Write MATLAB Programs for the following:

1. . Obtain the inverse Z –transform of the following:

$$X(z)=\frac{z^2+2z}{Z^2-2z+1} \quad \text{and} \quad f(z)=\frac{z(z+1)}{(z-1)^3}$$

2. For the LTI systems described by the following difference equations generate its impulse response and unit step response:
   1. Y(n)= x(n)+2x(n-1)
   2. Y(n)=0.9y(n-1)+x(n) also find the analytical expression
   3. Y(n)-0.3695y(n-1)+0.1958y(n-2)= 0.2066x(n)+0.4131x(n-1)+0.2066x(n-2)

3. For the discrete-time transfer function

$$H(z) = \frac{0.25^3-0.6273z^2+0.5153z-0.1367}{Z^3-2.811z^2+2.652z-0.8395}$$, obtain the following

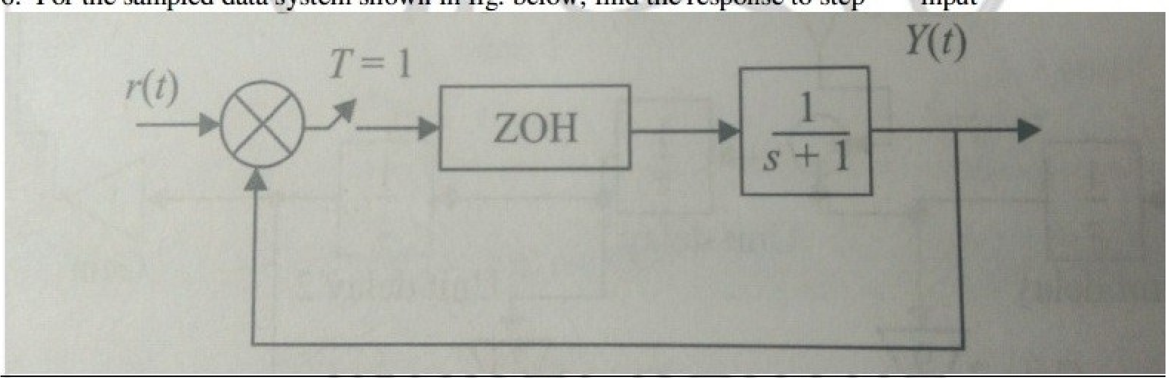
- Transfer function to polo-zero conversion
- Draw the polo-zero plot
- Polo-zero to transfer function
- Find the partial fraction expression of the transfer function
- r , p , k to transfer function
- Root locus and stability analysis

4. Find the ZOH equivalent transfer function of $\frac{10}{5s+1}$ .Obtained with the sampling period Ts=0.5sec.

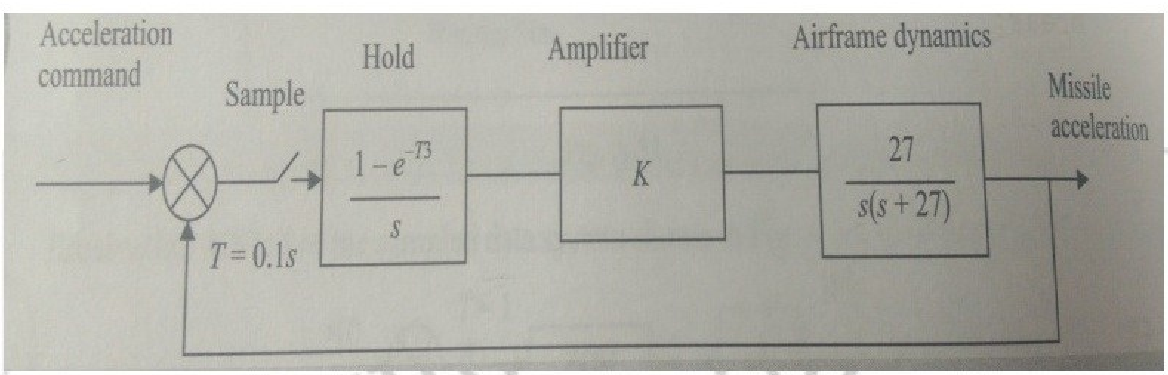
5. Obtain the six different realizations of the pulse transfer function

$$\frac{y(z)}{u(z)} = \frac{z+3}{z^3+9z^2+24z+20}$$

6. For the sampled data system shown in fig. below, find the response to step input



7. Find the gain for stability.



8. Determine whether the system is observable and state controllable.

$$x = \begin{bmatrix} -2 & -1 & -3 \\ 0 & -2 & 1 \\ -7 & -8 & -9 \end{bmatrix} x + \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix} u; y = [4 \quad 6 \quad 8]x$$

9. Obtain bilinear transformation for
   (i) $z^3 - 1.3z^2 + 0.08z + 0.24 = 0$ and analyse the stability.
   (ii) Obtain the root locus and analyze the stability.

10. Find the pulse transfer function of the given continuous-time system given below
    A= [0 0;1 -0.1]; B= [0.1; 0]; C= [0 1]; D=[0] For sampling time Ts = 0.2 s.