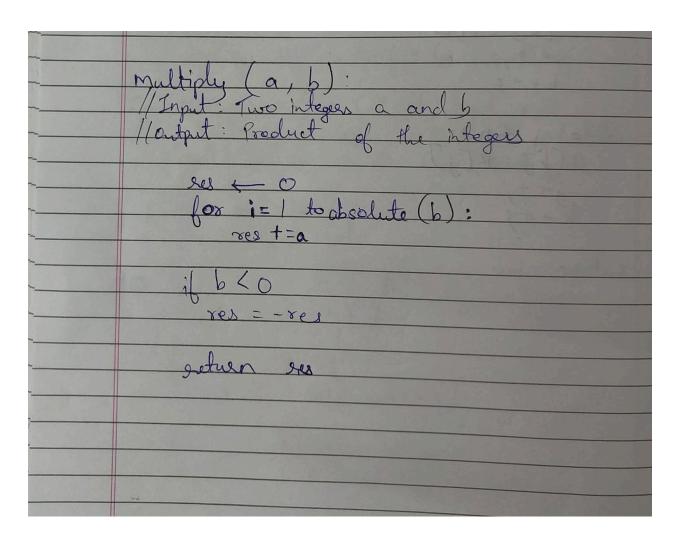
DAA Assignment 4

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Q. Write integer multiplication program.

Write integer multiplication program using divide and conquer technique.

Algorithm:



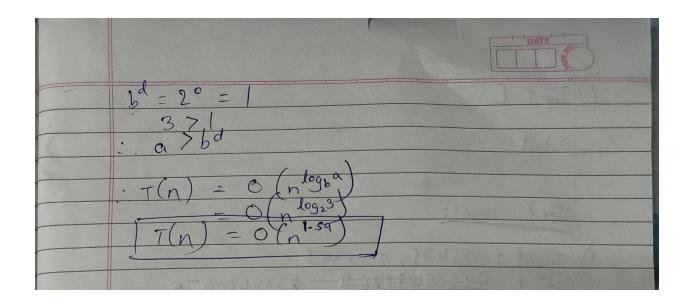
kasatsuba (a,b): HInput: Two ex integers a and Montput: Product of the integers

Test cases:

Input: 756393234,29828759 Output: 22562271486216606

Time Complexity:

Linear multiplication: Typut: Two integers a and b Basic operation: add a to result iteratively n) almose the time complexity the algorithm be generalised as O Karatsuba: Input: Two integers x and y of length Basic operation: compute multiplication of) he the time complexity 31/ 0(1 Comparing a= 3, b=2,



Program: PEP 08 Coding style for python is used

```
def multiply(a, b):
    """Multiply two integers using a for loop."""
    result = 0
    for _ in range(abs(b)):  # Repeat for the absolute value of b
        result += a  # Add a to the result for each iteration

# If b is negative, negate the result
    if b < 0:
        result = -result

def main():
    """Main function to execute the multiplication."""
    try:
        # Input: Get two integers from the user
        num1 = int(input("Enter the first integer: "))
        num2 = int(input("Enter the second integer: "))

# Process: Multiply the two integers
    result = multiply(num1, num2)</pre>
```

```
# Output: Display the result
    print(f"The result of {num1} * {num2} is: {result}")

except ValueError:
    print("Please enter valid integers.")

if __name__ == "__main__":
    main()
```

```
def karatsuba(x, y):
   \max len = \max(len(str(x)), len(str(y)))
   x high = x // (10 ** half len)
   y high = y // (10 ** half len)
   z1 = karatsuba(x_low + x_high, y_low + y_high) # Cross parts
   z2 = karatsuba(x high, y high) # High parts
if name == " main ":
           num1 = input("Enter the first integer: ")
```

```
num2 = input("Enter the second integer: ")

# Convert inputs to integers
num1 = int(num1)
num2 = int(num2)

result = karatsuba(num1, num2)
print(result)
break # Exit loop after successful calculation

except ValueError as ve:
    print("Please enter valid integers")
except Exception as e:
    print(f"An error occurred: {e}. Please try again.")
```

Output:

Enter the first integer: 35435 Enter the second integer: 235345 8339450075

Enter the first integer: a Enter the second integer: b Please enter valid integers

Enter the first integer: Enter the second integer: Please enter valid integers

Enter the first integer: 233567 Enter the second integer: 865432

202136355944

PS <u>C:\Users\Ishaan\Desktop\ok</u>> & C:, Enter the first integer: 756393234 Enter the second integer: 29828759 22562271486216606

Enter the first integer: 1543378
Enter the second integer: a
Please enter valid integers

Conclusion: Hence, we have studied the program to multiply two integers by linear and divide and conquer algorithm. Karatsuba's algorithm for multiplication was used in divide and conquer as it reduces the time complexity of the multiplication algorithm to a certain extent.