AMSC/CMSC460 Section 2.

MATLAB Exercise 4. 2011.04.19

A. Make a folder for your commonly used MATLAB codes, and setpath to the folder.

B. Least square estimation based on Cholesky factorization can be written in 4 steps

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Step 1. Compute $\mathbf{B}=\mathbf{A}^T\mathbf{A}$ [$=\mathbf{B}^T$] (R^{NxN} ; symmetric, called normal matrix)
$\mathbf{c}=\mathbf{A}^T\mathbf{b}$ (R^N)

Step 2. Obtain Cholesky Factorization of $\mathbf{B}=\mathbf{L}\mathbf{L}^T$

Step 3. Solve for $\mathbf{B}\mathbf{x} = \mathbf{c} \rightarrow (\mathbf{L}\mathbf{L}^T)\, \mathbf{x}= \mathbf{L}(\mathbf{L}^T \mathbf{x})= \mathbf{c}$
(1) Solve for $\mathbf{L}\mathbf{y}= \mathbf{c}$ [by letting $\mathbf{L}^T \mathbf{x}=\mathbf{y}$] through forward substitution
(2) Solve for $\mathbf{L}^T \mathbf{x}_{CF}=\mathbf{y}$ through backer substitution

Step 4. Compute residual $\mathbf{r}(\mathbf{x}_{CF})=\mathbf{b} - \mathbf{A}\mathbf{x}_{CF}$

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1. Write a MATLAB function code for the least square estimation
   [x,r]=LSE_CF(A,b)

You can make use of the MATLAB function codes you have developed for this class so far.

2. To check whether your code is properly working or not, use the same data set as in Exercise 3 that you save in a file. The data was generated based on
   b(l)=a0+a1*t(l)+epsilon(l)

for l=1,..,L=100, where

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a0=3;
a1=2;
e=0.3;
t=linspace(0,1,L)';
epsilon=e*randn(L,1).
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Write a MATLAB code to repeat Problem 3 in MATLAB Exercise 3.