Rutgers University
The State University Of New Jersey
College of Engineering
Department of Electrical and Computer Engineering

330:501 Systems Analysis

Problem Set 8

1. **S & B: Chapter 5, Problem 1**
2. **S & B: Chapter 5, Problem 2**
3. **S & B: Chapter 5, Problem 3**
4. **S & B: Chapter 5, Problem 4**
5. **S & B: Chapter 5, Problem 8**
6. **S & B: Chapter 5, Problem 10**
7. The following questions are representative of what you might find on a quiz.
   (a) What does the controllability canonical form of figure 3.12 (page 106) in your text have to do with controllability?
   (b) You are given the following scalar equation:
   $$\dot{x} = x^2 + u$$
   Since the equation is nonlinear, the contollability gramian is not useful in determining its controllability. Is this system completely controllable with bounded input?
8. As a cute prelude to optimal control consider a turkey whose weight $w(t)$ varies weekly according to the following equation:
   $$w(t+1) = (2 + u(t))w(t)$$
   where $u(t)$ is the amount of Super-Turkey food additive provided each week. Assuming the turkey farmer can only provide a total 10 units of food additive in weekly non-negative integer amounts, what $u(t)$, $t = 0, 1...9$ maximizes $w(10)$? What is the maximum $w(10)$? You may assume that $w(0) = 1$.

   For this problem you may poke around and guess. On a test, you'd need to prove your result (even though we have not considered optimal control yet!).

HAPPY THANKSGIVING VACATION!