AMS326HW2REPORT

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1 Problem Description

The following section is about implementing Strassen algorithm on multiply 2 matrices. We also implemented via the brute force method as well. I was also tasked to create a matrix where each element is a integer that is random distributed from $[-2, 2]$

2 Algorithm/PsuedoCode

The following codes are implemented in matlab. The first code is the code is the naive matrix multiplication. Here is the code for the naive matrix multiply

Algorithm 1: NaiveMatrixMultiplication

```
matrixa = -2 + (2+2)*rand(1024); 2DMatrix of floating points x ϵ[−2, 2]
matrixb = -2 +(2+2) * rand(1024)
matrixc = zeros(1024,1024) The output matrix
N = 1024 size of the matrix
for i = 1 toN do
    for j = 1 toN do
        for k = 1 toN do
            matrixc(i,j) = matrixc(i,j) + matrixa(i,k) * matrixb(k,j);
```

The second code is the code for the strassen mutiplication

Algorithm 2: StraseenMultiplication

```
1  n = length(MatrixA) The row length of the matrix
2  if n ≤ minimum then
3      C = MatrixA *MatrixB
6   M is variable which divides the matrix posistion by in half
7   N is a variable to to traverse rows
8  J is a variable to get the next ement in the row
9
10 m = n/2; h= 1:m; j = m+1:n ;
11
12 Compute individual parts according the strassen diagram recursively
13 P1 = strassenMulti( MatrixA(h,h)+MatrixA(j,j),
     MatrixB(h,h)+MatrixB(j,j), minimum)
14 P2 = strassenMulti( MatrixA(j,h)+MatrixA(j,j), MatrixB(h,h),
     minimum)
15 P3 = strassenMulti( MatrixA(h,h), MatrixB(h,j)-MatrixB(j,j),
     minimum);
16 P4 = strassenMulti( MatrixA(j,j), MatrixB(j,h)-MatrixB(h,h),
     minimum);
17 P5 = strassenMulti( MatrixA(h,h)+MatrixA(h,j), MatrixB(j,j),
     minimum);
18 P6 = strassenMulti( MatrixA(j,h)-MatrixA(h,h),
     MatrixB(h,h)+MatrixB(h,j), minimum)
19 P7 = strassenMulti( MatrixA(h,j)-MatrixA(j,j),
     MatrixB(j,h)+MatrixB(j,j), minimum)
20 The upper right and bottom left is is P3 +P5, P2+P4 respectively
21 The bottom right is( P1 + P3 ) - (P2 + P6)
22 return C = [ P1+P4-P5+P7 P3+P5; P2+P4 P1+P3-P2+P6 ]
23
```

The resultant matrix is given in the matlab code

3 OutPut/Resultant

The matrix is of size 1024 x 1024. There is no way for me to put it on this report. However, The reader of this document should run the matlab code and click on the necessary variables in the work-space pane inside the matlab. The strassen Matrix variable is the matrix where we perform the matrix with the straseen method. I have a matrixC variable that is performed via the brute force multiplication. I also have a test matrix variable to test if its actually the correct result. Warning it will take 30 seconds to 1 minute.

4 Analysis/Questions

The brute force matrix multiplication will do 1024^3 operations or 1073741824 operations . The straseen method will do about $1024^{2.807}$ or 281781176 operations. Despite only be 0.293 exponent faster.It is about 4 times faster than the naive method. Making significant runtime changes.