82. Strassens matrix multiplication

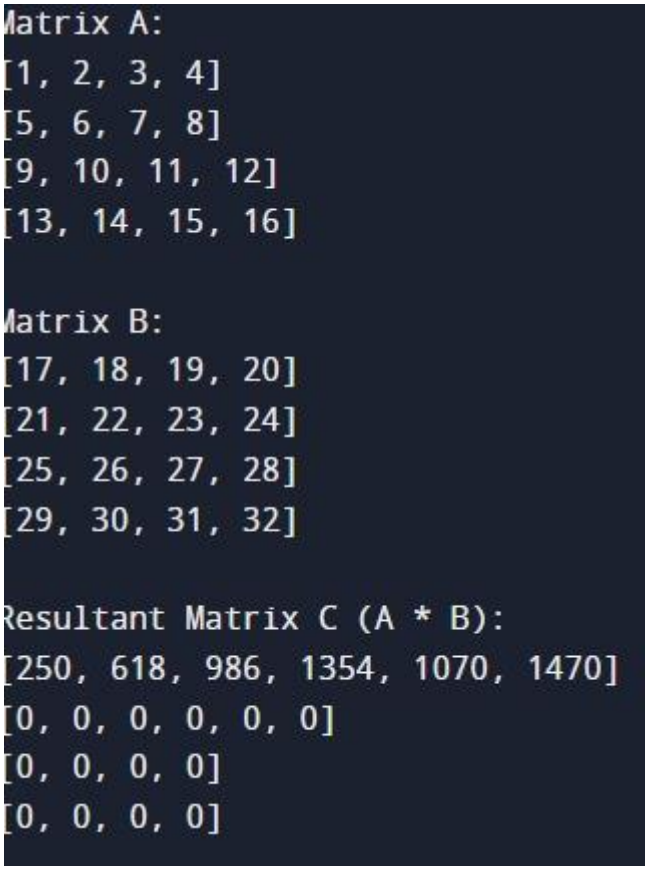
AIM : To find the Strassens matrix multiplication

PROGRAM:

```
def strassen_matrix_mult(A, B):
    n = len(A)
    if n == 1:
        return [[A[0][0] * B[0][0]]]
    C = [[0 for _ in range(n)] for _ in range(n)]
    mid = n // 2
    A11 = [row[:mid] for row in A[:mid]]
    A12 = [row[mid:] for row in A[:mid]]
    A21 = [row[:mid] for row in A[mid:]]
    A22 = [row[mid:] for row in A[mid:]]
    B11 = [row[:mid] for row in B[:mid]]
    B12 = [row[mid:] for row in B[:mid]]
    B21 = [row[:mid] for row in B[mid:]]
    B22 = [row[mid:] for row in B[mid:]]
    M1 = strassen_matrix_mult(add_matrices(A11, A22), add_matrices(B11, B22))
    M2 = strassen_matrix_mult(add_matrices(A21, A22), B11)
    M3 = strassen_matrix_mult(A11, subtract_matrices(B12, B22))
    M4 = strassen_matrix_mult(A22, subtract_matrices(B21, B11))
    M5 = strassen_matrix_mult(add_matrices(A11, A12), B22)
    M6 = strassen_matrix_mult(subtract_matrices(A21, A11), add_matrices(B11, B12))
    M7 = strassen_matrix_mult(subtract_matrices(A12, A22), add_matrices(B21, B22))
    C11 = add_matrices(subtract_matrices(add_matrices(M1, M4), M5), M7)
    C12 = add_matrices(M3, M5)
    C21 = add_matrices(M2, M4)
    C22 = add_matrices(subtract_matrices(add_matrices(M1, M3), M2), M6)
    for i in range(mid):
        C[i][:mid] = C11[i] + C12[i]
        C[i][mid:] = C21[i] + C22[i]
```

```
    return C
def add_matrices(A, B):
    n = len(A)
    return [[A[i][j] + B[i][j] for j in range(n)] for i in range(n)]
def subtract_matrices(A, B):
    n = len(A)
    return [[A[i][j] - B[i][j] for j in range(n)] for i in range(n)]
A = [[1, 2, 3, 4],
     [5, 6, 7, 8],
     [9, 10, 11, 12],
     [13, 14, 15, 16]]
B = [[17, 18, 19, 20],
     [21, 22, 23, 24],
     [25, 26, 27, 28],
     [29, 30, 31, 32]]
C = strassen_matrix_mult(A, B)
print("Matrix A:")
for row in A:
    print(row)
print("\nMatrix B:")
for row in B:
    print(row)
print("\nResultant Matrix C (A * B):")
for row in C:
    print(row)
```

OUTPUT:



TIME COMPLEXITY: O (n ^ $\log_2 7$)