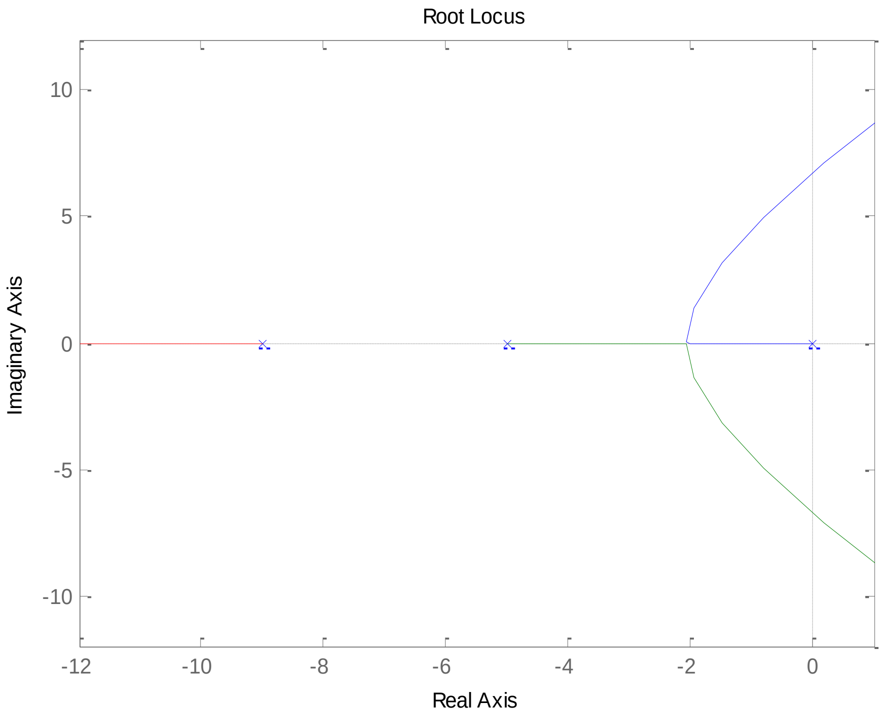
ECE-320, Practice
Quiz #3

Problems 1-5 refer to the following root locus plot for a unity feedback system.



1) Is it possible to find a value of k so that -6 is a closed loop pole? a) Yes b) No

2) When k = 623 two poles of the closed loop system are purely imaginary. In order for the system to remain stable

a) $0 < k < 623$ b) $k > 623$ c) $k > 0$ d) $k < 0$

3) Is it possible to choose k so the system becomes unstable?

a) Yes b) No c) It is not possible to determine given this root locus plot

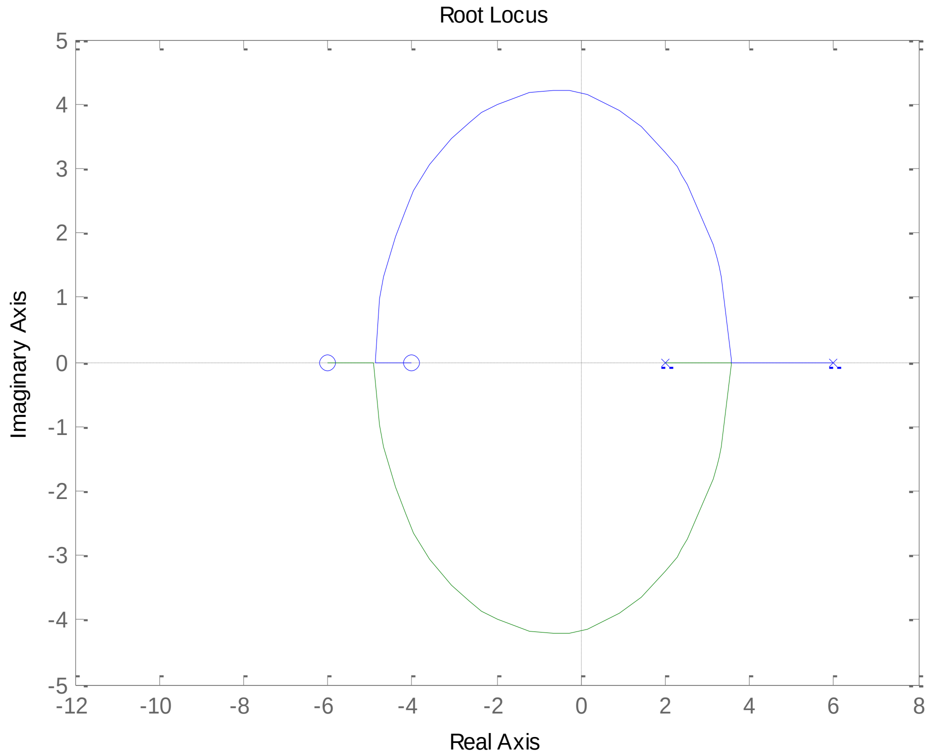
4) What type of system is this?

a) Type 0 b) Type 1 c) Type 2 d) Type 3 e) It is not possible to determine given this root locus plot

5) Is it possible to choose the poles so there is no overshoot (assuming the zeros do not affect the answer)?

a) Yes b) No c) It is not possible to determine given this root locus plot

Problems 6-10 refer to the following root locus plot for a unity feedback system.



6) Is it possible to find a value of *k* so that -5 is a closed loop pole? a) Yes b) No

7) When k = 0.795 two poles of the closed loop system are purely imaginary. In order for the system to remain stable

a) $0 < k < 0.795$ b) $k > 0.795$ c) $k > 0$ d) $k < 0$

8) Is it possible to choose k so the system becomes unstable?

a) Yes b) No c) It is not possible to determine given this root locus plot

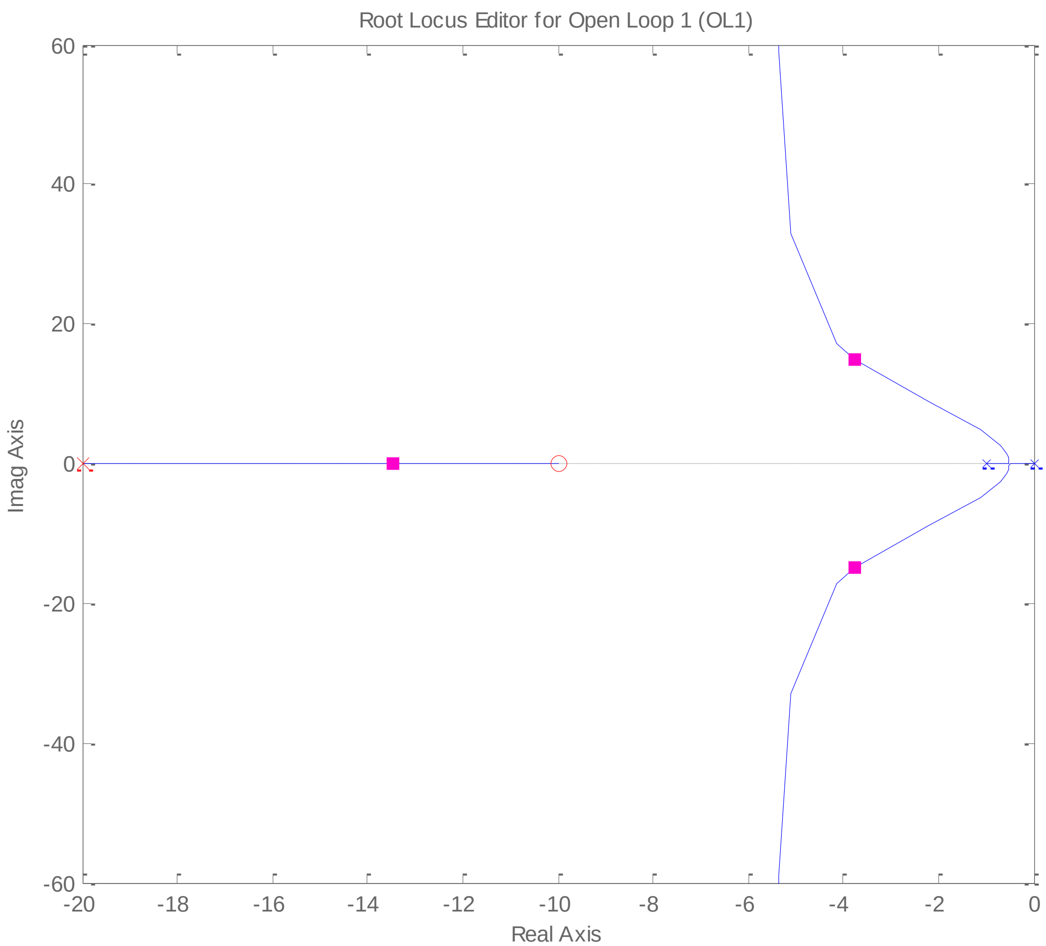
9) What type of system is this?

a) Type 0 b) Type 1 c) Type 2 d) Type 3 e) It is not possible to determine given this root locus plot

10) Is it possible to choose the poles so there is no overshoot (assuming the zeros do not affect the answer)?

a) Yes b) No c) It is not possible to determine given this root locus plot

Problems 11-13 refer to the following root locus plot for a unity feedback system.



11) Based on this root locus plot, the best estimate of the poles of the closed loop system are

a) 0, -2, and -20 b) -4+18j, -4-18j, -14

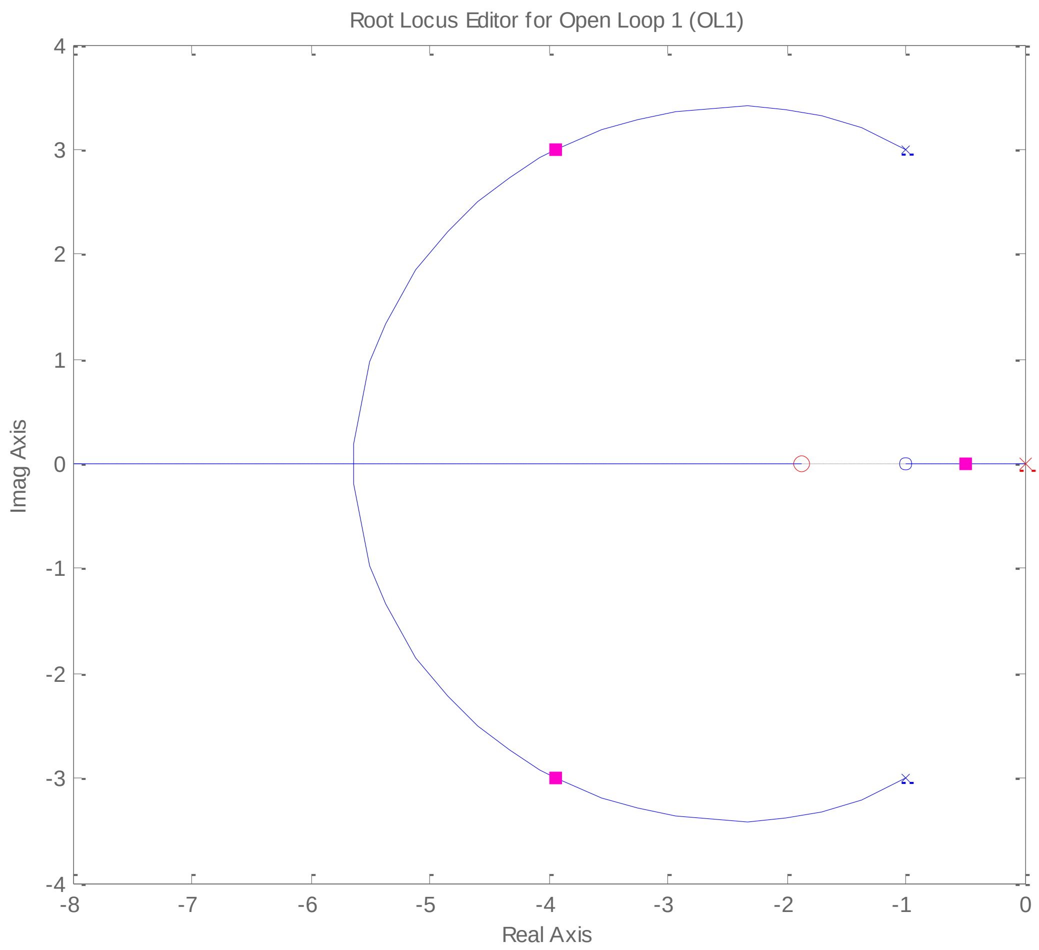
12) Is this a type one system?

a) yes b) no

13) Is this a stable system?

a) yes b) no

Problems 14-16 refer to the following root locus plot for a unity feedback system.



14) Based on this root locus plot, the best estimate of the poles of the closed loop system are

a) -1+j3, -1-3j b) -4+3j, -4-3j, -0.5

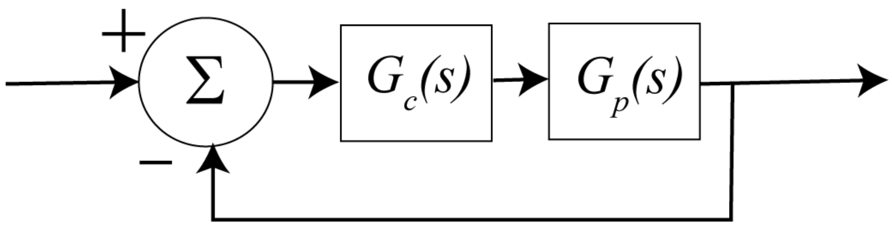
15) Is this a type one system?

a) yes b) no

16) Is this a stable system?

a) yes b) no

Problems 17-22 refer to the following feedback system with plant $G_p(s) = \frac{1}{s+3}$



17) If we use a proportional controller $G_c(s) = k_p$ will the system remain stable for all positive values of k_p?

a) yes   b) no

18) If we use a proportional controller $G_c(s) = k_p$ is there any value of k_p for which the settling time is less than 0.5 seconds?

a) yes   b) no

19) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ will the system remain stable for all positive values of k_i?

a) yes   b) no

20) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ is there any value of k_i for which the settling time is less than 0.5 seconds?

a) yes   b) no

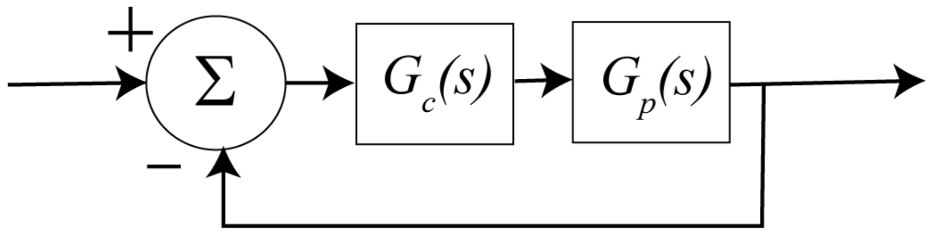
21) For which of the following PI controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = \frac{k(s+2)}{s}$ b) $G_c(s) = \frac{k(s+6)}{s}$ c) the results will be the same

22) For which of the following PD controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = k(s+5)$ b) $G_c(s) = k(s+10)$ c) the results will be the same

Problems 23-28 refer to the following feedback system with plant $G_p(s) = \frac{1}{(s+2+3j)(s+2-3j)}$



23) If we use a proportional controller $G_c(s) = k_p$ will the system remain stable for all positive values of k_p?

a) yes   b) no

24) If we use a proportional controller $G_c(s) = k_p$ is there any value of k_p for which the settling time is less than 0.5 seconds?

a) yes   b) no

25) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ will the system remain stable for all positive values of k_i?

a) yes   b) no

26) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ is there any value of k_i for which the settling time is less than 0.5 seconds?

a) yes   b) no

27) For which of the following PI controllers will the system become unstable as $k \to \infty$

a) $G_c(s) = \frac{k(s+2)}{s}$ b) $G_c(s) = \frac{k(s+6)}{s}$ c) $G_c(s) = \frac{k(s+10)}{s}$

28) For which of the following PD controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = k(s+5)$ b) $G_c(s) = k(s+10)$ c) the results will be the same

For your ease, assume the form of convolution $y(n) = \sum_{k=-\infty}^{k=\infty} x(k)h(n-k)$ in all of the following problems.

29) The finite summation $S_N = \sum_{k=0}^{N} a^k$ is equal to

a) $\frac{1-a^N}{1-a}$ b) $\frac{1-a^{N-1}}{1-a}$ c) $\frac{1-a^{N+1}}{1-a}$ d) $\frac{1+a^{N+1}}{1-a}$ e) none of these

30) The finite summation $S = \sum_{k=2}^{N-3} a^k$ is equal to

a) $\frac{1-a^{N-4}}{1-a}$ b) $a^2\left(\frac{1-a^{N-4}}{1-a}\right)$ c) $a^2\left(\frac{1-a^{N+4}}{1-a}\right)$ d) $a^2\left(\frac{1-a^{N-1}}{1-a}\right)$ e) none of these

31) For a discrete time system, $\delta(0)$ is equal to

a) 0 b) 1 c) ∞ d) it is not defined

32) If an LTI system with impulse response $h(n) = 4^n u(n)$ has input $x(n) = \delta(n)$, the output of the system is

a) $y(n) = 4^n u(n)\delta(n)$ b) $y(n) = 4^n \delta(n)$ c) $y(n) = 4^n u(n)$ d) none of these

33) If an LTI system with impulse response $h(n) = 3^n u(n)$ has input $x(n) = 3\delta(n-1)$, the output of the system is

a) $y(n) = 3^{n+1} u(n-1)$ b) $y(n) = 3^n u(n-1)$ c) $y(n) = 3^n u(n)$ d) none of these

34) If an LTI system with impulse response $h(n) = 2^n u(n-1)$ has input $x(n) = 2\delta(n-1)$, the output of the system is

a) $y(n) = 2^{n-1} u(n-2)$ b) $y(n) = 2^n u(n-2)$ c) $y(n) = 2^{n-1} u(n-2)$ d) none of these

35) If an LTI system with impulse response $h(n) = 3\delta(n-1)$ has input $x(n) = 2^n u(n-1)$, the output of the system is

a) $y(n) = 3\times 2^{n-1}u(n-2)$ b) $y(n) = 3\times 2^n u(n-1)$ c) $y(n) = 3\times 2^n u(n-2)$ d) none of these

36) If an LTI system with impulse response $h(n) = 3^n u(n)$ has input $x(n) = u(n)$, the output of the system is

a) $y(n) = 3^n u(n)$ b) $y(n) = 3^{n+1}u(n)$ c) $y(n) = \frac{1-3^{n+1}}{1-3}u(n)$ d) $y(n) = \frac{1-3^{n-1}}{1-3}u(n)$ e) none of these

37) If an LTI system with impulse response $h(n) = 3^n u(n)$ has input $x(n) = 2^n u(n)$, the output of the system is

a) $y(n) = 3^n 2^n u(n)$ b) $y(n) = 3^n \dfrac{1-\left(\frac{2}{3}\right)^{n+1}}{1-\frac{2}{3}}u(n)$ c) $y(n) = 2^n \dfrac{1-\left(\frac{3}{2}\right)^{n+1}}{1-\frac{3}{2}}u(n)$

d) $y(n) = \left[\dfrac{1-\left(\frac{1}{2}\right)^{n+1}}{1-\frac{1}{2}}\right]\left[\dfrac{1-\left(\frac{1}{3}\right)^{n+1}}{1-\frac{1}{3}}\right]u(n)$ e) none of these

38) The sum $S = \sum_{k=0}^{\infty} a^k$ will converge provided

a) $|a| > 1$ b) $|a| < 1$

39) If the sum $S = \sum_{k=0}^{\infty} a^k$ converges, it is equal to

a) $\frac{1}{1+a}$ b) $\frac{1}{1-a}$ c) $\frac{a}{1-a}$ d) $\frac{a}{1+a}$ e) none of these

Answers: 1-b, 2-a, 3-a, 4-b, 5-a, 6-a, 7-b, 8-a, 9-a, 10-a, 11-b, 12-a, 13-a, 14-b, 15-a, 16-a, 17-a, 18-a, 19-a, 20-b, 21-b, 22-b, 23-a, 24-b, 25-b, 26-b, 27-b and c, 28-b, 29-c, 30-b, 31-b, 32-c, 33-b, 34-b, 35-a, 36-c, 37-b, 38-b, 39-b