

CS 410/586: Quiz 7, 18 May 2009Name: _____ **KEY** _____**No books or notes. Work individually.**

The product of two complex numbers

$$(a + bi) \cdot (c + di)$$

is

$$(ac - bd) + (ad + bc)i$$

where a, b, c and d are real numbers.Question 6A (2 points): Compute $(6 + 2i) \cdot (1.5 + 3.5i)$.

$$(6 \cdot 1.5 - 2 \cdot 3.5) + (6 \cdot 3.5 + 2 \cdot 1.5)i = (9 - 7) + (21 + 3)i = 2 + 24i$$

Question 6B (8 points) The obvious way of computing a complex product takes 4 multiplications of real numbers. Show how to compute any complex product with just 3 multiplications of real numbers (and any number of additions and subtractions).

Hint: Consider the two quantities

$$P = (a + b)c$$

and

$$Q = -b(c + d)$$

Note that $P + Q = (a + b)c - b(c + d) = ac + bc - bc - bd = ac - bd$, which is the real term.

Looking at P again, we have the bc term we need for the imaginary part. However, we need to get rid of the ac part, while producing the ad part. So we need $ad - ac$.

Thus, let $R = a(d - c)$.

Then $P + R = (a + b)c + a(d - c) = ac + bc + ad - ac = ad + bc$, which is the imaginary term.

Each of P, Q and R can be computed with one multiplication, so we have computed both parts using 3 multiplications and 6 addition/subtractions.