Homework 1 - AMATH 583

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1 Level 1 BLAS (Basic Linear Algebra Subprograms)

Given the following specification, write a C++ function that computes $y \leftarrow \alpha x + y$, where $x, y \in \mathbb{R}^{\times}, \alpha \in \mathbb{R}$. Write a C++ code that calls the function and measures the performance for $n = 2$ to $n = 1024$. Let each n be measured ntrial times and plot the average performance for each case versus n, ntrial ≥ 3 (performance is FLOPs don't forget). You may initialize your problem with any non-zero values you desire (random numbers are good). The correctness of your function will be tested against a test system with known result, so please test prior to submission. Check for and flag incorrect cases. Submit C++ function file, main source file, and performance plot.

```
void daxpy (double a, const std::vector<double> &x, std::vector<double> &y);
```

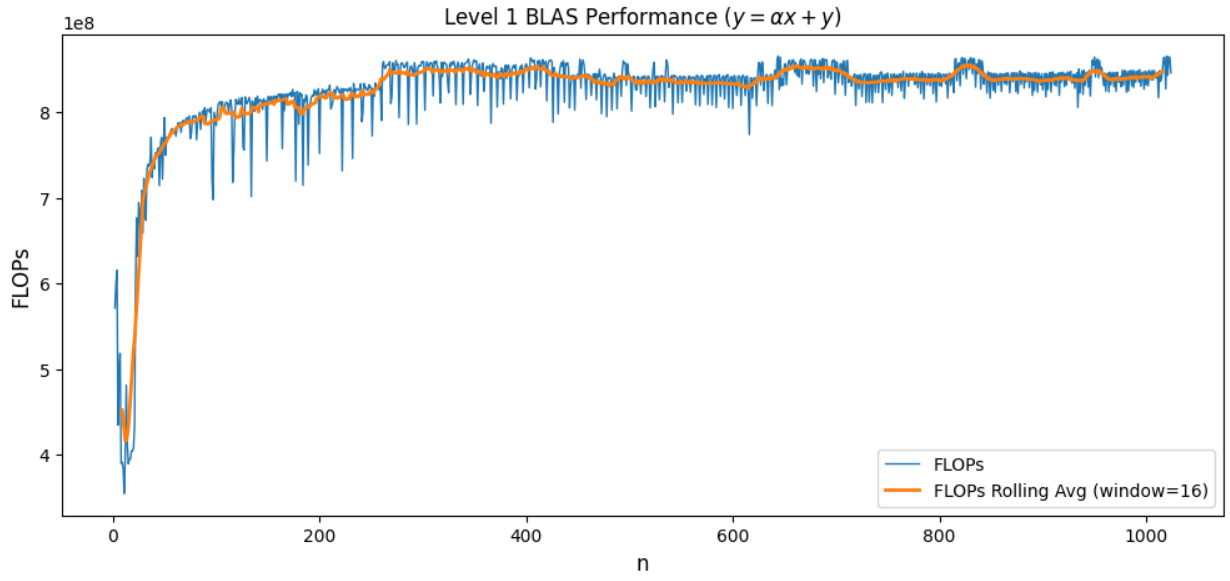

Figure 1: Level 1 BLAS Performance for $n \in [2, 1024]$, *ntrial=1000*.

2 Level 1 BLAS Loop Unrolled

Given the following specification, write a C++ function that computes $y \leftarrow \alpha x + y$, where $x, y \in \mathbb{R}^{\kappa}, \alpha \in \mathbb{R}$. Your function should unroll the loop at least to depth 4, and accept a block size parameter. Write a C++ code that calls the function and measures the performance for $n = 2048$ and study the block sizes 1,2,4,8,16,32,64. Measure *ntrial* times for each block size and plot the average performance for each case versus n, $ntrial \geq 3$. You may initialize your problem with any non-zero values you desire (random numbers are good). The correctness of your function will be tested against a test system with known result, so please test prior to submission. Check for and flag incorrect cases. Submit C++ function file, main source file, and performance plot.

```
void daxpy_unroll (double a, const std::vector<double> &x,
std::vector<double> &y, int blocksize);
```