Homework 1, Part 1

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1 Write-Up

For the first part of this assignment, we investigated performance improvements regarding Loop Unrolling and ILP. There were 3 timed loops - a reference, which was provided; a sequential loop, which unrolls the reference loop sequentially; and a interleaving loop, which unrolls the reference loop and interleaves independent instructions, separating the dependent instructions. In the below figure, the reference loop is the green line, the sequential loop is red, and the interleaving loop is blue.

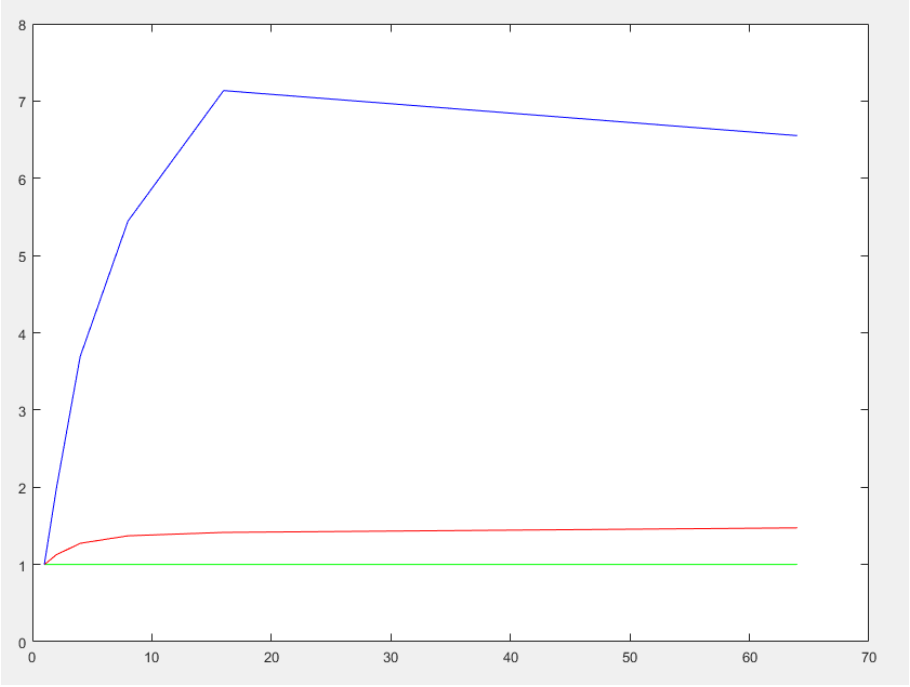

Figure 1: Results

2 Analysis

As expected, the speedups from the interleaving loop are streets ahead of the sequential speedups, although interleaving sees a slight performance drop as the unroll factor increases. This highlights the power of interleaving - taking advantage of the ability to process multiple commands concurrently is a significant speed increase, and it reaches a maximum at a relatively lower unrolling factor. Regarding the sequential loop, we can see that the performance improvement from unrolling trends towards a constant as the unrolling factor increases, showing that unrolling to an excessive amount will not necessarily help performance. To conclude: although unrolling definitely increases performance, the amount is inconsequential compared to the performance improvement resulting from unrolling and interleaving.