Week 5 Assignment

Name – Sumit Phalke

Class – TY CSE

PRN – 23510023

Q1) Naive Matrix Multiplication

Question:
Implement the **naive method** to multiply two matrices and justify that its complexity is **$O(n^3)$**.

Algorithm:

1. Let matrix A be of size `n × n` and matrix B be of size `n × n`.
2. Create an output matrix C of size `n × n` initialized with zeros.
3. For each element `C[i][j]`:
    - Loop through `k = 0 to n-1`.
    - Multiply `A[i][k] * B[k][j]` and add to `C[i][j]`.
4. Continue until all rows and columns are processed.
5. The resulting matrix C is the product of A and B.

Time Complexity Justification:

- For each element `C[i][j]`, we perform `n` multiplications and additions.
- There are `n × n` elements in C.
- Total operations = `n × n × n = O(n³)`.

Input Screenshot:

```
void question1() {

    int A[3][3] = {
        {1, 2, 3},
        {4, 5, 6},
        {7, 8, 9}
    };

    int B[3][3] = {
```

```
        {9, 8, 7},
        {6, 5, 4},
        {3, 2, 1}
    };

    int C[3][3] = {0};


    for(int i = 0; i < 3; i++) {
        for(int j = 0; j < 3; j++) {
            for(int k = 0; k < 3; k++) {
                C[i][j] += A[i][k] * B[k][j];
            }
        }
    }


    cout << "Result of 3x3 Matrix Multiplication:" << endl;
    for(int i = 0; i < 3; i++) {
        for(int j = 0; j < 3; j++) {
            cout << C[i][j] << " ";
        }
        cout << endl;
    }
}
```

```
MATRIX A :
1 2 3
4 5 6
7 8 9

MATRIX B :
9 8 7
6 5 4
3 2 1

Result of 3x3 Matrix Multiplication:
30 24 18
84 69 54
138 114 90
```