S)	CUDA Kernel Execution time (P)	Speed up (S/P)
1024	32	1024	1	To be filled	To be filled	To be filled
2048	32	1024	2	To be filled	To be filled	To be filled
4096	32	1024	4	To be filled	To be filled	To be filled
8192	32	1024	8	To be filled	To be filled	To be filled
16384	32	1024	16	To be filled	To be filled	To be filled
32768	32	1024	32	To be filled	To be filled	To be filled
65536	32	1024	64	To be filled	To be filled	To be filled
131072	32	1024	128	To be filled	To be filled	To be filled