22**C** : 031 **Algorithms**
Homework 2
Due Tuesday, October 2

You are expected to do the homework assignments on your own without consulting human and non-human sources (like web pages or books) for the solutions.

1. In class, we discussed an $O(n^{\log_2 3})$ algorithm for multiplying two n-polynomials. We assumed that n was an integer power of 2 for convenience. Now suppose that $m < n < 2m$ where m and $2m$ are integer powers of 2. One way of dealing with such an input is to convert each of the two n-polynomials into $2m$-polynomials by adding coefficients that are 0. We can then use the algorithm in class for multiplying the two $2m$-polynomials.

   Supply the details of this scheme – in particular, how do we obtain the desired output from the output of the algorithm in class ? Is the running time of the new algorithm also $O(n^{\log_2 3})$? Justify. (15 points)

2. Let P be a set of $n \geq 4$ points in $\Re^3$ (three dimensions). Suppose we partition P into two sets P_1 and P_2 both of size at least 2, and compute the closest pair among points in P_1 and the closest pair among points in P_2. Let δ denote the distance between the closer of the two pairs. Show that the number of pairs in the set

   $$\{ (p, q) \in P_1 \times P_2 \mid d(p, q) \leq \delta \}$$

   is $O(n)$. Recall that $d(p, q)$ denotes the distance between p and q. (15 points)

3. Exercise 6 of Chapter 5. (15 points)

4. Exercise 7 of Chapter 5. (15 points)