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ECE-205 Quiz #8

Problems 1 and 2 refer to a system with poles at -2+j. -2-j. -4, -1+2j, -1-2j, and -20

1) The best estimate of the **settling time** for this system is

a) 4 seconds b) 2 seconds c) 1 second d) 0.2 seconds

2) The **dominant pole(s)** of this system are

a) -2+j and -2-j b) -1+2j and -1-2j c) -4 d) -20

Problems 3 and 4 refer to the impulse responses of six different systems given below:

$$h_1(t) = [t + e^{-t}]u(t)$$
$$h_2(t) = e^{-2t}u(t)$$
$$h_3(t) = [2 + \sin(t)]u(t)$$
$$h_4(t) = [1 - t^3 e^{-0.1t}]u(t)$$
$$h_5(t) = [1 + t + e^{-t}]u(t)$$
$$h_6(t) = [te^{-t}\cos(5t) + e^{-2t}\sin(3t)]u(t)$$

3) The number of **stable systems** is a) 0 b) 1 c) 2 d) 3

4) The number of **unstable systems** is a) 0 b) 1 c) 2 d) 3

5) Which of the following transfer functions represents a **stable** system?

$$G_a(s) = \frac{s-1}{s+1} \qquad G_b(s) = \frac{1}{s(s+1)} \qquad G_c(s) = \frac{s}{s^2-1}$$

$$G_d(s) = \frac{s+1}{(s+1+j)(s+1-j)} \qquad G_e(s) = \frac{(s-1-j)(s-1+j)}{s} \qquad G_f(s) = \frac{(s-1-j)(s-1+j)}{(s+1-j)(s+1+j)}$$

a) all but G_c b) only G_a, G_b, and G_d c) only G_a, G_d, and G_f
d) only G_d and G_f e) only G_a and G_d

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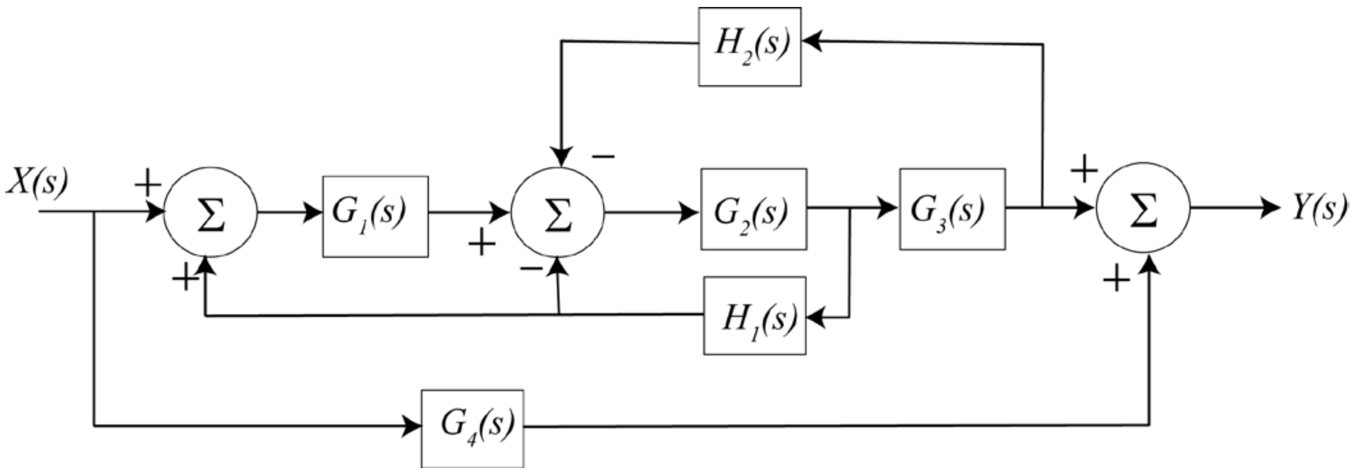
Problems 6 – 8 refer to the signal flow graph representation of the following block diagram.

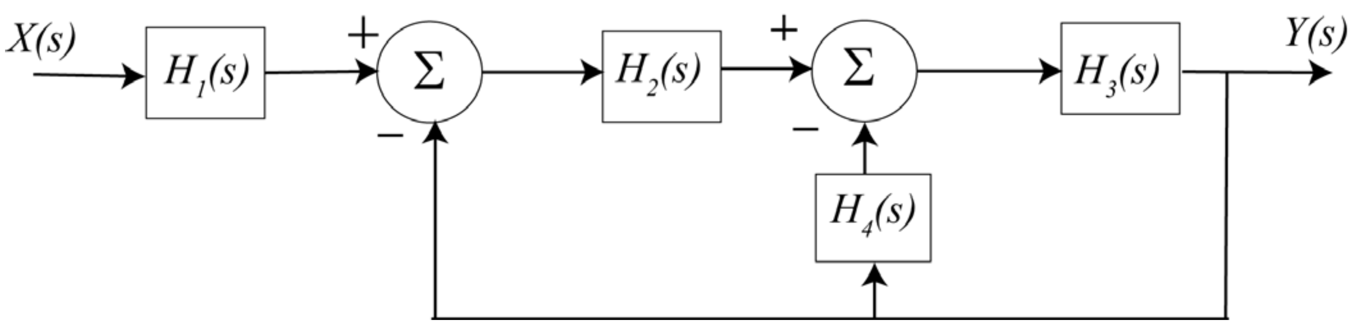


6) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4

7) How man **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4

8) Are any of the **cofactors** equal to 1? a) yes b) no

For problems 9 – 12 consider the signal flow graph representation of the following block diagram.



9) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4

10) How many **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4

11) The **determinant** (Δ) is a) 1 b) $1-H_2H_3-H_3H_4$ c) $1+H_2H_3+H_3H_4$ d) none of these

12) The **transfer function** is a) 1 b) $\dfrac{H_1H_2H_3}{1-H_2H_3-H_3H_4}$ c) $\dfrac{H_1H_2H_3}{1+H_2H_3+H_3H_4}$

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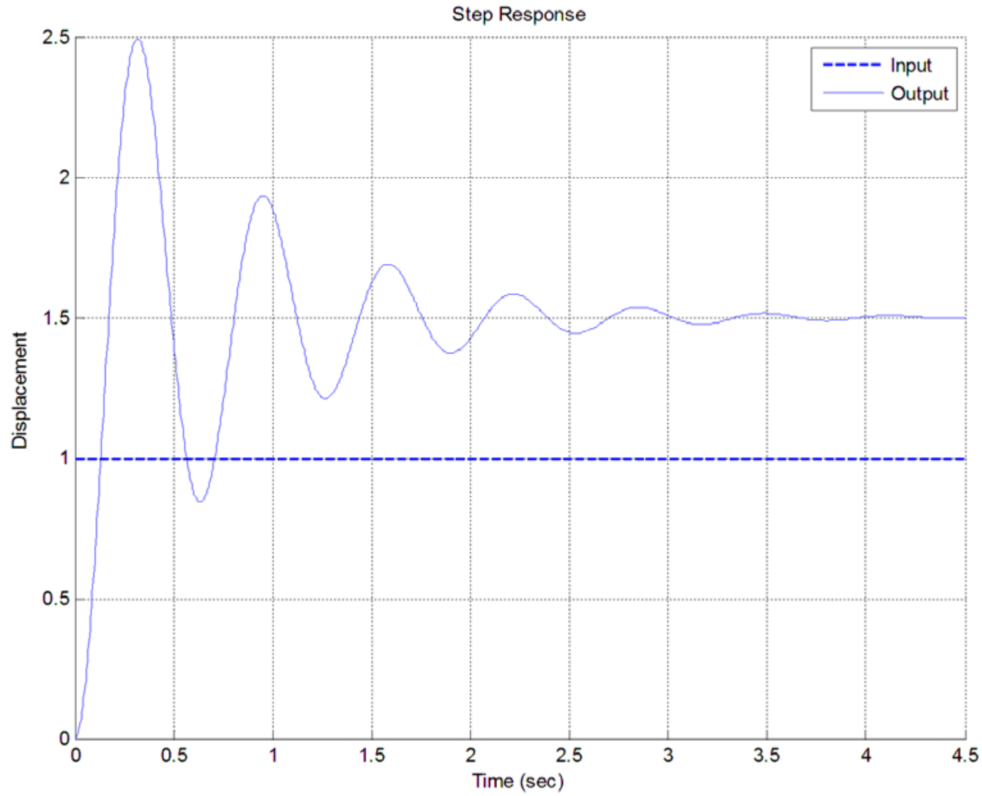
Problems 13 and 14 refer to the **unit step response** of a system, shown below



13) The best estimate of the **steady state error** for a **unit step input** is

a) 0.5 b) -0.5 c) 1.5 d) -1.5 e) none of these

14) The best estimate of the **percent overshoot** is

a) 200% b) 100% c) 67% d) 50% e) none of these

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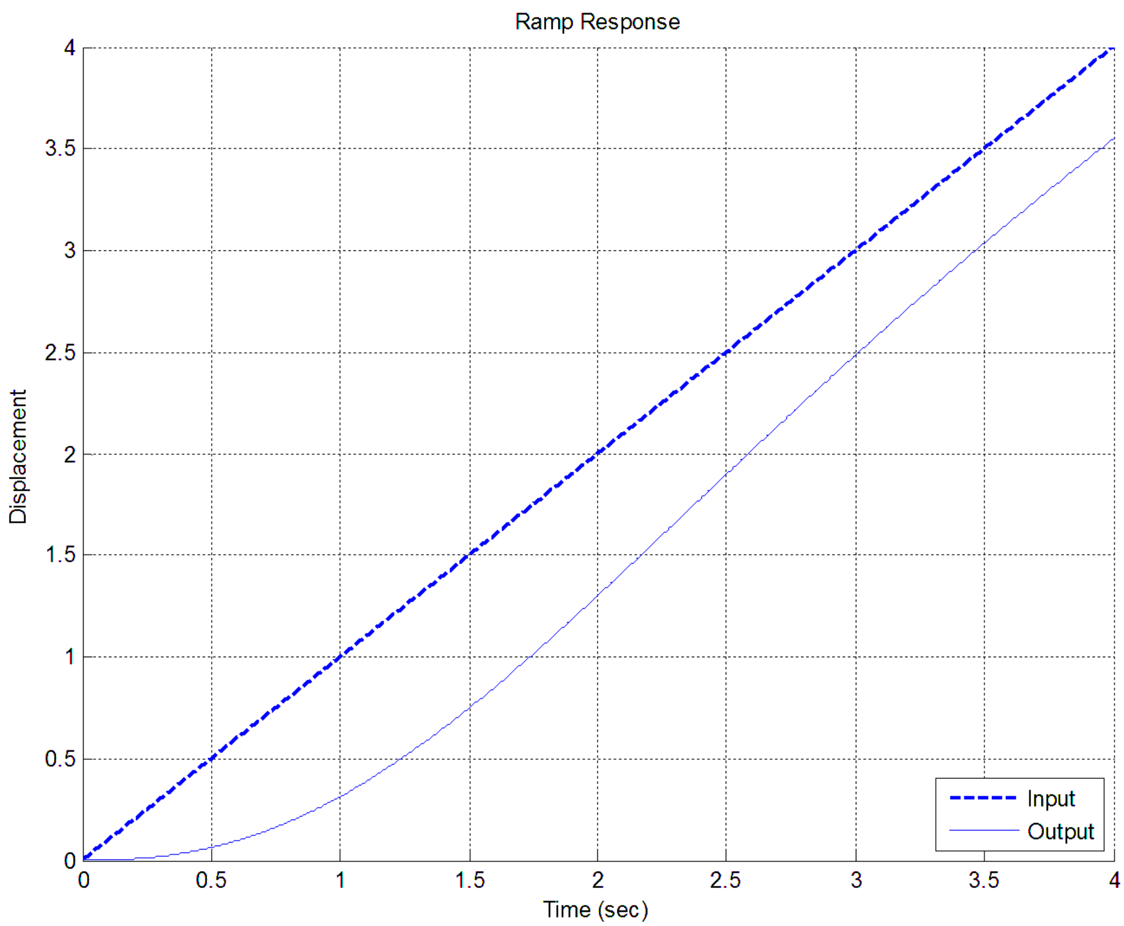
15) For a system with unit ramp response shown below, **t**he best estimate of the **steady state error** is

a) 0.5 b) -0.5 c) 0.8 d) -0.8 e) 0.0 f) none of these



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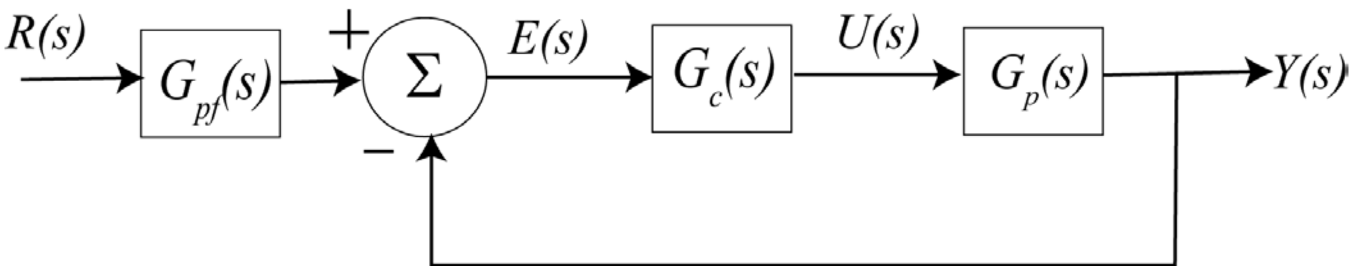
Problems **16-18** refer to the following feedback system, with the plant $G_p(s) = \frac{4}{s+1}$ and proportional controller, $G_c(s) = k_p$



16) What is the (2%) settling time of the plant alone ?

a) 1 second b) 2 seconds c) 3 seconds d) 4 seconds e) none of these

17) If we want the settling time of the closed loop system to be 4/21 seconds, the value of k_p should be

a) 5 b) 10 c) 21 d) 25 e) none of these

18) If we assume the prefilter is 1 ($G_{pf}(s) = 1$), and we want the steady state error for a unit step to be 1/25, then we should choose the value of k_p to be

a) 3 b) 4 c) 5 d) 6 e) none of these