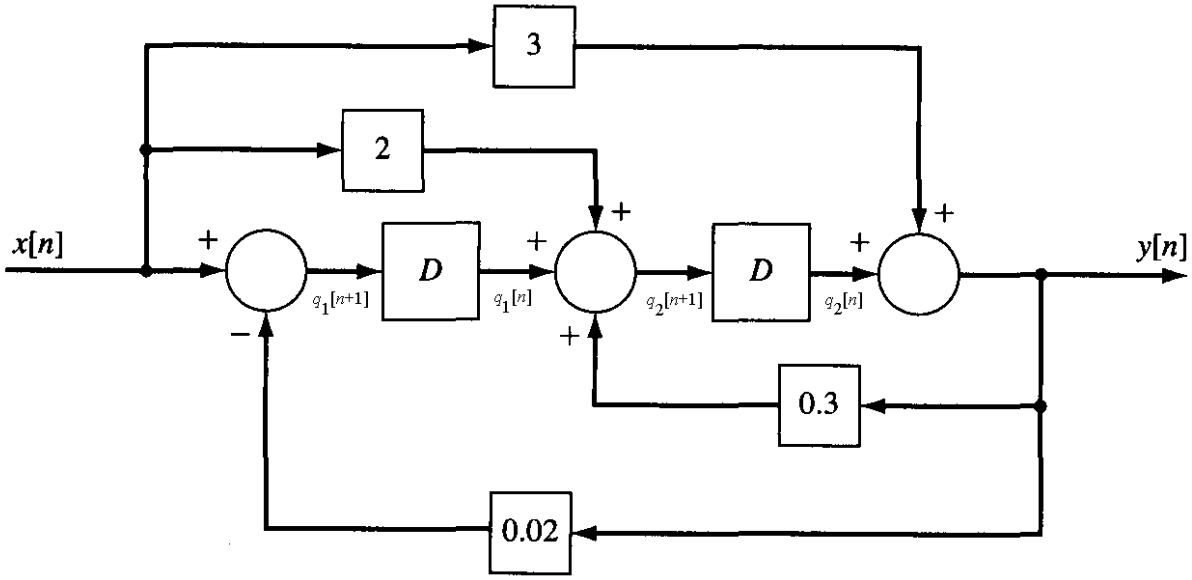
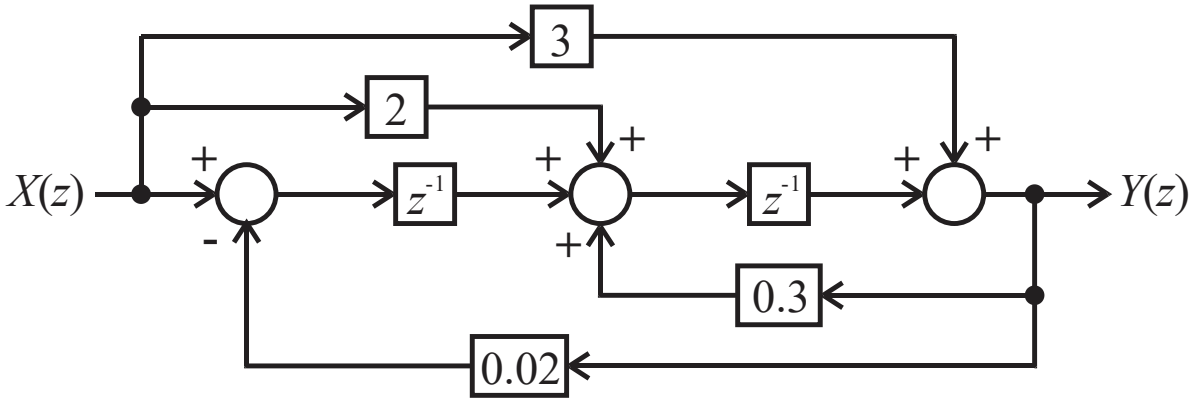
7.32 Consider the discrete-time system shown in Figure P7.32.

(a) Determine the transfer function $H(z)$ of the system.

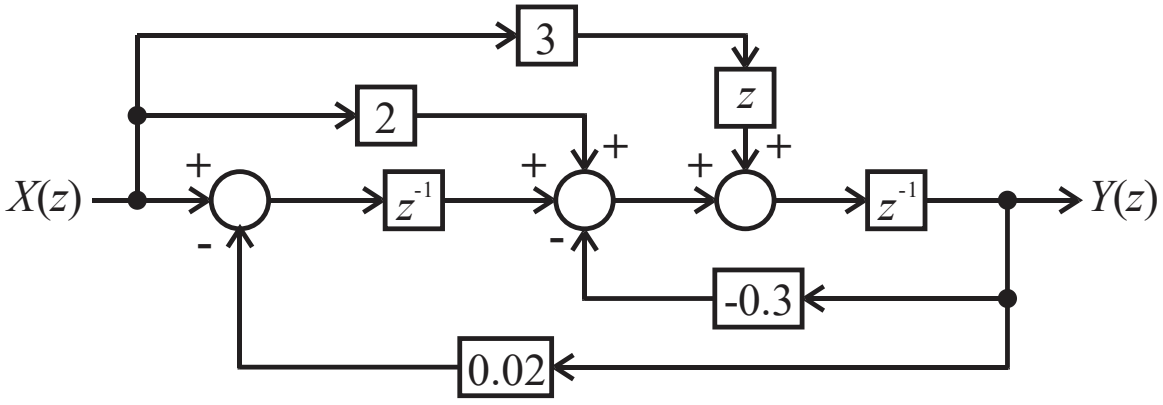
- Draw z-domain SFG and find $H(z)$ by SFG reduction.



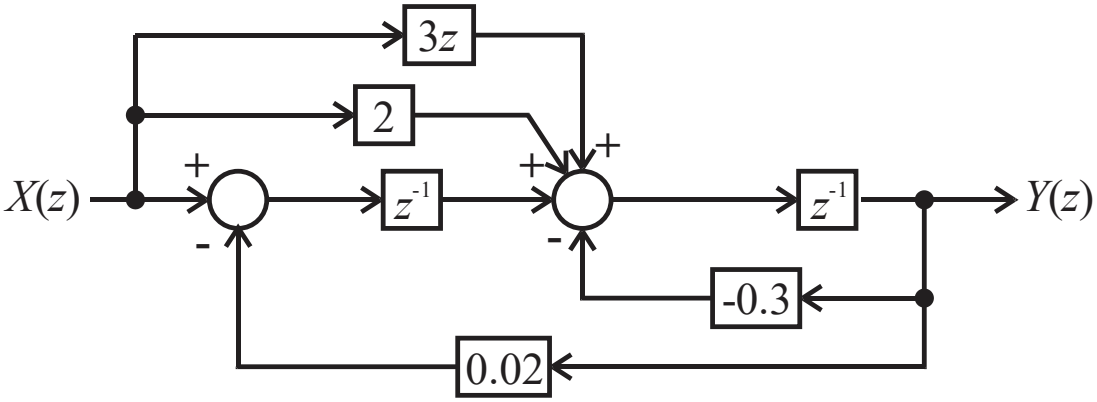
z-transform



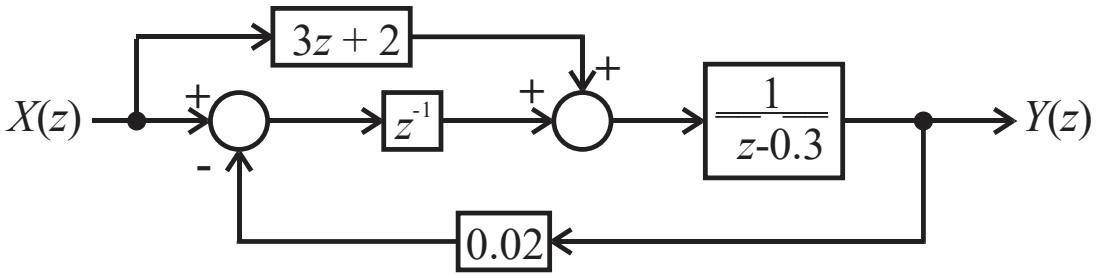
1) Move RH adder & modify RH loop



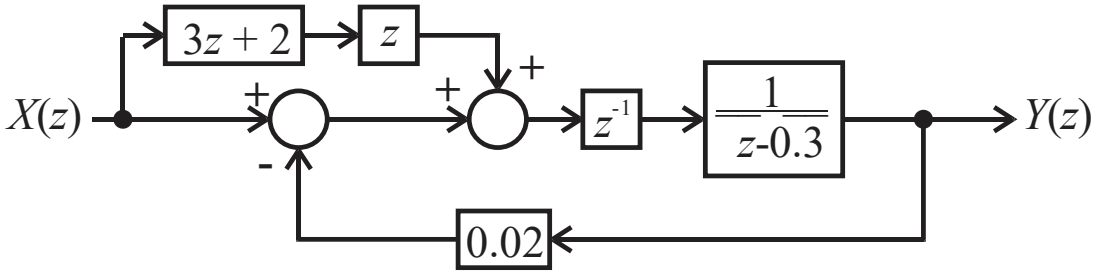
2) Combine RH series adders & use series rule on top branch



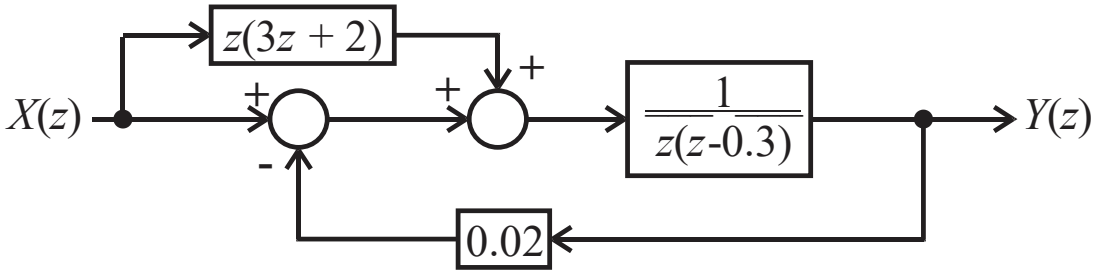
3) Use parallel rule on top branches, $H_1(z)+H_2(z)=3z+2$**, and feedback rule on RH loop w/** $H_1(z)=z^{-1}$**,** $H_2(z)=-0.3$**, &** $\dfrac{H_1(z)}{1+H_1(z)H_2(z)}=\dfrac{z^{-1}}{1+z^{-1}(-0.3)}=\dfrac{1}{z-0.3}$



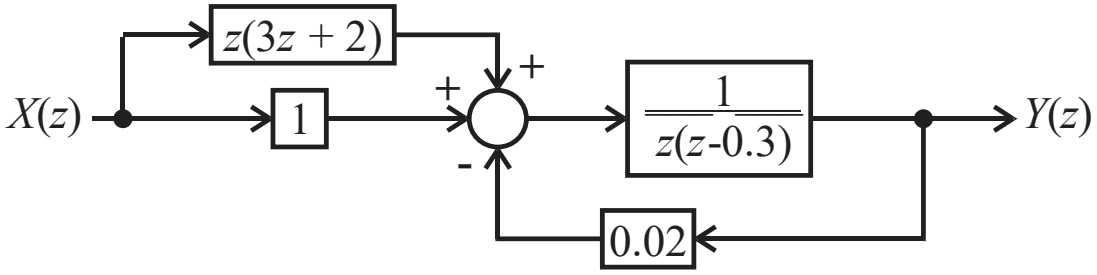
4) Move RH adder



5) Use series rule on top and RH branches

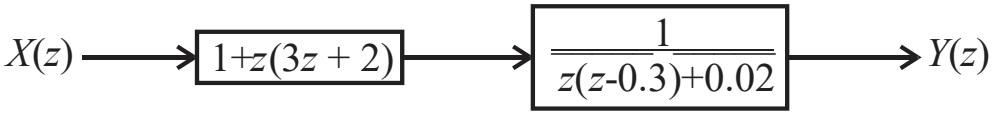


6) Combine adders and give direct branch a gain of 1.

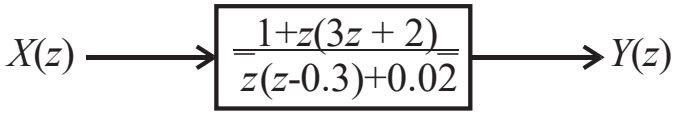


7) Use parallel rule on the left branches, $H_1(z)+H_2(z)=1+\left(3z+2\right)$**, and feedback rule on the RH loop w/** $H_1(z)=\dfrac{1}{z(z-0.3)}$**,** $H_2(z)=0.02$**, and**

$$\frac{H_1(z)}{1+H_1(z)H_2(z)}=\frac{\dfrac{1}{z(z-0.3)}}{1+0.02\dfrac{1}{z(z-0.3)}}=\frac{1}{z(z-0.3)+0.02}$$



8) Use series rule to get $H_1(z)H_2(z)=\dfrac{1+z(3z+2)}{z(z-0.3)+0.02}$



9) Using algebra, we get $\boxed{H(z)=\dfrac{Y(z)}{X(z)}=\dfrac{3z^2+2z+1}{z^2-0.3z+0.02}}$ **(again).**