Homework 1

Name: Anand Ravi

System Properties:

Processor : Intel Core i3-6100U
Number of Cores: 4
Operating System: Ubuntu 16.04

Problem 1a: Naive Multiplication

Number of Runs : 5
Average execution time = (1408 + 1351 + 1372 + 1508 + 1397) / 5 = 1407 sec = 1.41e+12 ns
Average performance = (97.6 + 101 + 100 + 91 + 98) / 5 = 97.52 MFLOPS/sec

Problem 1b: Block Matrix Multiplication

Case 1 : Block Size = 4

Number of Runs = 2
Average execution time = (575 + 560) / 2 = 567.5 Seconds
Average performance = (245 + 273) / 2 = 259 MFLOPS/sec

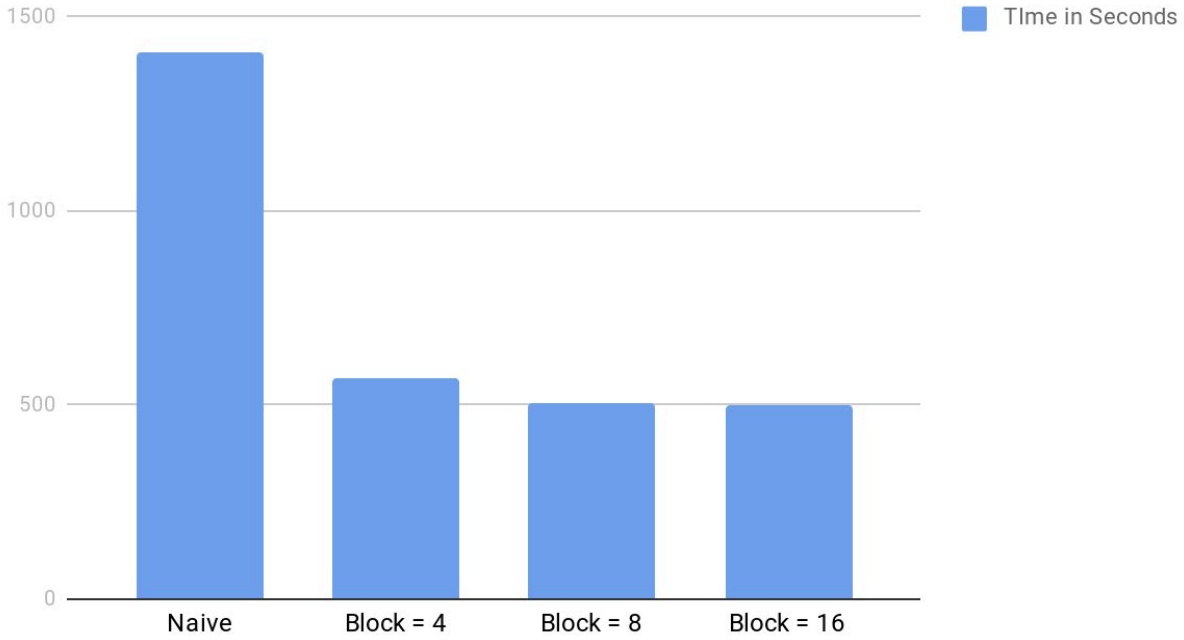
Case 2 : Block Size = 8

Number of Runs = 2
Average execution time = (502 + 504) / 2 = 503 Seconds
Average performance = (273 + 272) / 2 = 273.5 MFLOPS/sec

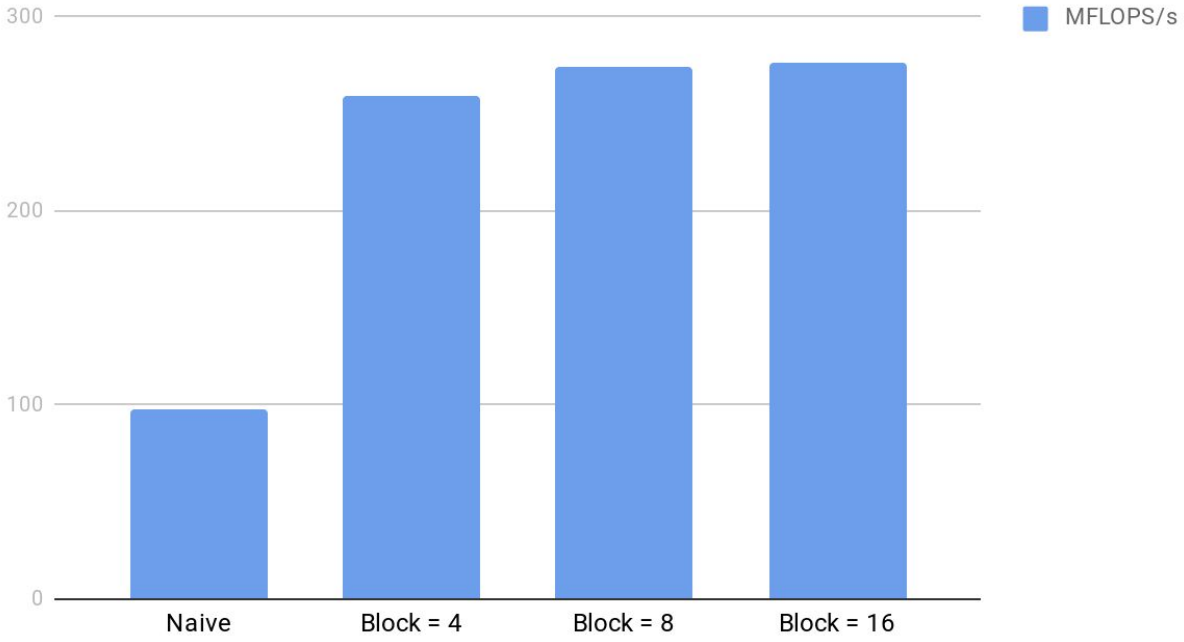
Case 2 : Block Size = 16

Number of Runs = 2
Average execution time = (496 + 498) / 2 = 497 Seconds
Average performance = (277 + 275) / 2 = 276 MFLOPS/sec

Execution Time

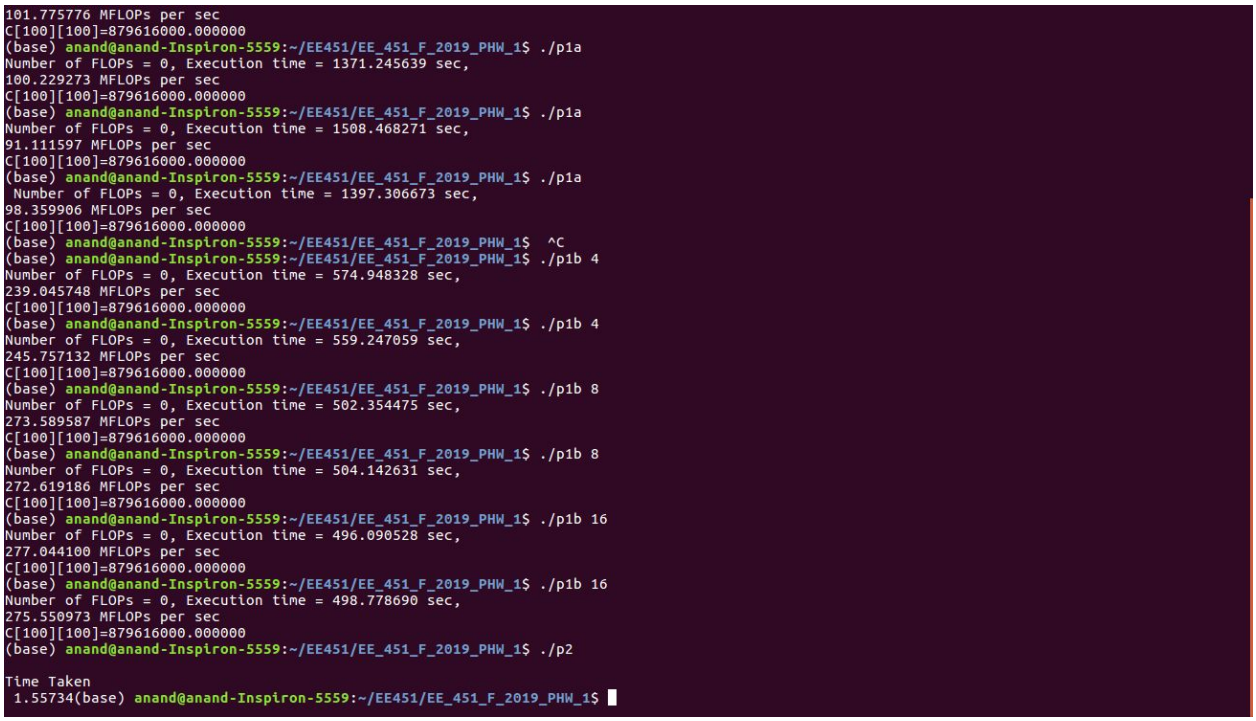


Performance



Observation:

From the plots we can understand that using blocks for matrix multiplication can improve the performance and decrease execution time. This gain is primarily due to efficient use of cache memory. We can also see that performance gain between block size = 8 and block size = 16 is low. Thus we can conclude that after a point we cannot improve performance solely by increasing block size.



Problem 2: Kmeans Algorithm

Execution time for 30 iterations = 1.56 sec

Output: