# Program na04: Doolittle's LU Decomposition

***Overview***: Solve systems of equations using Doolitle's LU decomposition.

***Introduction***: Write a module **LUdecomp** that solves equations using Doolitle's decomposition. It should contain subroutines **LUdecomp** and **LUSolve**. Do problems 2.3 numbers 8, 15, and 18. The main program file should contain a separate subroutine for each problem. The main program should call all three subroutines.

***Input***: Do all input from a file **na04in.txt**. Input the coefficient matrix and the constant vector for problem 8 as space delimited arrays. There is no input for problem 15. Problem 18 should input the points only, with one pair of space delimited coordinates per line.

***Output***: Output to the standard output. Required components of the output for each problem are given below. Use blank lines as needed to make the output look sharp.
For problem 8 include:

<Title. E.g. 'Problem #2.3.8'>
[A|b] = <augmented matrix>
[L\U] =<print the LU decomposition>
x = <print the vector x>T.
Ax – b = <print the vector>T

For problem 15, let **J** be the vector <1,1,…,1>. Output should include:

<Title>
The largest n with solution correct to 6 decimal places is n = <n>
The system is:
<The augmented matrix>
The solution is x = <x>T
The largest error is <max |x–J|>
The smallest n with solution not correct to 6 decimal places is n = <n>
The system is:
<The augmented matrix>
The solution is x = <x>T
The largest error is <max |x-J|>

For problem 17 include:

<Title>
[A|b] = <augmented matrix>
p(x) = <write out the polynomial.>

***Extra for experts:*** Write a module for printing polynomials in a nice way. Terms with 0 coefficients should not be included unless the entire polynomial is 0. The constant term should be written as just the coefficient, not multiplied by x**0. The linear term

should be written as x, not as x**1. Negative terms should be subtracted, not added with a negative. E.g. The polynomial with coefficients [2.0, 0.0, -5.0, 0.0] would be written as

2.0 – 5.0*x**2

## *Checklist:*

Module files: **matIO.py**, **LUdecomp.py**
Main program file: **na04.py**
Input file: **na04in.txt**
Extra credit: module **poly.py**