AA Assignment 1

Riekert Holder 2517888

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1 Psuedo code for STRASSENS-METHOD

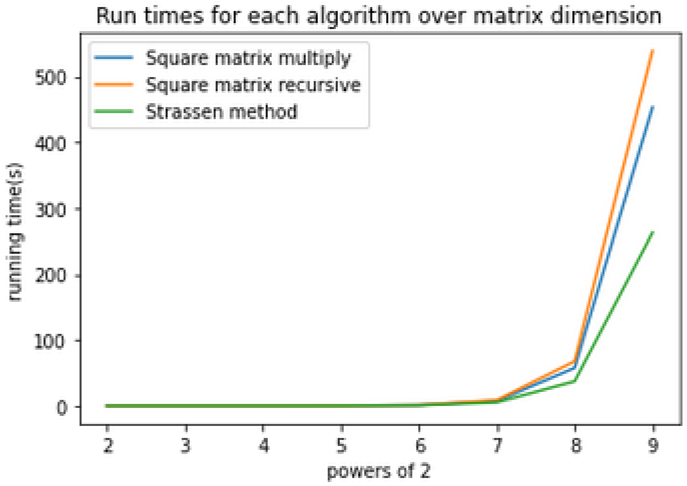
```
STRASSEN(A, B)
    n = A.rows
    if n == 1
        return a[1, 1] * b[1, 1]
    make a n × n matrix C
    A[1, 1] = A[1..n / 2][1..n / 2]
    A[1, 2] = A[1..n / 2][n / 2 + 1..n]
    A[2, 1] = A[n / 2 + 1..n][1..n / 2]
    A[2, 2] = A[n / 2 + 1..n][n / 2 + 1..n]
    B[1, 1] = B[1..n / 2][1..n / 2]
    B[1, 2] = B[1..n / 2][n / 2 + 1..n]
    B[2, 1] = B[n / 2 + 1..n][1..n / 2]
    B[2, 2] = B[n / 2 + 1..n][n / 2 + 1..n]
    S[1] = B[1, 2] - B[2, 2]
    S[2] = A[1, 1] + A[1, 2]
    S[3] = A[2, 1] + A[2, 2]
    S[4] = B[2, 1] - B[1, 1]
    S[5] = A[1, 1] + A[2, 2]
    S[6] = B[1, 1] + B[2, 2]
    S[7] = A[1, 2] - A[2, 2]
    S[8] = B[2, 1] + B[2, 2]
    S[9] = A[1, 1] - A[2, 1]
    S[10] = B[1, 1] + B[1, 2]
    P[1] = STRASSEN(A[1, 1], S[1])
    P[2] = STRASSEN(S[2], B[2, 2])
    P[3] = STRASSEN(S[3], B[1, 1])
    P[4] = STRASSEN(A[2, 2], S[4])
    P[5] = STRASSEN(S[5], S[6])
    P[6] = STRASSEN(S[7], S[8])
    P[7] = STRASSEN(S[9], S[10])
    C[1..n / 2][1..n / 2] = P[5] + P[4] - P[2] + P[6]
```

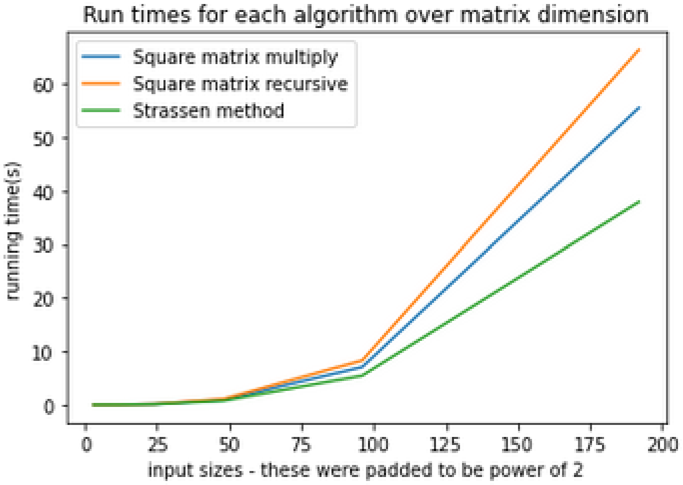
```
C[1..n / 2][n / 2 + 1..n] = P[1] + P[2]
C[n / 2 + 1..n][1..n / 2] = P[3] + P[4]
C[n / 2 + 1..n][n / 2 + 1..n] = P[5] + P[1] - P[3] - P[7]
return C
```

1.1 Solution to 4.2.3

If n isn't a power of 2 we can round n to the next power of 2 and pad it with 0's so that our matrix is a square whose width and length is a power of 2.

1.2 Graphs of running times





1.3 Graphs Description on how it was Obtained

Range of dimensions: The power of 2 graph's x-axis was obtained by taking the first 9 power of two's,this is the range

$$2^2 - 2^9$$

, these values were stored in a list for plotting.They y-axis contains the running times of the matrices with a size of

$$2^2 - 2^9$$

respectively.For graph 2 the input sizes of the different matrices are stored in list and used for the x-axis, the y-axis is the result list containing the run times for all those matrices sizes.
Num of generated matrices:The matrices were generated randomly and can be adjusted by changing the variables for more variety.They can be square matrices of any size you want to test.The program ensures its a square matrix that is a power of 2 by padding matrices that arent powers of 2 with 0's.
Types of matrices: They can matrices containing ints or float values.