Table 1 - Matrix multiplication compute time time for increasing matrix size (Serial & Parallel with POSIX/OMP). **Note: You may reduce the size of the matrices to suit your local computing resources**

Number of CPU cores or logical processes: 2 Number of threads used for POSIX/OMP: 2					
Matrix size	500x500	1000x1000	2000x2000	3000x3000	4000x4000
Serial time, Ts (s)	0.49	3.91	33.14	137.18	333.25
Parallel time, Tp - POSIX/OMP (s)	0.37	2.63	22.13	76.90	183.86
Speed Up (Ts/Tp)	1.32	1.49	1.50	1.78	1.81

The theoretical speed up is approximately 1.818.
To calculate the theoretical speedup when using 2 threads compared to the serial version of your matrix multiplication code, we can use Amdahl's Law. This law states that the speedup of a task using multiple processors is limited by the sequential portion of the task.
Amdahl's Law Formula:
$S = 1 / ((1 - P) + P / N)$
Assume that about 90% of the work can be parallelized, then P = 0.9.
$S= 1 / ((1 - 0.9) + 0.9 / 2) \approx 1.818$

   The comparison of actual versus theoretical speed up in matrix multiplication reveals that the actual speed-up achieved with parallel implementations using POSIX threads is close to the theoretical predictions derived from Amdahl's Law. For larger matrices, the actual speed up aligns more closely with theoretical expectations but does not follow for the smaller matrices due to reasons such as overhead from thread management and memory bandwidth limitations.

```
fit3143-student@fit3143:~/Desktop$ ./MatrixMul_1D_bin
Matrix Multiplication using 1-Dimension Arrays - Start

Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Matrix Multiplication - Start
Matrix Multiplication - Done
Write Resultant Matrix C to File - Start
Write Resultant Matrix C to File - Done
Overall time (Including read, multiplication and write)(s): 0.490057
Matrix Multiplication using 1-Dimension Arrays - Done
```

```
fit3143-student@fit3143:~/Desktop$ ./MatrixMul_1D_bin
Matrix Multiplication using 1-Dimension Arrays - Start

Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Matrix Multiplication - Start
Matrix Multiplication - Done
Write Resultant Matrix C to File - Start
Write Resultant Matrix C to File - Done
Overall time (Including read, multiplication and write)(s): 3.910191
Matrix Multiplication using 1-Dimension Arrays - Done
```

```
fit3143-student@fit3143:~/Desktop$ ./MatrixMul_1D_bin
Matrix Multiplication using 1-Dimension Arrays - Start

Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Matrix Multiplication - Start
Matrix Multiplication - Done
Write Resultant Matrix C to File - Start
Write Resultant Matrix C to File - Done
Overall time (Including read, multiplication and write)(s): 33.136195
Matrix Multiplication using 1-Dimension Arrays - Done
```

```
fit3143-student@fit3143:~/Desktop$ ./MatrixMul_1D_bin
Matrix Multiplication using 1-Dimension Arrays - Start

Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Matrix Multiplication - Start
Matrix Multiplication - Done
Write Resultant Matrix C to File - Start
Write Resultant Matrix C to File - Done
Overall time (Including read, multiplication and write)(s): 137.176132
Matrix Multiplication using 1-Dimension Arrays - Done
```

```
fit3143-student@fit3143:~/Desktop$ ./MatrixMul_1D_bin
Matrix Multiplication using 1-Dimension Arrays - Start

Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Matrix Multiplication - Start
Matrix Multiplication - Done
Write Resultant Matrix C to File - Start
Write Resultant Matrix C to File - Done
Overall time (Including read, multiplication and write)(s): 333.251255
Matrix Multiplication using 1-Dimension Arrays - Done
```

```
fit3143-student@fit3143:~/Desktop$ ./task1
Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Writing Resultant Matrix C to File - Start
Writing Resultant Matrix C to File - Done
Overall time (s): 0.370403
```

```
fit3143-student@fit3143:~/Desktop$ ./task1
Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Writing Resultant Matrix C to File - Start
Writing Resultant Matrix C to File - Done
Overall time (s): 2.630539
```

```
fit3143-student@fit3143:~/Desktop$ ./task1
Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Writing Resultant Matrix C to File - Start
Writing Resultant Matrix C to File - Done
Overall time (s): 22.131506
```

```
fit3143-student@fit3143:~/Desktop$ ./task1
Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Writing Resultant Matrix C to File - Start
Writing Resultant Matrix C to File - Done
Overall time (s): 76.902083
```

```
fit3143-student@fit3143:~/Desktop$ ./task1
Reading Matrix A - Start
Reading Matrix A - Done
Reading Matrix B - Start
Reading Matrix B - Done
Writing Resultant Matrix C to File - Start
Writing Resultant Matrix C to File - Done
Overall time (s): 183.858334
```