Parallel Computing **Assignment #1**

1. Consider the problem of computing the dot-product of two vectors. The dot product can be computed in a single loop. To study the impact of loop unrolling, unroll the for loop k ways (for k = 1, 2, 4, 8). Write program(s) for doing this and compute the time for executing this on two vectors of length 100,000 elements. Plot the time against the value of k. Count the number of Floating Point Operations (FLOPS) in your program. What is the peak speed in Floating Point Operations Per Second (FLOPS) of your code ?

2. Consider the problem of multiplying two matrices. Two $n \times n$ matrices can be multiplied using three nested loops. This formulation expresses each element of the result Matrix (C) as a dot product of a row of A and a column of B. The elements of C are computed row-by-row. Modify the loops in such a way that matrix C is organized into blocks of size $k \times k$. All elements of a block are computed before proceeding to the next block. The blocks themselves are computed row-by-row. Write a matrix-multiplication program to perform blocked matrix multiplication. Use this to multiply two matrices of size 512×512. For values of k equal to, 1, 2, 4, and 8, compute the runtime. Plot this runtime against the value of k. Compute the peak FLOP rate of your program.