Please hand in your solutions no later than Mar 22, 2010, 3:42 a.m., sending one email, with your solutions attached, to rsteinwa@fau.edu. Solutions received after this deadline will be graded with 0 points.

Problem 1 (Karatsuba)  
In this problem we represent polynomials \( a_0 + a_1 x + \ldots + a_n x^n \) with integer coefficients as a list of integers \([a_0, a_1, \ldots, a_n]\).

(a) Write a Python function `prettyprint` that on input such a list \([a_0, a_1, \ldots, a_n]\) returns a string of the form \( a_0 + a_1 x + a_2 x^2 + \ldots + a_n x^n \), where \( n \) and the \( a_i \) are chosen according to the list specified. All superfluous 0-coefficients must be omitted in the returned string. Also the exponent 1 should be omitted, i.e., \( x \) instead of \( x^1 \) should be used. On input the empty list the function must return 0.

(b) Write a Python function that on input a list of integers appends as many zeros at the end of the list as are necessary to make the length of the list a power of 2.

(c) Write a Python function that uses Karatsuba’s algorithm to multiply two polynomials of arbitrary (and not necessarily identical) degree.

Problem 2 (Matrices)  
In this problem we represent matrices as lists of rows, each row being represented as a list of integers.

(a) Write a Python function that tests if a matrix is a square matrix, i.e., returns True if the given matrix has the same number of rows and columns.

(b) Write a Python function that returns the product of two given matrices.

(c) Write a Python function that tests if a matrix \( A \) is symmetric, i.e., returns True if and only if \( A = A^T \).

(d) Write a Python function that has a matrix \( A \) and a non-negative integer \( m \) as input and returns \( A^m \), computed by means of the square-and-multiply algorithm.

Good luck—and do not hesitate to ask questions!!