Final Project
INF236: Parallel Programming
Parallel Matrix Multiplication

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1 Introduction

2 Algorithms

In this section all the implemented algorithms are explained in further detail.

2.1 Matrix Multiplication

Algorithm 1 Matrix Multiplication

Input: $\mathbf{A}, \mathbf{B}$
Output: $\mathbf{C}$ (the resulting matrix)

```
1: function MATMUL(A, B)
2:     for i = 0, ..., n − 1 do
3:         for j = 0, ..., n − 1 do
4:             c[i][j] = 0
5:         for k = 0, ..., n − 1 do
6:             for j = 0, ..., n − 1 do
7:                 c[i][j] += a[i][k] * b[k][j]
8:     return C
```

2.2 Strassen Algorithm

Algorithm 2 Strassen Matrix Multiplication

Input: $\mathbf{A}, \mathbf{B}$
Output: $\mathbf{C}$ (the resulting matrix)

function STRASSEN($\mathbf{A}, \mathbf{B}, n$)
  if n == cutoff **then**
    return $\mathbf{A} * \mathbf{B}$
  $\mathbf{P}_1 = strassen(\mathbf{A}_{00} + \mathbf{A}_{11}, \mathbf{B}_{00} + \mathbf{B}_{11}, \frac{n}{2})$
  $\mathbf{P}_2 = strassen(\mathbf{A}_{10} + \mathbf{A}_{11}, \mathbf{B}_{00}, \frac{n}{2})$
  $\mathbf{P}_3 = strassen(\mathbf{A}_{00}, \mathbf{B}_{01} - \mathbf{B}_{11}, \frac{n}{2})$
  $\mathbf{P}_4 = strassen(\mathbf{A}_{11}, \mathbf{B}_{10} - \mathbf{B}_{00}, \frac{n}{2})$
  $\mathbf{P}_5 = strassen(\mathbf{A}_{00} + \mathbf{A}_{01}, \mathbf{B}_{11}, \frac{n}{2})$
  $\mathbf{P}_6 = strassen(\mathbf{A}_{10} - \mathbf{A}_{00}, \mathbf{B}_{00} + \mathbf{B}_{01}, \frac{n}{2})$
  $\mathbf{P}_7 = strassen(\mathbf{A}_{01} - \mathbf{A}_{11}, \mathbf{B}_{10} + \mathbf{B}_{11}, \frac{n}{2})$
  $\mathbf{C}_{00} = \mathbf{P}_1 + \mathbf{P}_4 - \mathbf{P}_5 + \mathbf{P}_7$
  $\mathbf{C}_{01} = \mathbf{P}_3 + \mathbf{P}_5$
  $\mathbf{C}_{10} = \mathbf{P}_2 + \mathbf{P}_4$
  $\mathbf{C}_{11} = \mathbf{P}_1 - \mathbf{P}_2 + \mathbf{P}_3 + \mathbf{P}_6$
  return $\mathbf{C}$

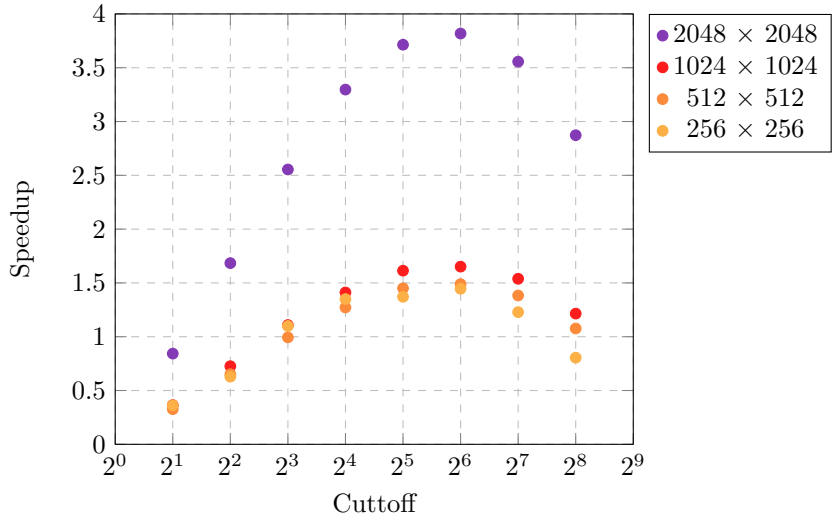
Winograd algorithm [**boyer2009memory**]

2.3 Parallel Matrix Multiplication

2.4 Parallel Strassen Algorithm

3 Experiments

Sequential Strassen Algorithm with different values for the cutoff level



4 Conclusion