ENCM 369 – B04

Laboratory 5

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Exercise D

*Part 1*

[Index A for data]

>> gcc main.c functions.c

5 Fastest times for index\_version: 40132.30; 40358.00; 40268.80; 40473.70; 40414.40

Average = 40429.44 us

5 Fastest times for pointer\_version: 28948.00; 29030.90; 29628.40; 29478.60; 29502.90

Average = 29317.76 us

Speedup = 40429.44/29317.76 = 1.379

microseconds spent in index\_version: 9285.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 10890.50

The sum from pointer\_version was 1125000075000000.

>> gcc -O2 main.c functions.c

Average time in index\_version: 12803.32 us

Average time in pointer\_version: 15469.56 us

Optimized vs Non-Optimized Speedup:

Index\_version: ( 40429.44 / 12803.32 ) = 3.1577

Pointer\_version: ( 29317.76 / 15469.56 ) = 1.8952

With optimization, pointer\_version is not significantly faster than index\_version.

Using the compiler for optimization appears to be an important factor when processing through arrays, more important than just using pointers over indices.

*Part 2*

[Index B for data]

>> gcc -O2 -funroll-loops main.c functions.c

Average time in index\_version: 9283.80 us

Average time in pointer\_version: 11531.68 us

Speed up with loop unrolling:

Speedup = ( 15469.56 / 11531.68 ) = 1.3415

Exercise E

What is the machine code for the instruction addq $0x4,-0x10(%rbp) ?

0x48\_83\_45\_f0\_04

What does this line get replaced with in the translation unit main.i?

sum = index\_version(x, (int) 1.5e7);

What is the machine code for the instruction cmpl $0xe4e1bf,-0x4(%rbp) ?

0x81\_7d\_fc\_bf\_e1\_e4\_00

>>gcc functions.o main.o -o exE.exe [OUTPUT]

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./exe.exe

microseconds spent in index\_version: 39882.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 39076.40

The sum from pointer\_version was 1125000075000000.

Index A

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ gcc -O2 main.c functions.c

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 12489.40

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 14424.70

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 12418.00

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 14344.10

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 13013.60

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 17133.40

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 12649.50

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 13571.40

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 13084.00

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 15614.30

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 16021.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 14756.40

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 14484.70

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 14325.20

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 12811.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 17886.50

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 13068.30

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 16778.70

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 12874.80

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 16501.50

The sum from pointer\_version was 1125000075000000.

Index B

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9285.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 10890.50

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 11064.20

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11186.60

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9679.50

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11913.80

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 8754.10

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11852.90

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9522.70

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 12779.70

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9520.80

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11824.60

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9717.50

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 12797.20

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9689.10

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 12408.40

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9429.70

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11466.90

The sum from pointer\_version was 1125000075000000.

mmmta@LAPTOP-35G9NI35 /cygdrive/e/encm369/lab05/exd

$ ./a

microseconds spent in index\_version: 9191.60

The sum from index\_version was 1125000075000000.

microseconds spent in pointer\_version: 11568.30

The sum from pointer\_version was 1125000075000000.