

## In Class work for Lecture 3/31/2017

Objective: Learn about program optimization: Observe the problems with memory aliasing. Observe the benefits of loop unrolling

1. Observe the limits of optimization in the presence of memory aliasing
  - 1.1. Compile `memory_alias_base.c` with no optimization
  - 1.2. Remove the memory aliasing in `memory_alias_base.c` by introducing a temporary variable. Save the file as `memory_alias_fixed.c` Compile this version with no optimization
  - 1.3. What was the percentage speed up of your optimization?
2. Do the same experiment but turn on full compiler optimization
  - 2.1. Compile `memory_alias_base.c` with full optimization
  - 2.2. Compile `memory_alias_fixed.c` with full optimization
  - 2.3. Now, what was the percentage speed up of your optimization?
3. In addition to fixing your memory aliasing, add four times loop unrolling to `sum_row`
  - 3.1. Compile `memory_alias_loop_unroll.c` with no optimization
  - 3.2. What was the percentage speed up of your optimization compared to `memory_alias_fixed` ?
  - 3.3. Compile `memory_alias_loop_unroll.c` with full optimization
  - 3.4. What was the percentage speed up of your optimization compared to `memory_alias_fixed_optimized` ?
4. Throw everything you can at the problem. Can you get any more speed out of the program by optimizing just the summing loop in `main()` and any functions that it calls?
5. Were you able to improve performance by manually optimizing your code?
  - 5.1. By eliminating memory aliasing?
  - 5.2. By unrolling your loops?
6. Were you able to beat the automatic optimizations?

(Table on reverse side)

Condition	How long did it take to run the program?	Comments
gcc -o memory_alias_base memory_alias_base		
gcc -o memory_alias_fixed ./memory_alias_fixed.c		
gcc -o memory_alias_base_optimized -O3 ./memory_alias_base.c		
gcc -o memory_alias_fixed_optimized -O3 ./memory_alias_fixed.c		
gcc -o memory_alias_loop_unroll -O3 ./memory_alias_loop_unroll.c		
gcc -o ./memory_alias_loop_unroll_optimized -O3 ./memory_alias_loop_unroll.c		