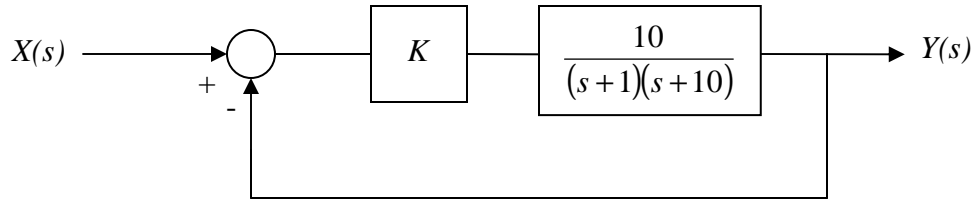
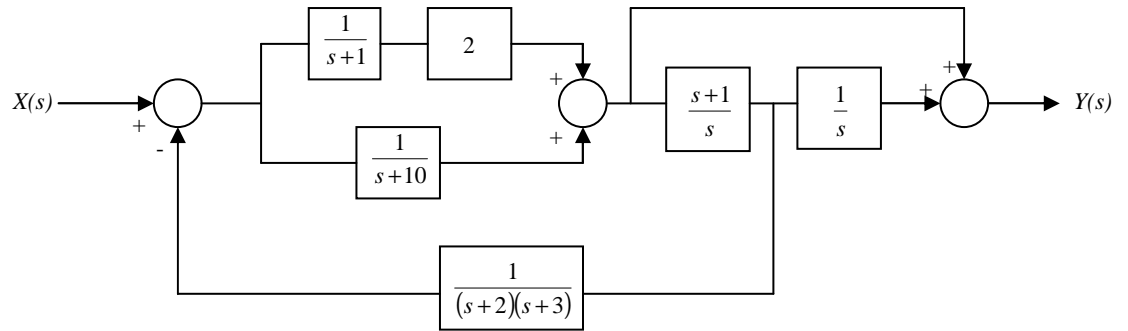


EE 327 Signals and Systems 1  
Homework 6

1. Perform block diagram reduction on the following block diagrams. Reduce them to a single block.



a.



b.

2. Given the system defined by the following transfer function, find the output to the given inputs.

$$H(s) = \frac{s+1}{(s+2)(s+3)}$$

- a. The input is a unit step function,  $x(t) = u(t)$
  - b. The input is a unit ramp function,  $x(t) = tu(t)$
3. Find the poles of the following transfer functions, and then determine if the system is stable, marginally stable, or unstable.

- a.  $H(s) = \frac{s+1}{s^2 + s - 6}$
- b.  $H(s) = \frac{2(s-5)}{s^3 + 3s^2 + 3s + 1}$
- c.  $H(s) = \frac{s+2}{s(s+2)(s+3)}$
- d.  $H(s) = \frac{s+1}{(s+5)((s-2)^2 + 9)}$
- e.  $H(s) = \frac{s+1}{(s+5)((s+2)^2 - 9)}$

4. Determine if the following systems are stable.

a. 
$$H(s) = \frac{1}{s^4 + 2s^3 + s^2 + 10s + 4}$$

b. 
$$H(s) = \frac{2(s-5)}{s^3 + 4s^2 + 9s + 10}$$

c. 
$$H(s) = \frac{s+10}{s^4 + 3s^3 + 6s^2 + 12s + 8}$$

5. Determine the values of  $K$  for which the systems remain stable.

a. 
$$H(s) = \frac{2(s+10)}{s^3 + 3s^2 + 4s + K}$$

b. 
$$H(s) = \frac{K(s+10)}{s^2 + (K+2)s + 2 - K}$$