

**ECE-320 Quiz #1**

Problems 1 and 2 refer to the impulse responses of six different systems given below:

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

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

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

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

$$\begin{aligned}
 G_a(s) &= \frac{s-1}{s+1} & G_b(s) &= \frac{1}{s(s+1)} & G_c(s) &= \frac{s}{s^2-1} \\
 G_d(s) &= \frac{s+1}{(s+1+j)(s+1-j)} & G_e(s) &= \frac{(s-1-j)(s-1+j)}{s} & G_f(s) &= \frac{(s-1-j)(s-1+j)}{(s+1-j)(s+1+j)}
 \end{aligned}$$

- 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  $G_d$

Problems 4 and 5 refer to the following transfer function

$$H(s) = \frac{2s+1}{(s+2)^2+1}$$

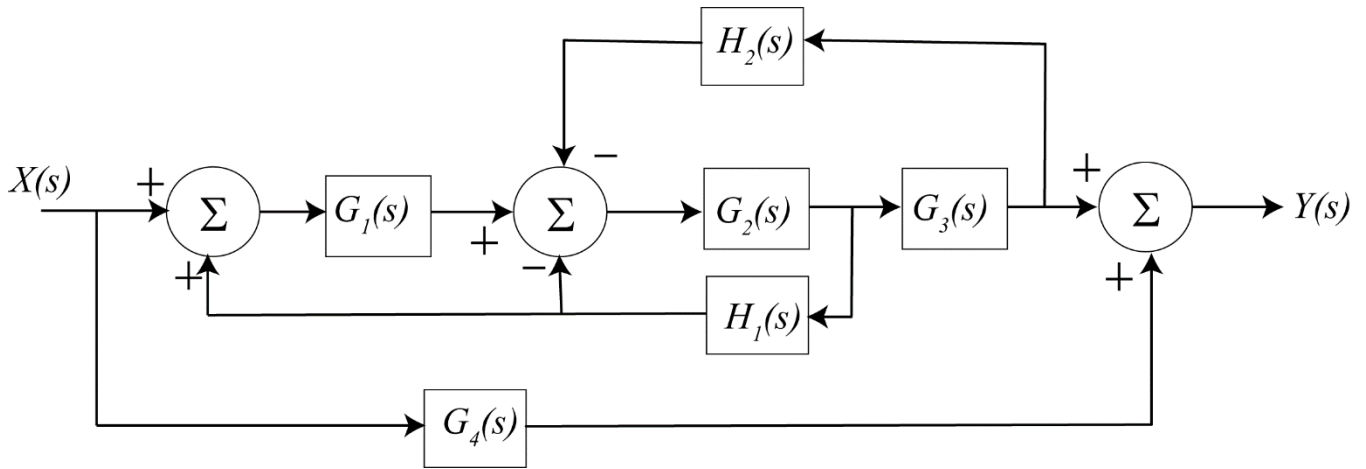
4) For this transfer function, the corresponding impulse response  $h(t)$  is composed of which terms?

- a)  $e^{-t} \cos(2t), e^{-t} \sin(2t)$       b)  $e^{-2t} \cos(t), e^{-2t} \sin(t)$   
 c)  $e^{-t} \cos(4t), e^{-t} \sin(4t)$       d)  $e^{-4t} \cos(t), e^{-4t} \sin(t)$

5) The **poles** of the transfer function are

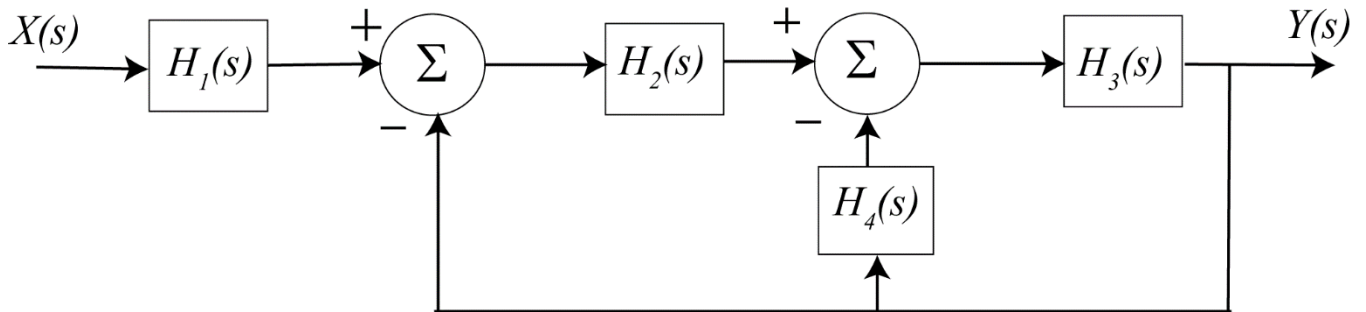
- a)  $2 \pm j$                       b)  $-2 \pm j$   
 c)  $-1 \pm 2j$                       d)  $-1 \pm 4j$

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 many **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** ( $\Delta$ ) 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)  $\frac{H_1H_2H_3}{1 - H_2H_3 - H_3H_4}$  c)  $\frac{H_1H_2H_3}{1 + H_2H_3 + H_3H_4}$