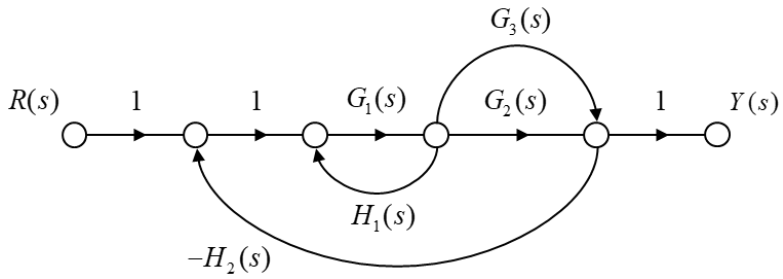
Quiz 2: Control Systems Eng.
2019/05/14

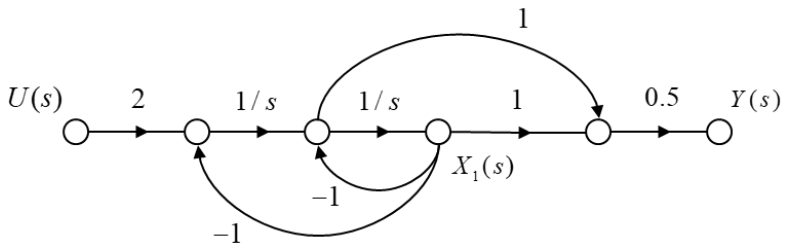
Student Number: [ ] Name:

1. (20 points = 2×10 pts)

(1) Find the transfer function using Mason's rule of the signal flow graph shown below.



(2) Find $A,\ B,\ C,\ D$ for the state-space representation of the signal flow graph shown below.

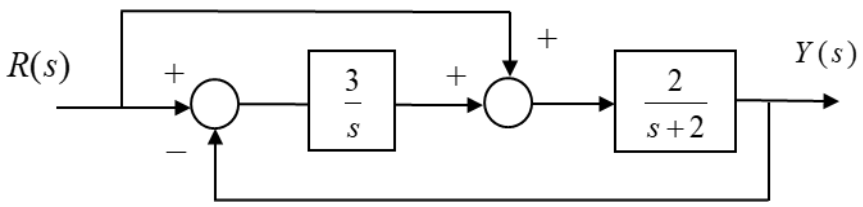


$$\dot{x} = Ax + Bu$$
$$y = Cx + Du$$

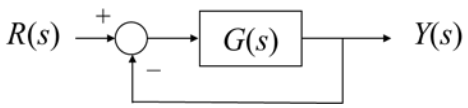
2. (20 points = 2×10 pts) An unit step input is applied to the following system.

(1) Find the transfer function $(Y(s)/R(s))$.

(2) Find the steady-state error, $\lim_{t\to\infty} e(t)$, where $e(t) = r(t) - y(t)$.

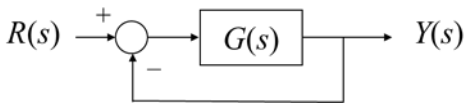


3. (20 points) Determine the condition of K using Routh-Hurwitz criterion so that the following system is stable.

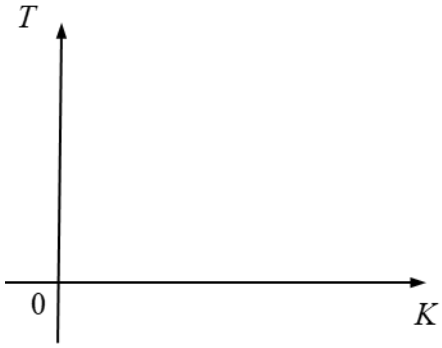


$$G(s)=\frac{K}{s(s^2+s+1)(s+4)},\quad K>0$$

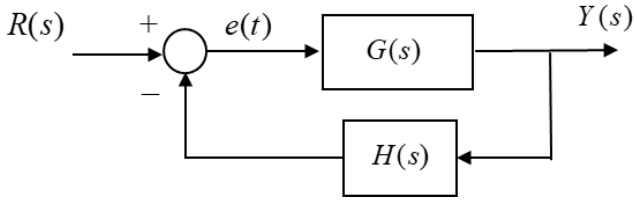
4. (20 points) Show the region of the K-T plane in which the following feedback system is stabilized.



$$G(s)=\frac{K(1+s)}{s(1+Ts)(1+2s)} \quad \text{with} \quad K>1, T>1$$



5. (20 points) Determine the value of $'\alpha'$ to have a zero steady-state error $(\lim_{t\to\infty} e(t))$ for a step input in the following feedback system.



$$G(s)=\frac{s+1}{s^2+5s+\alpha}$$

$$H(s)=\frac{1}{s+4}$$

$$E(s)=R(s)-H(s)Y(s)$$