Operating System-2
Assignment 1

Parallel Matrix Multiplication using Multi Threading

Submission Date: 24th January 2021, 9:00 PM

Problem Statement : Given two matrices, A and B, where matrix A contains M rows and K columns and matrix B contains K rows and N columns, the matrix multiplication of A and B is matrix C, where C contains M rows and N columns. The entry in matrix C for row i, column j ($C_{i,j}$) is the sum of the products of the elements for row i in matrix A and column j in matrix B. You have to implement it using the following soutions:

Solution 1 : This will involve creating $M \times N$ worker threads and each thread will calculate $C_{i,j}$ in parallel. The main-or parent-thread will initialize the matrices A and B and allocate sufficient memory for matrix C, which will hold the product of matrices A and B.

Solution 2 : This will involve creating M worker threads and each thread will calculate one row of Matrix C in parallel. The main-or parent-thread will initialize the matrices A and B and allocate sufficient memory for matrix C, which will hold the product of matrices A and B.

Input: The input to the program will be a file (named inp.txt) where the first 3 digits will be the size of the matrix, i.e., M, K, and N. Next line must contain $M \times K$ elements for matrix A. Third line should have $K \times N$ elements for Matrix B.

Example: inp.txt

2 3 3 \\Size of the Matrix A,B i.e. M,K,N
1 2 3 4 1 2 \\Elements of Matrix A
3 2 4 1 2 3 1 3 4 \\Elements of Matrix B

Output: Once all worker threads have completed, the main thread will output the product contained in matrix C. Output should again be in the file named output.txt. All the inputs and outputs are in the row-major forms.

Example: output.txt

8 15 22 15 16 27 \\Elements of Matrix C

Report: As a part of this assignment, you have to prepare a report which will describe the low-level design of your program and give an analysis of its output. As a part of the report, you have to measure the performance of the algorithms by following the mentioned steps. Calculate the time taken by the solution 1 and 2. Don't include the timing of reading and writing to file in this. Create a graph showing the time taken by these solutions for different values of the number of threads. The x-axis should be the size of Matrix C i.e. 2×4, 4×4, 6×4, 8×4, 10×4, 12×4. The y-axis will include time taken by the program to terminate (in micro/milliseconds). Report should include the detailed analysis of the graph.

Deliverables:

1. Report describing the low-level design of your program and analysis of output and graph. This file should be named as Asgn1_ <Roll No.> Report.pdf
2. Prepare a README file that contains the instructions on how to execute your submitted file. The file should be named as README.txt
3. Name the source code file in the following format: Asgn1_sol1_ <Roll No.>.c and Asgn1_sol2_ <Roll No.>.c
4. Upload the source code, report and README as a zip archive file and name it as Asgn1_ <Roll No.>.zip

Please see the instructions given above before uploading your file. Your assignment will NOT be evaluated if there is any deviation from the instructions posted there.

The policy for grading this assignment will be -

- Design as described in report and analysis of the obtained results: 50%
- Execution: 40%
- Code documentation and indentation: 10%.

As mentioned before, all assignments for this course has the late submission policy of a penalty of 10% each day after the deadline.

Kindly remember that all submissions are subjected to plagiarism checks.