Assignment - 8

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Code:

```cpp
#include<iostream>
#include<vector>

using namespace std;

vector<vector<int>> add(vector<vector<int>> a, vector<vector<int>> b) {
    int n = a.size();
    vector<vector<int>> res(n, vector<int>(n));
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            res[i][j] = a[i][j] + b[i][j];
        }
    }
    return res;
}

vector<vector<int>> subtract(vector<vector<int>> a, vector<vector<int>> b) {
    int n = a.size();
    vector<vector<int>> res(n, vector<int>(n));
    for (int i = 0; i < n; i++) {
```

```cpp
        for (int j = 0; j < n; j++) {

            res[i][j] = a[i][j] - b[i][j];

        }

    }

    return res;

}


vector<vector<int>> strassen(vector<vector<int>> a, vector<vector<int>> b) {

    int n = a.size();

    if (n == 1) {

        return {{a[0][0] * b[0][0]}};

    }

    int k = n / 2;

    vector<vector<int>> a11(k, vector<int>(k)), a12(k, vector<int>(k)), a21(k, vector<int>(k)),
a22(k, vector<int>(k));

    vector<vector<int>> b11(k, vector<int>(k)), b12(k, vector<int>(k)), b21(k, vector<int>(k)),
b22(k, vector<int>(k));

    for (int i = 0; i < k; i++) {

        for (int j = 0; j < k; j++) {

            a11[i][j] = a[i][j];

            a12[i][j] = a[i][j + k];

            a21[i][j] = a[i + k][j];

            a22[i][j] = a[i + k][j + k];

            b11[i][j] = b[i][j];

            b12[i][j] = b[i][j + k];

            b21[i][j] = b[i + k][j];

            b22[i][j] = b[i + k][j + k];

        }

    }

    auto p1 = strassen(a11, subtract(b12, b22));
```

```cpp
        auto p2 = strassen(add(a11, a12), b22);

        auto p3 = strassen(add(a21, a22), b11);

        auto p4 = strassen(a22, subtract(b21, b11));

        auto p5 = strassen(add(a11, a22), add(b11, b22));

        auto p6 = strassen(subtract(a12, a22), add(b21, b22));

        auto p7 = strassen(subtract(a11, a21), add(b11, b12));

        auto c11 = add(subtract(add(p5, p4), p2), p6);

        auto c12 = add(p1, p2);

        auto c21 = add(p3, p4);

        auto c22 = subtract(subtract(add(p5, p1), p3), p7);

        vector<vector<int>> c(n, vector<int>(n));

        for (int i = 0; i < k; i++) {

            for (int j = 0; j < k; j++) {

                c[i][j] = c11[i][j];

                c[i][j + k] = c12[i][j];

                c[i + k][j] = c21[i][j];

                c[i + k][j + k] = c22[i][j];

            }

        }

        return c;

}


int main() {

    vector<vector<int>> a = {{1, 2}, {3, 4}};

    vector<vector<int>> b = {{5, 6}, {7, 8}};

    auto c = strassen(a, b);

    for (auto &i : c) {

        for (int j : i) {

            cout << j << ' ';
```

```
        }

        cout << '\n';

    }

    return 0;

}
```

Output:

```
PS C:\Users\Dhairya Arora\OneDrive\Desktop\C++> cd "c:\Users\Dhairya Arora\OneDrive\Desktop\C++\" ; if ($?) { g++ DAAassignment-1.cpp -o DAAassignment-1 } ;
if ($?) { .\DAAassignment-1 }
19 22
43 50
PS C:\Users\Dhairya Arora\OneDrive\Desktop\C++>
```