

ECE-205 Practice Quiz 8

(no Tables, Calculators, or Computers)

Problems 1 and 2 refer to the following transfer function $H(s) = \frac{2s+1}{(s+1)^2+4}$

1) 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) $e^{-4t} \cos(t), e^{-4t} \sin(t)$

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

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

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

$$h_1(t) = [1 + e^{-t}]u(t)$$

$$h_2(t) = e^{-2t}u(t)$$

$$h_3(t) = [2 + \sin(t)]u(t)$$

$$h_4(t) = [1 - t^3 e^{-0.1t}]u(t)$$

$$h_5(t) = [1 + t + e^{-t}]u(t)$$

$$h_6(t) = [te^{-t} \cos(5t) + e^{-2t} \sin(3t)]u(t)$$

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

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

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

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

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

- 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

Problems 6 and 7 refer to the following impulse responses of six different systems

$$h_1(t) = [te^{-t}]u(t)$$

$$h_2(t) = e^{-2t}u(t)$$

$$h_3(t) = [2e^{-2t} + t^3 \sin(t)]u(t)$$

$$h_4(t) = [1 - t^3 e^{-0.1t}]u(t)$$

$$h_5(t) = [1 + t + e^{-t}]u(t)$$

$$h_6(t) = [te^{-t} \cos(5t) + e^{-2t} \sin(3t)]u(t)$$

- 6) The number of (asymptotically) **unstable** systems is a) 1 b) 2 c) 3 d) 4
 7) The number of (asymptotically) **marginally stable** systems is a) 1 b) 2 c) 3 d) 4

Problems 8 and 9 refer to a system with poles at $-2+5j$, $-2-5j$, $-10+j$, $-10-j$, and -20

- 8) The best estimate of the **settling time** for this system is
 a) 2 seconds b) 0.4 seconds c) 4/5 seconds d) 0.2 seconds
 9) The **dominant pole(s)** of this system are
 a) $-2+5j$ and $-2-5j$ b) $-10+j$ and $-10-j$ c) -20

10) Which of the following transfer functions represents a (asymptotically) **stable** system?

$$G_a(s) = \frac{s-1}{s+1}$$

$$G_b(s) = \frac{s}{(s+1)}$$

$$G_c(s) = \frac{s}{s^2-1}$$

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

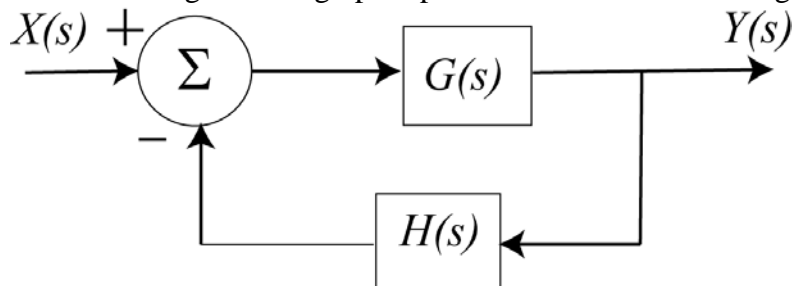
$$G_e(s) = \frac{(s-1-j)(s-1+j)}{(s+2)^2}$$

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

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

For problems 11-15, consider the signal flow graph representation of the following block diagram.



11) The **path** is a) 1 b) G c) H d) GH e) none of these

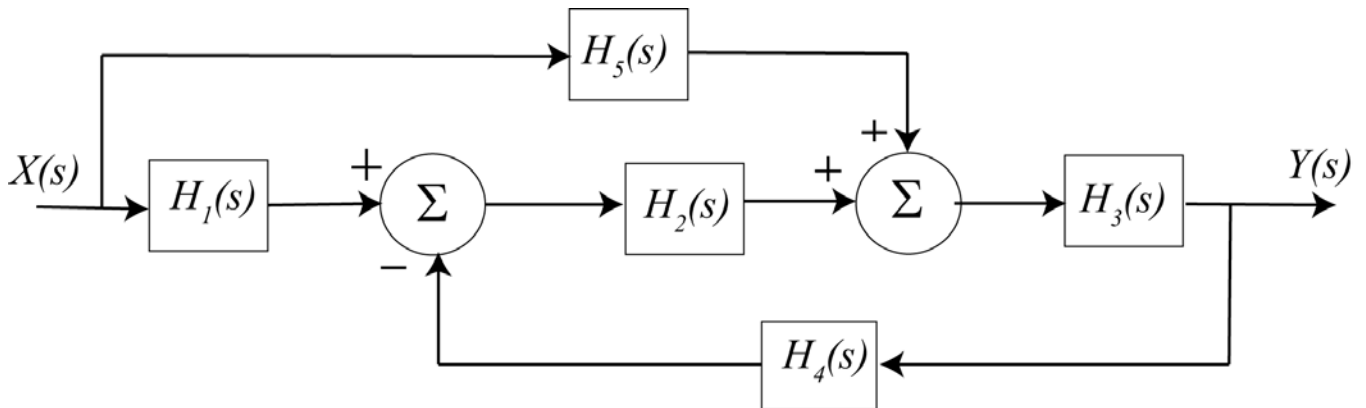
12) The **loop** is a) 1 b) G c) H d) GH e) none of these

13) The **determinant** (Δ) is a) 1 b) $1-GH$ c) $1+GH$ d) none of these

14) The **cofactor** is a) 1 b) G c) H d) GH e) none of these

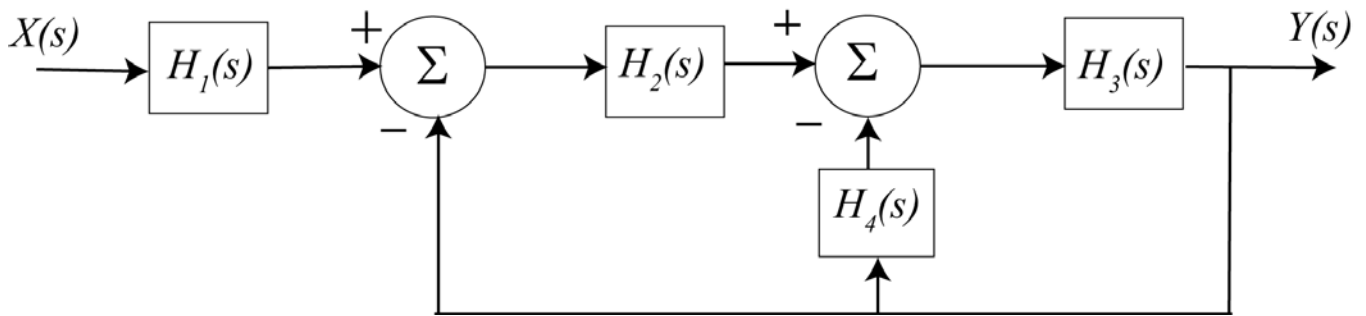
15) The **transfer function** is a) 1 b) G c) GH d) $\frac{G}{1-GH}$ e) $\frac{G}{1+GH}$

For problems 16-19, consider the signal flow graph representation of the following block diagram.



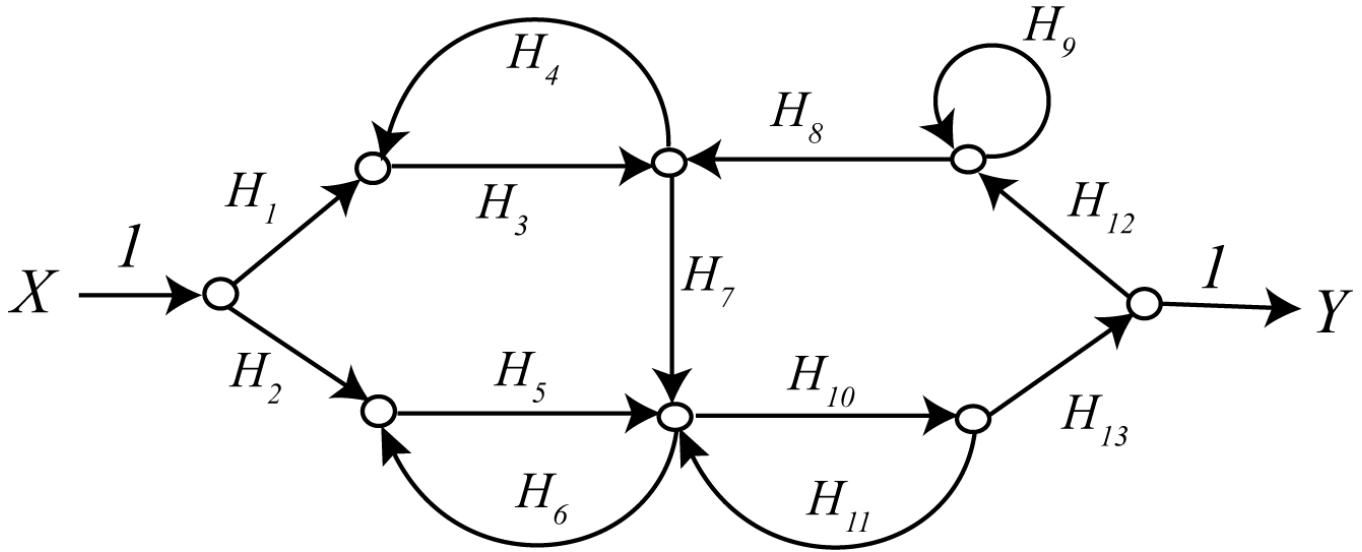
- 16) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4
- 17) How many **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4
- 18) The **determinant** (Δ) is a) 1 b) $1 - H_2H_3H_4$ c) $1 + H_2H_3H_4$ d) none of these
- 19) The **transfer function** is a) 1 b) $\frac{H_3H_5 + H_1H_2H_3}{1 + H_2H_3H_4}$ c) $\frac{H_3H_5 + H_1H_2H_3}{1 - H_2H_3H_4}$

For problems 20 – 23 consider the signal flow graph representation of the following block diagram.



- 20) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4
- 21) How many **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4
- 22) 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
- 23) The **transfer function** is a) 1 b) $\frac{H_1H_2H_3}{1 - H_2H_3 - H_3H_4}$ c) $\frac{H_1H_2H_3}{1 + H_2H_3 + H_3H_4}$

For problems 24-26 consider the following signal flow graph



- 24) How many **paths** are there? a) 1 b) 2 c) 3 d) 4
- 25) How many **loops** are there? a) 2 b) 3 c) 4 d) 5 e) 6 f) 7
- 26) Are any of the **cofactors** equal to 1? a) yes b) no

Answers: 1-a, 2-c, 3-d, 4-b, 5-c, 6-b, 7-a, 8-a, 9-a, 10-a, 11-b, 12-e, 13-c, 14-a, 15-e, 16-c, 17-b, 18-c, 19-b, 20-b, 21-c, 22-c, 23-c, 24-b, 25-d, 26-b