Tips: Make sure your reasoning and work are clear to receive full credit for each problem.

1. 5 pts. Chen 5.11 (note that Chen’s “marginally stable” is our “stable”).

2. 5 pts. Chen 5.12

3. 5 pts. Chen 5.14.

4. 8 pts. Use the \textbf{discrete-time} Lyapunov stability theorem to determine if the eigenvalues of
\[
A = \begin{bmatrix}
1/2 & 1/2 \\
-1/2 & 1/2
\end{bmatrix}
\]
all have magnitude less than one. Repeat your analysis for
\[
A = \begin{bmatrix}
1 & 1 \\
-1 & 1
\end{bmatrix}
\].

5. 7 pts. Given the homogeneous \textbf{discrete-time} system
\[
x(k + 1) = \begin{bmatrix}
\cos(\theta) & \sin(\theta/2) \\
-\sin(\theta/2) & \cos(\theta)
\end{bmatrix} x(k)
\]
where $\theta$ is a fixed parameter, analytically find all values of $\theta \in [0, 2\pi)$ such that this system is stable. Also, analytically find all values of $\theta \in [0, 2\pi)$ such that this system is asymptotically stable. Hint: You can confirm your analysis with Matlab.