

170. Given two integers  $X=1234$  and  $Y=5678$ : Use the Karatsuba algorithm to compute the product  $Z=X \times Y$

**Test Case 1:**

Input:  $x=1234, y=5678$

Expected Output:  $z=1234 \times 5678=7016652$

Code:

```
def karatsuba_multiply(x, y):
    if x < 10 or y < 10:
        return x * y

    num_digits = max(len(str(x)), len(str(y)))
    m = num_digits // 2

    high1 = x // (10 ** m)
    low1 = x % (10 ** m)
    high2 = y // (10 ** m)
    low2 = y % (10 ** m)

    z0 = karatsuba_multiply(low1, low2)
    z1 = karatsuba_multiply((low1 + high1), (low2 + high2))
    z2 = karatsuba_multiply(high1, high2)

    result = z2 * (10 ** (2 * m)) + (z1 - z2 - z0) * (10 ** m) + z0

    return result

x = 1234
y = 5678
z = karatsuba_multiply(x, y)

print(f"Result of {x} × {y} = {z}")

output:
```

```
PS C:\Users\karth>
PS C:\Users\karth> & c:/Users/karth/AppData/Local/Programs/Python/Python312/python.exe c:/Users/karth/OneDrive/Desktop/csa0863_karthik/PROBLEM.py
Result of 1234 x 5678 = 7006652
PS C:\Users\karth> █
```

Time complexity: $f(n)=o(n\log n)$