



**Marwari University**  
**Faculty of Technology**  
**Department of Information and Communication Technology**

**Subject: Design and Analysis of Algorithms (01CT0512)**

**Aim:** Implementing Application-based Algorithm using D&C Approach

**Experiment No: 05**

**Date: 13\09\2025**

**Enrollment No: 92301733054**

**Karatsuba Algorithm**

Code :-

```
#include <bits/stdc++.h>
using namespace std;

int Get_Size(long long num) {
    return num == 0 ? 1 : static_cast<int>(log10(num)) + 1;
}

long long int Karatsuba(long long num1, long long num2) {

    if (num1 < 10 || num2 < 10) {
        return num1 * num2;
    }

    int length = max(Get_Size(num1), Get_Size(num2));
    int half = length / 2 + length % 2;
    long long powerOf10 = static_cast<long long>(pow(10, half));
    long long powerOf102x = powerOf10 * powerOf10;
    long long a = num1 / powerOf10;
    long long b = num1 % powerOf10;
    long long c = num2 / powerOf10;
    long long d = num2 % powerOf10;
    long long ac = Karatsuba(a, c);
    long long bd = Karatsuba(b, d);
    long long ab_cd = Karatsuba(a + b, c + d);
    long long int ans = ac * powerOf102x + (ab_cd - ac - bd) * powerOf10 + bd;

    return ans;
}

int main() {

    long long x;
    cout << "Enter the First Number :- ";
    cin >> x;

    long long y;
    cout << "Enter the Second Number :- ";
    cin >> y;

    long long int ans = Karatsuba(x, y);
    cout << "The Product of " << x << " and " << y << " is: " << ans;
```



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```
return 0;
```

```
}
```

**Output :-**

```
Enter the First Number :- 4
```

```
Enter the Second Number :- 5
```

```
The Product of 4 and 5 is: 20
```

**Conclusion:** We learnt in this experiment that the Karatsuba Algorithm is an efficient multiplication method that reduces the complexity from  $O(n^2)$  in normal multiplication to about using the Divide and Conquer approach. It splits large numbers into parts and combines the results, making multiplication faster for very large inputs.