

Name: **SOLUTION**

[10p] The time complexity of the usual multiplication of two  $n$ -digit numbers is  $O(n^2)$ . However, using Karatsuba method, which is a **Divide and Conquer** algorithm, this can be reduced to  $O(n^{\log_2 3})$ , i.e. the product of two 4-digit numbers can be calculated with  $4^{\log_2 3} = 3^{\log_2 4} = 3^2 = 9$  multiplications of digits.

Calculate  $1230 \cdot 4021$  using this algorithm. Show your work. (Note that you are only allowed to multiply digits.)

1230 · 4021								
12 · 40			42 · 61			30 · 21		
1 · 4	3 · 4	2 · 0	4 · 6	6 · 7	2 · 1	3 · 2	3 · 3	0 · 1
4	12	0	24	42	2	6	9	0
	8			16			3	
400	80	0	2400	160	2	600	30	0
	480			2562			630	
				1452				
		4800000		145200		630		
				<b>4945830</b>				