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HW 3 OCT. 1, 2020

1. G_1 / G_2 are in Series, equ. Trans. Function.

   D. $G_1 G_2$

2. When the summing point from behind to ahead the input R_2

   B. R_2 / G

3. Pick off value moves ahead to behind, value is.

   a. Divide by G.

4. SFG, Node represent

   D. Input / output / Junction.

5. SFG, Branches represent.

   B. The Transfer Function.

6. Path Transfer Function is equal to

   C. Product of all Transfer Func. in path.

7. Mason's formula

   D. Path, Loop, Determinant Function

8. For Single path,

   D. $\Delta_1 = 1$, All ~~path~~ Loop paths Touch, $T(s) = P_1 \Delta_1 / \Delta$

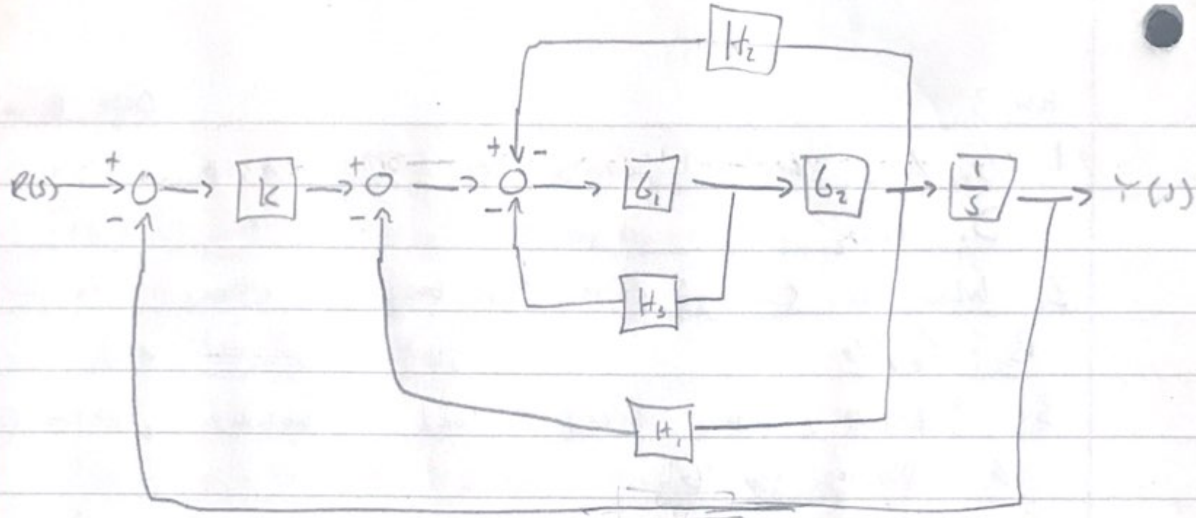
9. Two paths,

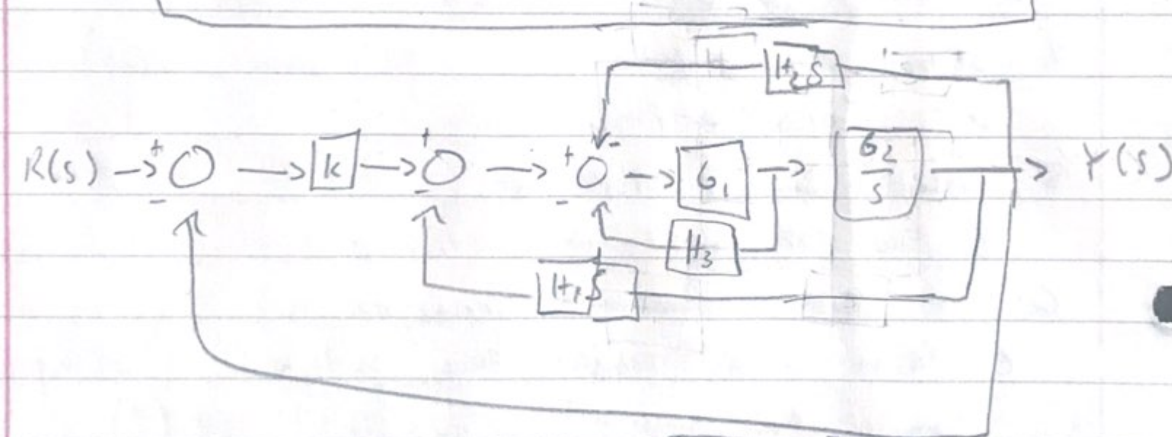
   B. $(P_1 \Delta_1 + P_2 \Delta_2)/\Delta$

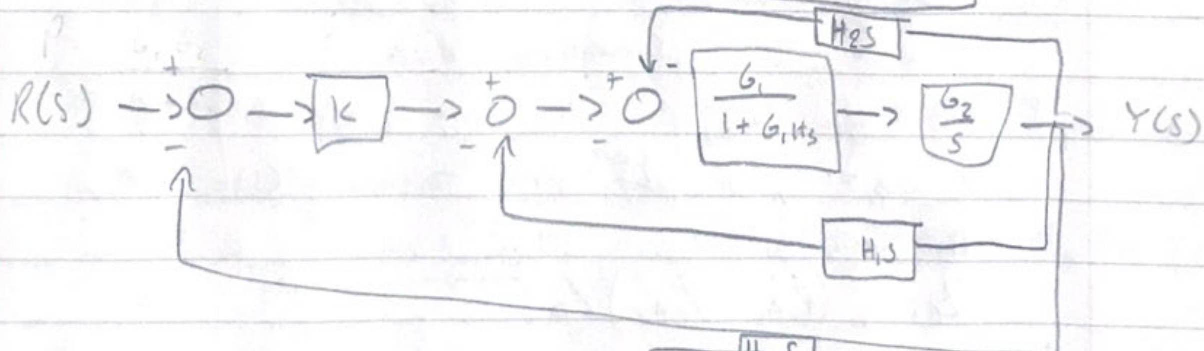
10. touching,

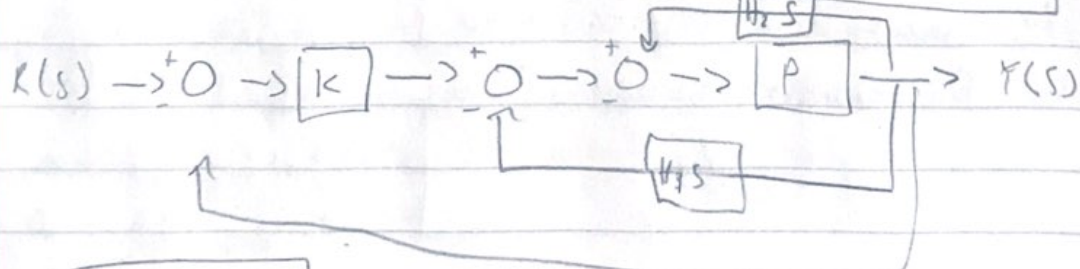
   D. adjacent, overlapping, across

2.

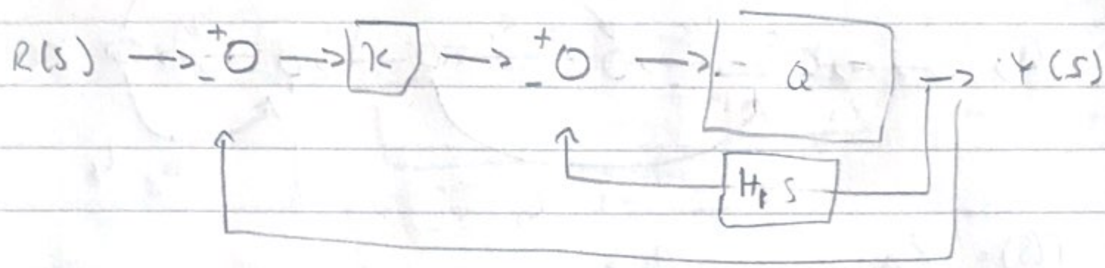




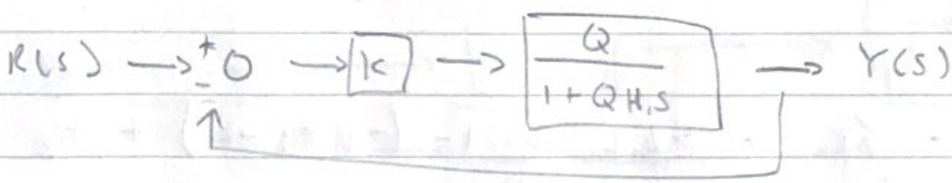


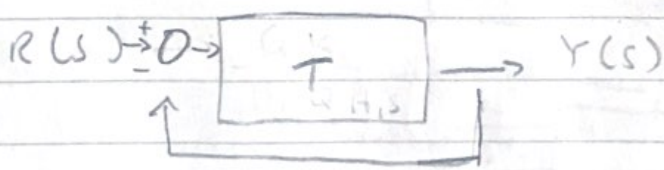


$$\boxed{P = \frac{G_1 G_2}{S + SG_1H_3}}$$



$$Q = \frac{P}{1+PH_2S}$$



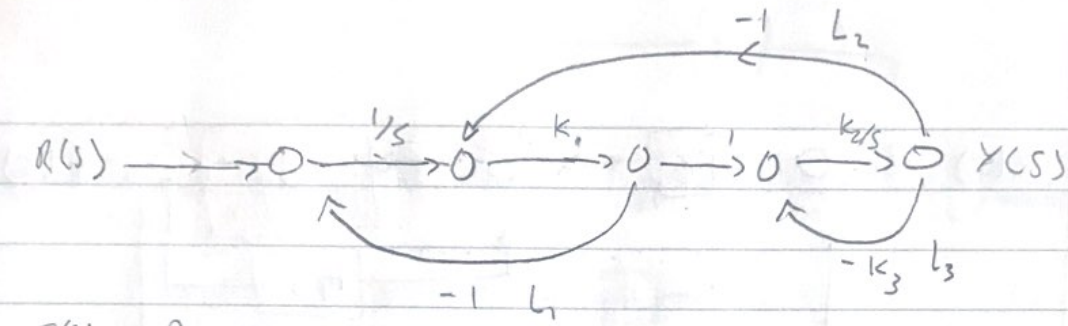


$$T(s) = \frac{QK}{1+QH_1S} = \frac{K\left(\frac{P}{1+PH_2S}\right)}{1+\left(\frac{P}{1+PH_2S}\right)(H_1S)} = \frac{\left(\frac{PK}{1+PH_2S}\right)}{\frac{1+PH_2S+P(H_1S)}{1+PH_2S}}$$

$$= \frac{PK}{1+PS(H_2+H_1)} = \frac{\left(\frac{G_1G_2K}{S+SG_1H_3}\right)}{1+\left(\frac{G_1G_2}{S+SG_1H_3}\right)S(H_2+H_1)} = \frac{\left(\frac{G_1G_2K}{S+SG_1H_3}\right)}{\frac{S+SG_1H_3+G_1G_2S(H_1+H_1)}{S+SG_1H_3}}$$

$$\boxed{T(S) = \frac{G_1G_2K}{S+SG_1H_1+G_1G_2S(H_2+H_1)}}$$

3.



$$T(s) = \frac{P_1 \Delta_1}{\Delta} \qquad n = 3$$

$$P_1 = (1)(1/s)(K_1)(1)(K_2/s) = \frac{K_1 K_2}{s^2}$$

$$\Delta_1 = 1$$

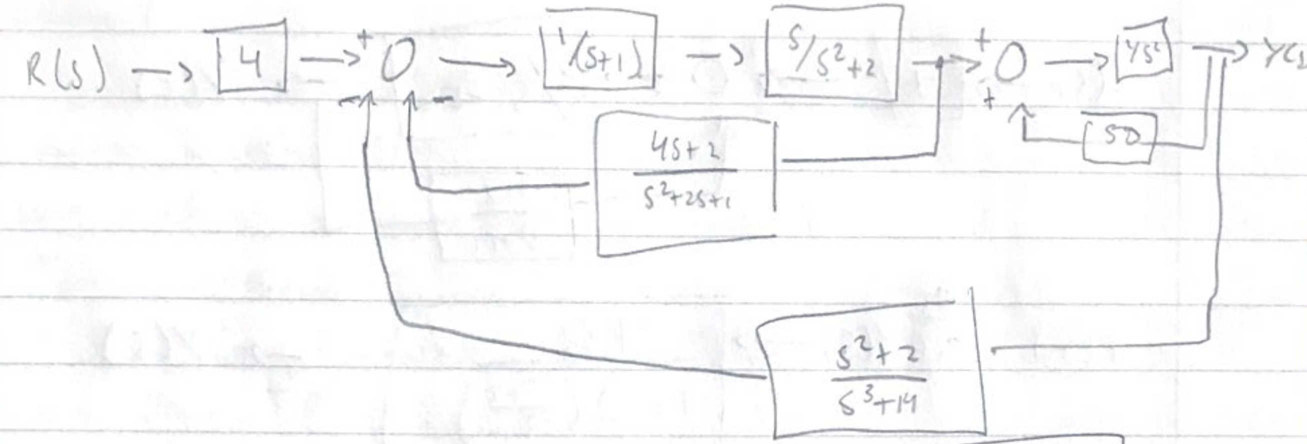
$$\Delta = 1 - \sum L_n + \sum L_n L_m = 1 - (-1 - 1 - K_3) + K_3$$

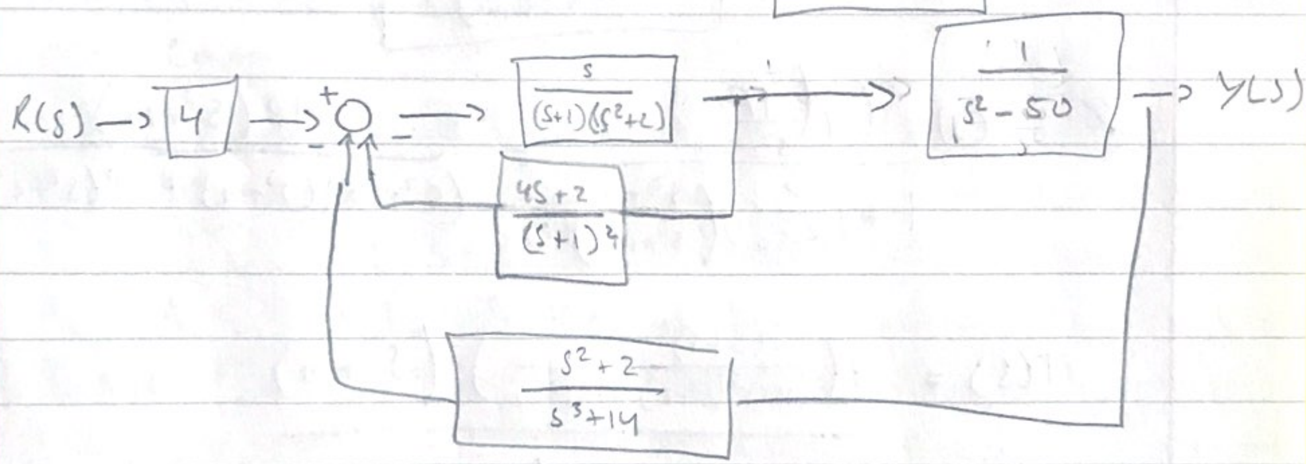
$$= 1 - (-2 - K_3) + K_3$$

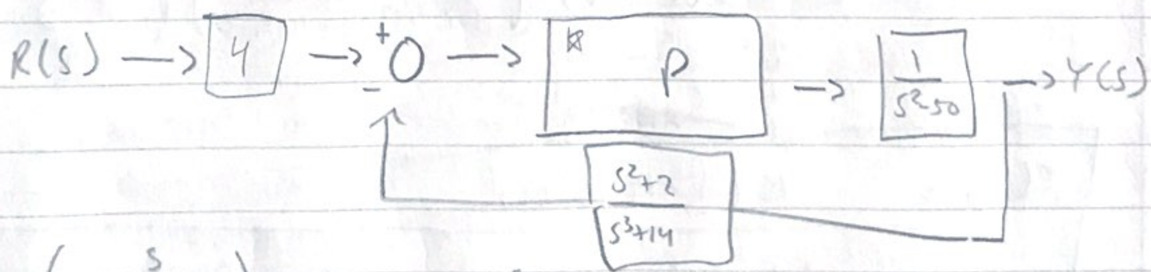
$$\Delta = 3 + 2K_3$$

$$\boxed{T(s) = \frac{K_1 K_2}{s^2 (3 + 2K_3)}}$$

4.



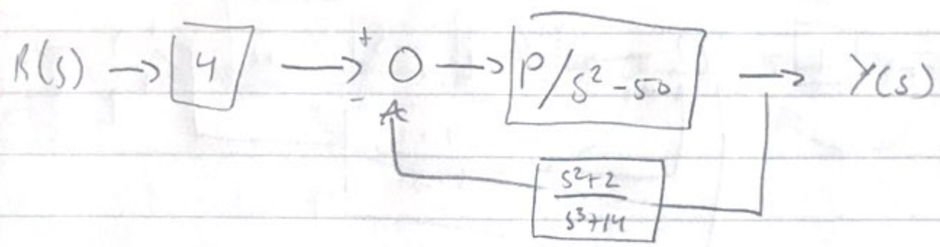




$$\star\ \frac{\left(\frac{s}{(s+1)(s^2+2)}\right)}{1+\left(\frac{s}{(s+1)(s^2+2)}\right)\left(\frac{4s+2}{(s+1)^2}\right)} = \frac{\frac{s}{(s+1)(s^2+2)}}{1+\frac{4s^2+2s}{(s+1)^3(s^2+2)}} = \frac{\frac{s}{(s+1)(s^2+2)}}{\frac{(s+1)^3(s^2+2)+4s^2+2s}{(s+1)^3(s^2+2)}}$$

$$= \frac{s}{\left(\frac{(s+1)^3(s^2+2)+4s^2+2s}{(s+1)^2}\right)} = \frac{s(s+1)^2}{(s+1)^3(s^2+2)+4s^2+2s} = P$$

$P = \dfrac{s(s+1)^2}{(s+1)^3(s^2+2)+4s^2+2s}$ $\qquad$ $Q = \dfrac{P}{s^2+50}$



$$R(s) \longrightarrow \boxed{\dfrac{4Q}{1+Q\left(\frac{s^2+2}{s^3+14}\right)}} \longrightarrow Y(s)$$

$$T(s) = \frac{\left(\frac{4P}{s^2-50}\right)}{1+\left(\frac{P}{s^2-50}\right)\left(\frac{s^2+2}{s^3+14}\right)} = \frac{4P(s^3+14)}{(s^2-50)(s^3+14)+P(s^2+2)}$$

$$T(s) = \frac{4\left(\frac{s(s+1)^2}{(s+1)^3(s^2+2)+4s^2+2s}\right)(s^3+14)}{(s^2-50)(s^3+14)+\left(\frac{s(s+1)^2}{(s+1)^3(s^2+2)+4s^2+2s}\right)(s^2+2)}$$

~~Simp~~ Simplified in Matlab

$$\boxed{T(s) = \frac{4s(s^3+14)(s+1)^2}{s^8+8s^7+7s^6+34s^5+124s^4+107s^3+270s^2+142s+84}}$$