CDS 101/110: Homework #6

(Due Friday, November 18, 2016)

Problem 1 (CDS 101, CDS110): (15 points) Do Problem 10.1 in Chapter 10 of FBS, 2^{nd} edition.

Problem 2 (CDS 101, CDS110): (10 points) Do Problem 10.2 in Chapter 10 of FBS, 2^{nd} edition.

Problem 3 (CDS CDS110): (30 points)

Consider the unstable plant, P, with transfer function $P(s)$ given by

$$P(s) = \frac{1}{s-1}.$$

In class, we consider a simple integrator control system with unit negative feedback, and found that such as system was unstable for all possible gains. in this homework, you will consider unity negative feedback with a controller of the form:

$$C(s) = \frac{K_2(1+K_1 s)}{s}$$

implying that:

$$L(s) = P(s)C(s) = \frac{K_2(1+K_1 s)}{s(s-1)}.$$

Part (a): (5 points) Compute the poles of the closed loop system, $G_{yr}(s) = \frac{L(s)}{1+L(s)}$, and show that the system is stable if $K_1 K_2 > 1$.

(b): (20 points) Sketch the Nyquist diagram of this system.

(c): (5 points) Show using the Nyquist diagram and Nyquist analysis that the system is stable if $K_1 K_2 > 1$

Problem 4 (CDS 110:) (20 points) Do Problem 10.7 in Chapter 10 of FBS, 2^{nd} edition.