Study questions for APPM 4650 – Part II

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1. Given the data

x	y
1	1
2	2
4	3

   Write a Matlab program that finds the linear least squares solution for the parameters a, b in the model $y \approx a + b\cos(x)$ using the data from the table above.

2. Write a Matlab program that finds the nonlinear least squares solution using Gauss-Newton for the parameters a, b in the model $y \approx \exp(ax) + \cos(bx)$ using the data from the table above.

3. Show that the solution to the normal equations $A^TAx = A^Tb$ minimizes the 2-norm of the residual $r = b - Ax$ of the over determined system $Ax = b$.

4. Discuss the properties of sparse system of equations. How do they arise? When factoring $PA = LU$ you want to have as little fill-in as possible. What is fill-in? Discuss strategies for avoiding it.

5. Write a matlab program that finds L and U in $A = LU$ (don't use backslash). You may assume that no pivoting is necessary.