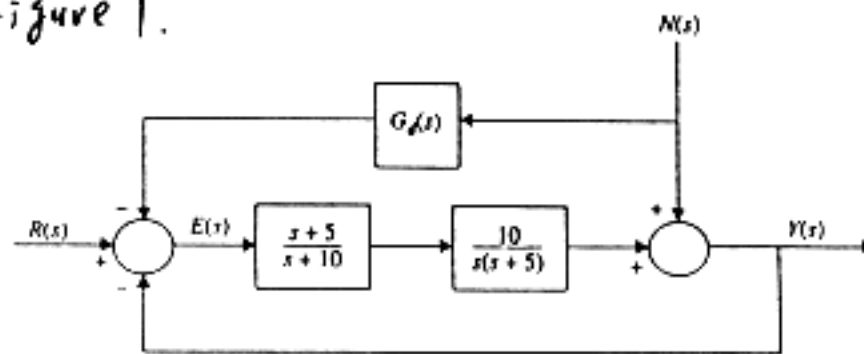


- (1) What is Feedback and what are its effects? What are general types of Feedback Control systems? (20%)
- (2) Solve the following difference equation using Z-transform (20%)  
 $y(k+2) - y(k+1) + 0.1y(k) = u(k)$   
 where  $u(k) = 1$  for  $k = 0, 1, 2, \dots$  and initial conditions  $y(0)=y(1)=0$
- (3) Figure 1 shows the block diagram of the antenna control system of a solar-collector field system. The signal  $N(s)$  denotes the wind gust disturbance that acted on the antenna. The feedforward transfer function  $G_d(s)$  is used to eliminate the effect of  $N(s)$  on the output  $Y(s)$ . Find the transfer function  $Y(s)/N(s)|_{R=0}$ . Determine the expression of  $G_d(s)$  so that the effect of  $N(s)$  is eliminated entirely. (40%)

Figure 1.



- (4) What are the PD, PI, and PID controllers? Write down their input-output transfer functions. (20%)