CSCI 251: Concepts of Parallel and Distributed Systems

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Project 1

This project involved the implementation of the Gauss-Jordan elimination algorithm to reduce an augmented matrix to reduced row echelon form. This implementation was done in C serially, and the parallelized using POSIX threads. The serial implementation of the algorithm involved iterating through each row of the matrix and reducing all the columns in the other rows to zero via the elementary row operations. To parallelize this operation, the rows were simply distributed among the threads for computation.

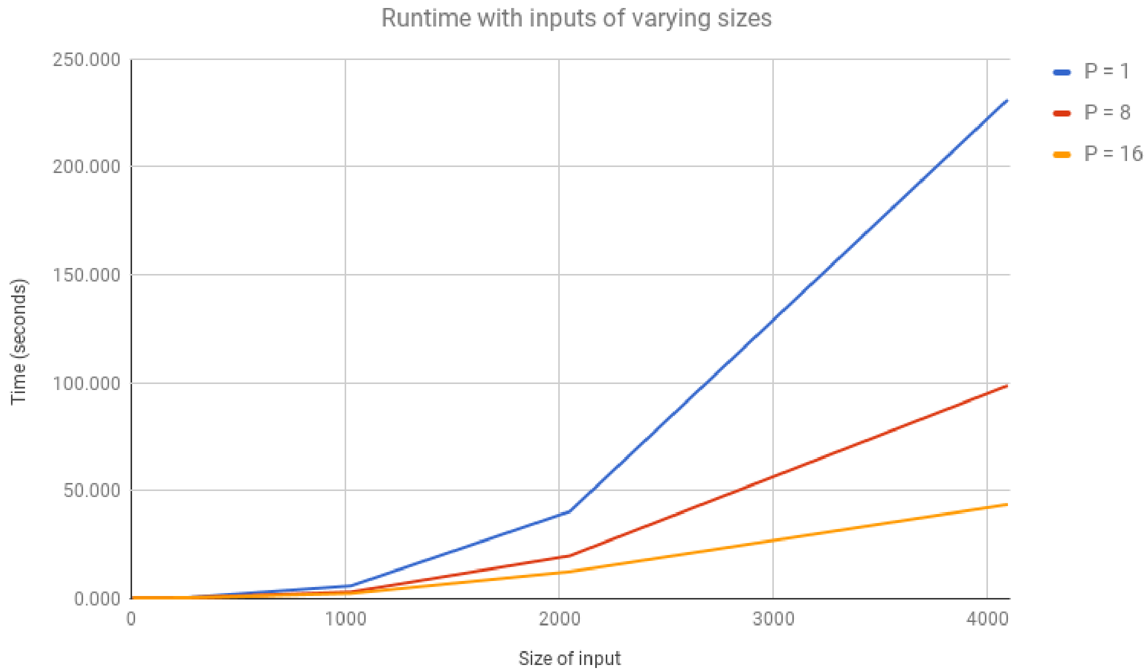
Serial Psuedocode

This implementation assumed that the given augmented matrix was consistent and that the coefficient matrix was $n \times n$. Thus the augmented matrix is of dimension $n \times (n + 1)$.

```
def solve(matrix):
    let n = rows of matrix
    for i = 0 to n:
        for j = 0 to n:
            if i != j:
                let c = matrix[j][i] / matrix[i][i] # scaling factor
                for k = 0 to n + 1:
                    matrix[j][k] -= c * matrix[i][k]
    for i = 0 to n:
        matrix[i][n] /= matrix[i][i]
        matrix[i][i] = 1
    return matrix
```

Analysis

The full data sheet of the runtimes is in the included data.pdf file. In terms of the runtimes, as data size increased, runtimes improved the more threads we used.



At low data sizes though, the extra threads caused overhead and led to a decrease in speedup. In general however, more threads allowed for better performance at high input sizes.