ECE-320, Practice Quiz #4

1) Assuming we are going to use the linear quadratic method for determining a closed loop transfer function $G_o(s)$ by minimizing the following expression:

$$J = \int_0^\infty \left[q(r(t) - y(t))^2 + u^2(t) \right] dt$$

Consider the response of the resulting closed loop system as the weighting parameter q is **increased**

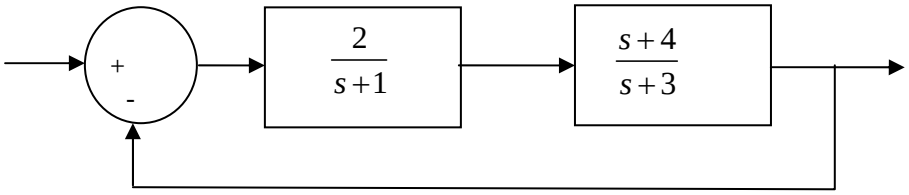
i) nothing will change ii) the settling time will decrease iii) the settling time will increase

iv) the control effort will decrease v) the control effort will increase

Which of the following is most likely to happen:

a) *i* b) *ii* and *iv* c) *ii* and *v* d) *iii* and *iv* e) *iii* and *v*

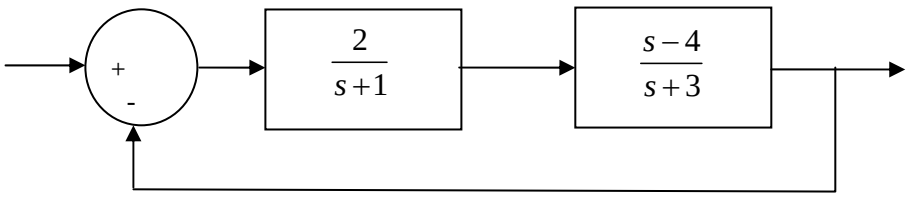
2) For the following system



The dynamic prefilter which cancels the closed loop zeros and produces a zero steady state error for a unit step input is

a) $\frac{\frac{11}{8}}{s+4}$ b) $\frac{\frac{11}{2}}{s+4}$ c) $\frac{11}{s+4}$ d) $\frac{\frac{3}{2}}{s+4}$

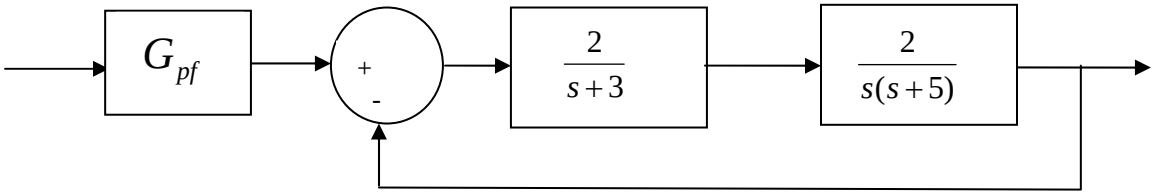
3) For the following system, is it possible to construct a dynamic prefilter to cancel the closed loop zero and produce a zero steady state error for a unit step input?



a) yes b) no

4) For the block diagram below, the value of the prefilter G_{pf} that produces zero **steady state error** for a unit step input is:

a) 1 b) 3/2 c) 3 d) 1/3



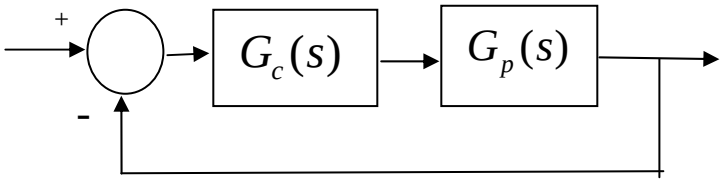
5) The second order ITAE transfer function can be written as

$$G_o(s) = \frac{\omega_0^2}{s^2 + 1.4\omega_0 s + \omega_0^2}$$

Increasing ω_0 has what general effect on the settling time, T_s?

a) it increases T_s b) it decreases T_s c) it has no effect on T_s

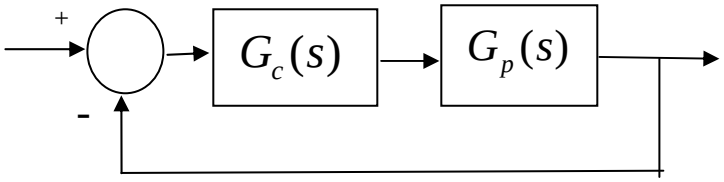
6) For the following system



if the plant is $G_p(s) = \frac{2}{s+3}$ and the desired closed loop transfer function is $G_0(s) = \frac{5}{s^2 + 2s + 5}$, then the required controller is

a) $G_c(s) = \frac{5(s+3)}{s(s+2)}$ b) $G_c(s) = \frac{5(s+3)}{2s(s+2)}$ c) $G_c(s) = \frac{(s+3)}{2s(s+2)}$ d) none of these

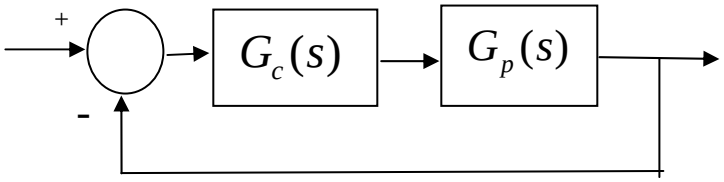
7) For the following system



if the plant is $G_p(s)=\frac{1}{s}$ and we use quadratic optimal control with $q=4$, then the closed loop transfer function is

a) $G_0(s)=\frac{4}{s+4}$ b) $G_0(s)=\frac{4}{s+2}$ c) $G_0(s)=\frac{2}{s+4}$ d) $G_0(s)=\frac{2}{s+2}$

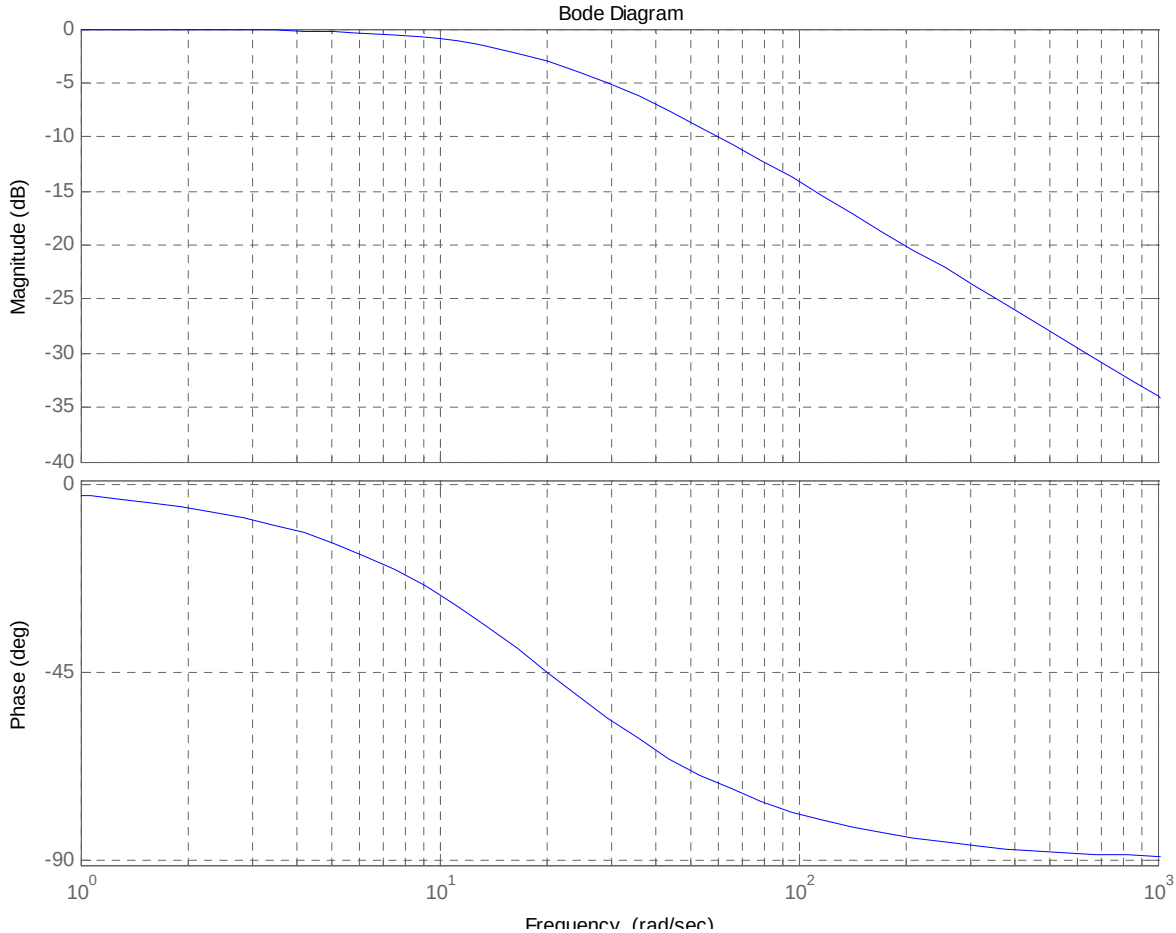
8) For the following system



if the plant is $G_p(s)=\frac{2}{2s+1}$ and we use quadratic optimal control with $q=2$, then the closed loop transfer function is

a) $G_0(s)=\frac{4}{2s+3}$ b) $G_0(s)=\frac{8}{2s+3}$ c) $G_0(s)=\frac{3}{2s+3}$ d) $G_0(s)=\frac{8/3}{2s+3}$

9) For a system represented by the following Bode plot,



The (2%) settling time for this system is approximately

a) $\frac{1}{20}$ sec b) $\frac{4}{20}$ sec c) $\frac{1}{10}$ sec d) $\frac{4}{10}$ sec e) none of these

Answers: 1-c, 2-b, 3-b, 4-a, 5-b, 6-b, 7-d, 8-d, 9-b