

Matrices provide a convenient mechanism to manage large amounts of data. Bioinformatics is a field with very large data sets and there are many applications with utilize matrices. Ordinary matrix multiplication is $O(n^3)$. With very large matrices, even shaving a small amount off the cost can still give you a worthwhile cost savings. The following reference is an example of using matrix multiplication.

Akutsu, T. S. Miyano, & S. Kuhara. 2000. **Algorithms for identifying boolean networks and related biological networks based on matrix multiplication and fingerprint**

Implement Strassen's Algorithms in CLRS Chapter 4.2. Be sure to read the entire section and the chapter notes. Check out Appendix D in CLRS for background information on Matrices, if you need it. For the purposes of this assignment, it is only necessary to handle matrices where the size is a power of two. **Implement ordinary multiplication and compare your results.** Count individual multiplications to use as a basis for comparison. If you want to try timing, please do it in addition to, not instead of counting comparisons.

Required Input

```
2 1 6 7
1 5 4 3
```

```
3 2 1 4 -1 2 -1 0
-1 2 0 1 3 -1 0 2
2 3 -1 -2 -4 0 -3 1
5 1 1 0 0 -2 1 2
```

```
1 0 1 2 0 -1 -1 -1 Calculate the square of this one.
-1 1 -1 1 2 0 0 3
1 -1 2 -3 -1 1 1 0
0 2 3 2 1 0 -1 -2
2 3 -1 0 -1 0 -1 0
1 2 2 1 0 1 1 2
3 -1 0 2 2 2 2 1
2 -2 1 -3 3 0 1 2
```

A file with required input is provided. All input you create should be formatted the same: the first line should contain the order of the matrix, then the first matrix, in row major order, then the second matrix. This is followed by a blank line, then the order of the next matrix pair and so on. You need to collect enough data to have a meaningful comparison of the theoretical efficiency to the observed efficiency.

The analysis should include comments about what you learned, what you might do differently next time, justification of your design decision, and issues of efficiency with respect to time and space. It must include a table and a graph, as per the guidelines. Be sure to consider your experiences with the problem and particularly consider the efficiency. Why is it useful and relevant to Bioinformatics? You can expect to discuss these items on the analysis for all the projects. **Before you hand this in, be sure to reread the Programming assignments guidelines.**