1. Analytically determine the value of n0 that optimizes the running time of this algorithm in this model.

n: input matrix size

- standard matrix multiplication complexity

In order to speed up the multiplication operation, make matrix memory to be flatten in 1d array

And when iterate the row of A, col of B, use pointer operation aa, bb

As a result, operation is decreased from 7 \* n ^ 3 to 5 \* n \* 3

n : a \* b – multiply n times

n : sum += addition n times

index operation: 3 \* n (k++, aa++, bb += m)

S(n) = n \* n \* (5 \* n ) = 5 \* n ^ 3

- Strassen matrix multiplication complexity

Split Matrix to sub matrix –2 \* n^2

Generate s0 ~ s10: 10 \* 5 \* n^2 / 4

Generate p1 ~ p7: 7 \* T(n/2)

Reconstruct matrix: 15 \* n ^ 2 / 4

In order to upgrade speed, following optimization is implemented

In split matrix stage, memory copy operation is involved.

In submatrix calculate stage, avoid the index addition operation to use pointer

In reconstruction stage, avoid the index addition operation to use pointer.

- Caluculating the cross-point

Let’s assume that standard matrix multiplication complexity S(n) = p \* n ^ 3

Strassen matrix multiplication complexity T(n) = 7 \* T(n/2) + q \* n^2

In our algorithm, p = 5, q = 20,

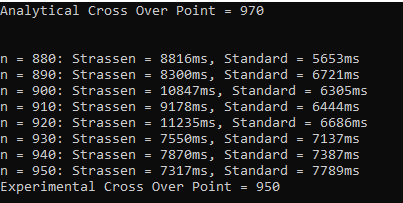
Generally p < q, because Strassen algorithm requires additional operation for recuristion(split, submatrix, reconstruction)

So for small n, S(n) < T(n), but while n is increased, S(n) > T(n)

We can identity this change point (cross point) using numerical anaylsis.

Analytically Cross Over Point 970

2. Implement your variant of Strassen’s algorithm and the standard matrix multiplication algorithm to  
find the cross-over point experimentally.



Experimental Cross Over Point 950

When changed the base cross point, Strassen’s algorithm’s performance was changed, if base n0 is small, this algorithm is slow, but when increase this value to 500, algorithm speed will be faster.

According to experiment that, cross point seems to be 1024.

And Strassen’s algorithm involves the recursive calls and additional operation such as splitting, sub matrix calculation, reconstruction, it is not easy to track the cross point correctly.

When multiply matrix, I used 0, 1 matrix based on random

When change the rule of entry, cross point is changed slighty, but not so much.

3. Triangle in random graphs

When calculate the count of triangle based on analytically and experimentally, real count is always greater than expected count.

Expected count is the mean of triangle count, and there will be deviation.