Homework #5
ME EN 5210/6210 & CH EN 5203/6203 & ECE 5652/6652
Linear Systems & State-Space Control

Use this page as the cover page on your assignment, submitted as a single pdf.

Problem 1

Find the characteristic polynomial and the minimal polynomial of each of the following Jordan matrices, which can be determined from inspection.

$$A_1 = \begin{bmatrix} 2 & 1 & 0 & 0 \\ 0 & 2 & 1 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 5 \end{bmatrix} \quad A_2 = \begin{bmatrix} 2 & 1 & 0 & 0 \\ 0 & 2 & 1 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix} \quad A_1 = \begin{bmatrix} 2 & 1 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix} \quad A_1 = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix}$$

Use MATLAB to convince yourself that each matrix really does satisfy its own characteristic polynomial and minimal polynomial (you don't need to include this).

Problem 2

Find the characteristic polynomial and minimal polynomial of each of the following matrices. Make sure to show your work and/or explain your thought process.

$$A_1 = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 6 & 10 \\ 0 & 0 & 3 \end{bmatrix} \quad A_2 = \begin{bmatrix} 2 & 1 & 10 \\ 0 & 6 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

Problem 3

Consider

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

Compute A^{103} and e^{At}, using the method of Theorem 3.5 in the textbook. Use MATLAB to check your answer (you don't need to include this).