STAT 8060-Final Exam
Fall 2017

You will have three hours for this exam. You may use any sources of information that you want (notes, books, internet, etc). There are two exceptions: 1) you may not communicate with anyone other than me via any means; 2) You may not copy actual code (it will be easy for me to tell and easy to verify using search tools). Doing either of these things will be grounds for a zero grade on the exam. Your code should be well documented and well organized. Follow instructions about input and output exactly. Submit you code as a single file. This should include lines that run your function and produce output as directed. In addition, submit a single pdf that shows output and demonstrates the functioning of you functions. Submit your answers via the Final Exam droxbox on eLC.

Important: The exam will be due in the dropbox by 3:15. I have a meeting and will need to leave by 3:00. The dropbox will be available until 3:15, but will not accept submissions after that. Be certain to have everything submitted by 3:15.

1. Write a function that does *LU* decomposition. The input should be of the form *LUdecomp(A,z)*, where *A* is a *Numpy* matrix. The function should replace *A* with a matrix that contains elements of the *L* matrix below the diagonal and elements of the *U* matrix on the diagonal and above. *z* is a vector that the function should modify to give the row permutations from pivoting. For example if we had swaps $3 \Leftrightarrow 1, 2 \Leftrightarrow 1$, then *z*= [3,1,2]. The function should modify the variable *r* so that it is +1 if there are an even number of row swaps and -1 if there are an odd number of row swaps.

2. Write a function that takes the LU decomposition for a matrix *A* and solves the system of equations *AX=Y* for the vector *X*. The function call should be of the form *LUSub(B,Y,z)*, where *B* is a matrix containing the LU decomposition for the matrix *A* (as produced by your *LUdecomp* routine), *Y* is a the right-hand side vector, and *z* is the permutation vector. This function should use the *L* and *U* matrices to do backwards and forwards substitution to solve the system. It should modify the vector *Y* so that after the function is run *Y* contains the solution vector.

In the Final Exam folder on eLC is a file called **FinalExamStarter.py**. This contains code to generates y-values from a quadratic regression curve $3x^2 + 5x + 7 + \varepsilon,\ \varepsilon \sim Normal(0,20)$. It then makes a matrix A. You should apply the **LUdecomp** function to the matrix A. You should use your **LUsolve** function to solve the system of equations as shown in the code.