

Figure 1: Problem 1

Figure 2: Problem 2



Figure 3: Problem 3

Figure 4: Problem 4

## Eskişehir Osmangazi University - Electrical Engineering Department Fundamentals of Control Systems - Final Examination - Summer 2012

**1.** Find the transfer function C(s)/R(s) for the LTI system in Figure 1.

Ans. 
$$\frac{C(s)}{R(s)} = \frac{K(s+1)}{(s-1)(s+2) + K(s+1)} = \frac{K(s+1)}{s^2 + (K+1)s + K - 2s}$$

**2.** (a) Sketch the root locus plot for the LTI system in Figure 2. (b) For which K values the system is stable.



Ans. Stable for K > 0.

**3.** (a) Sketch the Nyquist plot for the LTI system in Figure 3. (b) Write P, Z, and N. Is this system stable?



Ans.  $P = 0, N = 0, Z = 0 \rightarrow$  Stable. 4. (a) Find the transfer function  $\frac{Y(z)}{X(z)}$  for the discrete LTI system in Figure 4. (b) Is this system stable?

Ans. 
$$\frac{Y(z)}{X(z)} = \frac{3}{z^2 + z + 3}$$

Its poles -0.5000 + 1.6583i and -0.5000 - 1.6583i are not all in the unit circle, therefore, it is unstable. Good Luck,

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