

**ECE-320,  
Practice Quiz #7**

For all of the following problems, assume we are using a two-sided z-transform.

1) The z-transform of a sequence  $x(n)$  is defined as

a)  $X(z) = \sum_{k=-\infty}^{\infty} x(k)z^k$     b)  $X(z) = \sum_{k=-\infty}^{\infty} x(k)z^{-k}$

2) The z-transform of the sequence  $x(n) = 3^n u(n)$  is

a)  $\frac{z}{3-z}$     b)  $\frac{1}{z-3}$     c)  $\frac{1}{3-z}$     d)  $\frac{z}{z-3}$     e) none of these

3) The z-transform of  $x(n) = u(n)$  is

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

4) The z-transform of  $x(n) = u(n-1)$  is

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

5) The z-transform of the sequence  $x(n) = \delta(n)$  is

a) 1    b)  $z$     c)  $z^{-1}$     d) 0    e) none of these

6) The z-transform of the sequence  $x(n) = \delta(n-1)$  is

a) 1    b)  $z$     c)  $z^{-1}$     d) 0    e) none of these

7) The z-transform of the sequence  $x(n) = 3^{n-1} u(n)$  is

a)  $\frac{3z}{z-3}$     b)  $\frac{1}{3} \frac{z}{z-3}$     c)  $\frac{1}{3} \frac{z^2}{z-3}$     d)  $\frac{3z^2}{z-3}$     e) none of these

8) The z-transform of the sequence  $x(n) = 3^{n+1}u(n-1)$  is

- a)  $\frac{3}{z-3}$    b)  $\frac{3z}{z-3}$    c)  $\frac{9z}{z-3}$    d)  $\frac{9}{z-3}$    e) none of these

9) The z-transform of the sequence  $x(n) = 3^{n-1}u(n+1)$  is

- a)  $\frac{3z^2}{z-3}$    b)  $\frac{1}{3} \frac{z}{z-3}$    c)  $\frac{1}{9} \frac{z^2}{z-3}$    d)  $\frac{1}{3} \frac{z^2}{z-3}$    e) none of these

10) The z-transform of the sequence  $x(n) = 2^n u(n)$  converges provided

- a)  $2 < |z|$    b)  $|z| < 2$

11) The z-transform of the sequence  $x(n) = \left(\frac{1}{3}\right)^n u(n-1)$  converges provided

- a)  $\frac{1}{3} < |z|$    b)  $|z| < \frac{1}{3}$

12) For z-transform  $Y(z) = \frac{1}{z-2}$ , the inverse z-transform is

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

13) For z-transform  $Y(z) = \frac{1}{z-2}$ , the inverse z-transform is

- a)  $y(n) = \frac{1}{2} \delta(n) - \frac{1}{2} 2^n u(n)$    b)  $y(n) = -\frac{1}{2} \delta(n) + \frac{1}{2} 2^n u(n)$

14) Which of the following transfer functions represents an (asymptotically) unstable systems? (circle all of them)

- a)  $G(z) = \frac{z}{z+0.8}$    b)  $G(z) = \frac{z}{z-0.8}$    c)  $G(z) = \frac{z}{z+1.2}$    d)  $G(z) = \frac{z}{z-1.2}$

15) Which of the following systems will have a smaller settling time?

- a)  $G(z) = \frac{z}{z-0.9}$    b)  $G(z) = \frac{z}{z-0.7}$    c)  $G(z) = \frac{z}{z+0.5}$    d)  $G(z) = \frac{z}{z+0.1}$

16) Which of the following systems will have a smaller **settling time**?

a)  $G(z) = \frac{1}{(z-0.2+j0.2)(z-0.2-j0.2)}$    b)  $G(z) = \frac{1}{(z-0.1+j0.5)(z-0.1-j0.5)}$    c)  $G(z) = \frac{1}{(z+0.5)}$

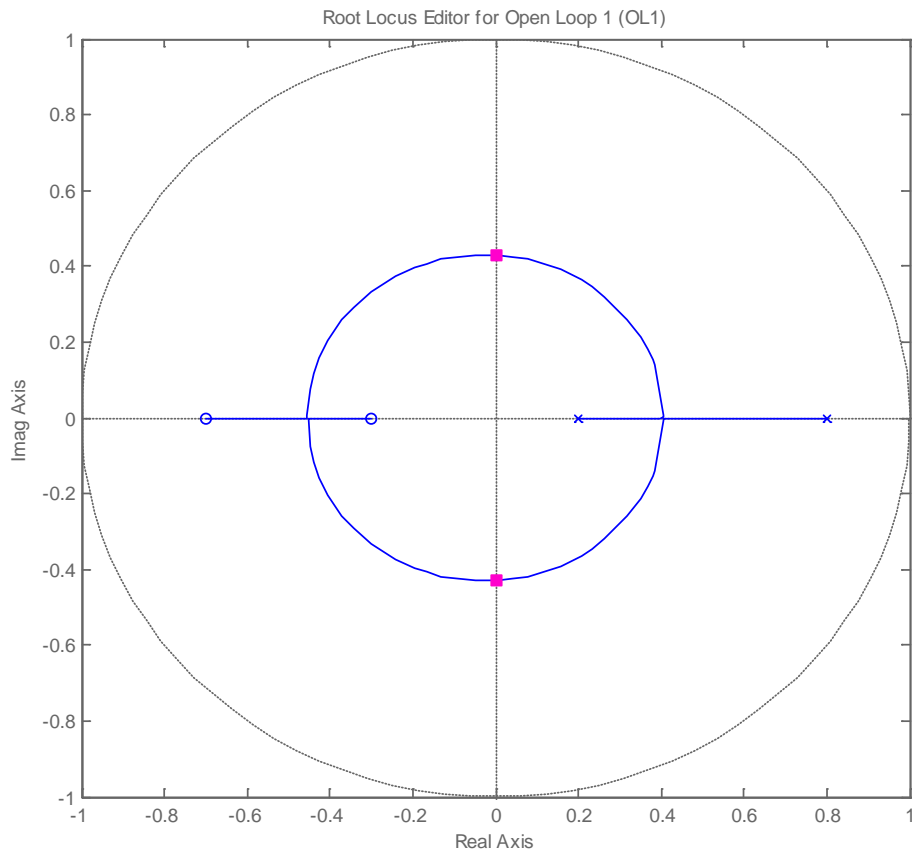
17) Consider a continuous-time system with plant transfer function  $G_p(s) = \frac{1}{s+2}$ . If we sample the system and then convert it to a discrete-time transfer function, the equivalent discrete-time transfer will be

a)  $G_p(z) = \frac{z}{z-e^{-2T}}$    b)  $G_p(z) = \frac{z}{z+e^{-2T}}$    c)  $G_p(z) = \frac{z}{z+e^{+2T}}$    d)  $G_p(z) = \frac{z}{z-e^{+2T}}$    e) none of these

18) Consider a continuous-time stable system with a plant transfer function  $G_p(s)$  that is modeled as a discrete-time transfer function  $G_p(z)$  assuming a zero order hold. As the sampling interval T gets smaller, the poles of  $G_p(z)$

- a) move closer to the unit circle (the system becomes less stable)
- b) move closer to the origin (the system becomes more stable)
- c) do not move

Problems 19 and 20 refer to the following root locus plot for a discrete-time system



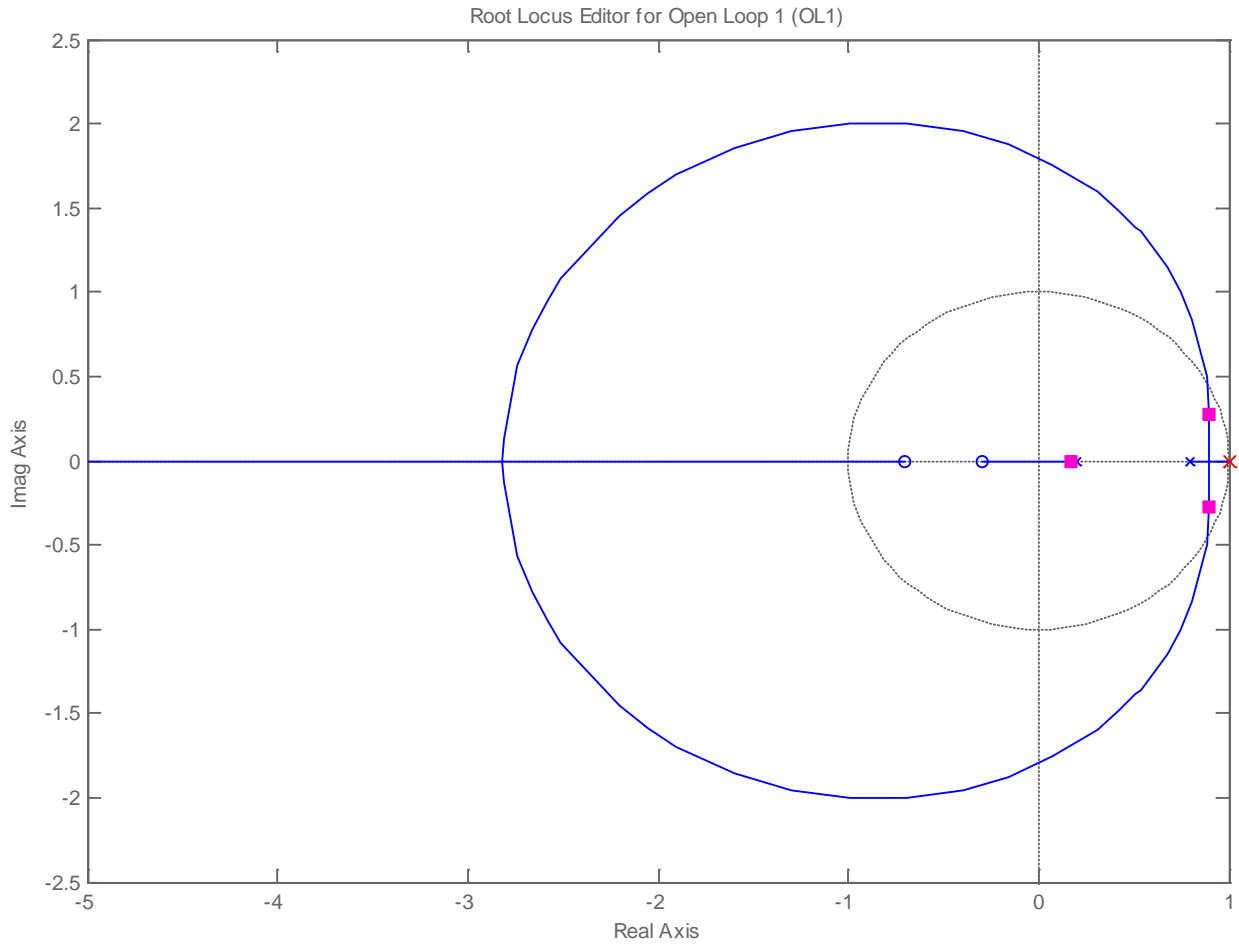
**19)** Are there any values of  $k$  (the variable parameter) for which the system is stable?

a) yes   b) no   c) there is not enough information to answer

**20)** As  $k$  increases, the close loop poles of the system

a) move to the left   b) move to the right   c) do not move at all

Problems 21-23 refer to the following root locus plot for a discrete-time system



**21)** With the closed loop pole locations shown in the figure, is the closed loop system stable?

a) yes b) no c) not enough information

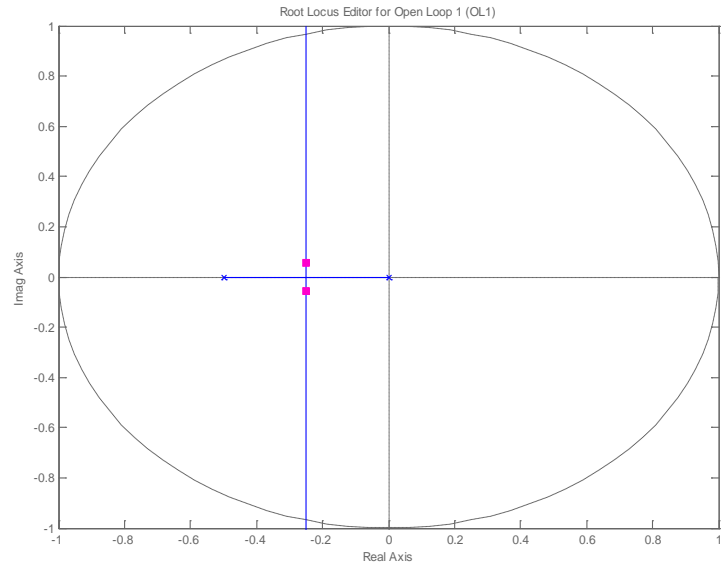
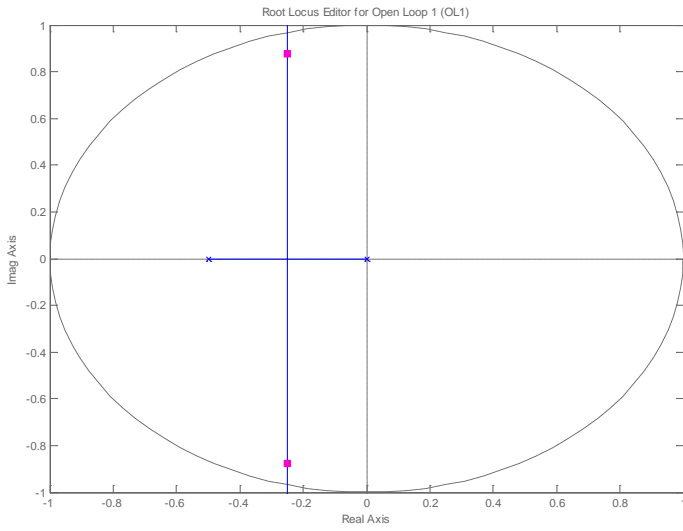
**22)** Is there any value of  $k$  for which the closed loop system is stable?

a) yes b) no c) not enough information

**23)** Is this a type one system?

a) yes b) no c) not enough information

Problems 24 and 25 refer to the following two root locus plot for a discrete-time system



**24)** For which system is the settling time likely to be smallest?

- a) The system on the left   b) the system on the right   c) the settling time will be the same

**25)** Is this a type 1 system?

- a) yes   b) no   c) not enough information

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