ECE-597: Optimal Control
Homework #9

Due: Last day of class, 2007

In this problem you will write a Matlab routine that computes the steady state value of S and the feedback gain K for a Linear Quadratic Regulator which minimizes the performance index

$$J = \frac{1}{2}\int_0^\infty \left[y(t)^T Q y(t) + u(t)^T R u(t)\right] dt$$

subject to the linear, time-invariant state model

$$\begin{aligned} \dot{x}(t) &= Ax(t) + Bu(t) \\ y(t) &= Cx(t) \end{aligned}$$

Specifically, you are to write a Matlab function that

- has input arguments A, B, C, Q, and R
- uses Matlab's built in command **lqry** to compute the steady state LQR values of S and state feedback gain K. These values should be written to the screen (the command **ss** may be useful here)
- determines the eigenvalues and corresponding eigenvalues of the matrix

$$\begin{bmatrix} A & -BR^{-1}B^T \\ -C^TQC & -A^T \end{bmatrix}$$

  (the command **eig** may be usefull here)

- locates all the negative eigenvalues and the corresponding eigenvectors and puts them into the array

$$\begin{bmatrix} X_- \\ \Lambda_- \end{bmatrix}$$

- determines the steady state value of S and K from the previously derived matrix and writes them to the screen (the command **length** or **size** may be useful)

Note that your code should work for any state variable model I choose to use! You need to e-mail me your code when you are done.