

# CS6023 GPU Programming

## Problem Set 2: Memory

1. Write a CUDA kernel which takes an integer parameter with value in the range 0..31 and creates a memory access pattern with coalescing degree equal to that value. 31 indicates fully coalesced, while 0 indicates uncoalesced.
2. Write a matrix multiplication kernel. Now try all six permutations of the three nested loops and measure times taken for 1024x1024 matrices.
3. Write a kernel which checks if a given matrix is a valid solution to a Sudoku puzzle. Parallelize the processing as much as possible. Try for coalesced accesses. Compare the times between CPU and GPU.
4. Check if a given matrix is lower triangular. Parallelize as much as possible. Compare the times between CPU and GPU. Plot time for increasing matrix size.
5. Write a stencil code wherein you are given a matrix A, and your code should populate matrix B such that  $B[i][j]$  is a stencil function of  $A[i][j]$  and neighbors of  $A[i][j]$ . A cell may have upto eight neighbors (three in row  $i-1$ , two in row  $i$ , and three in row  $i+1$ ).  $B[i][j]$  is set to the median of all these elements from A. Exploit shared memory.