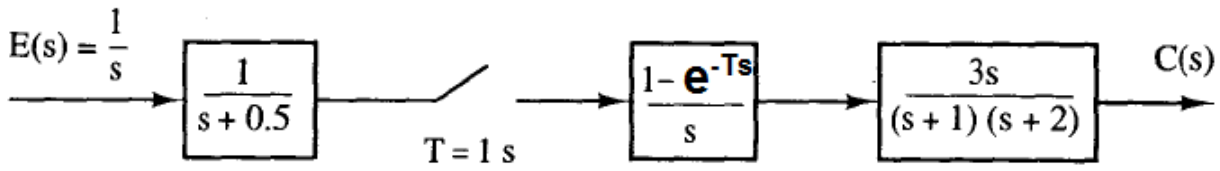
1- Find the system response at the sampling instants to a unit step input for the system shown below. Plot the output signal showing the initial and final values.



2- Assume a digital filter is given by the following difference equation:

$$y(k) + a_1 y(k-1) + a_2 y(k-2) + a_3 y(k-3) = b_1 x(k) + b_2 x(k-1) + b_3 x(k-2)$$

Draw block diagrams for the filter using (a) direct programming, (b) standard programming, and (c) ladder programming.

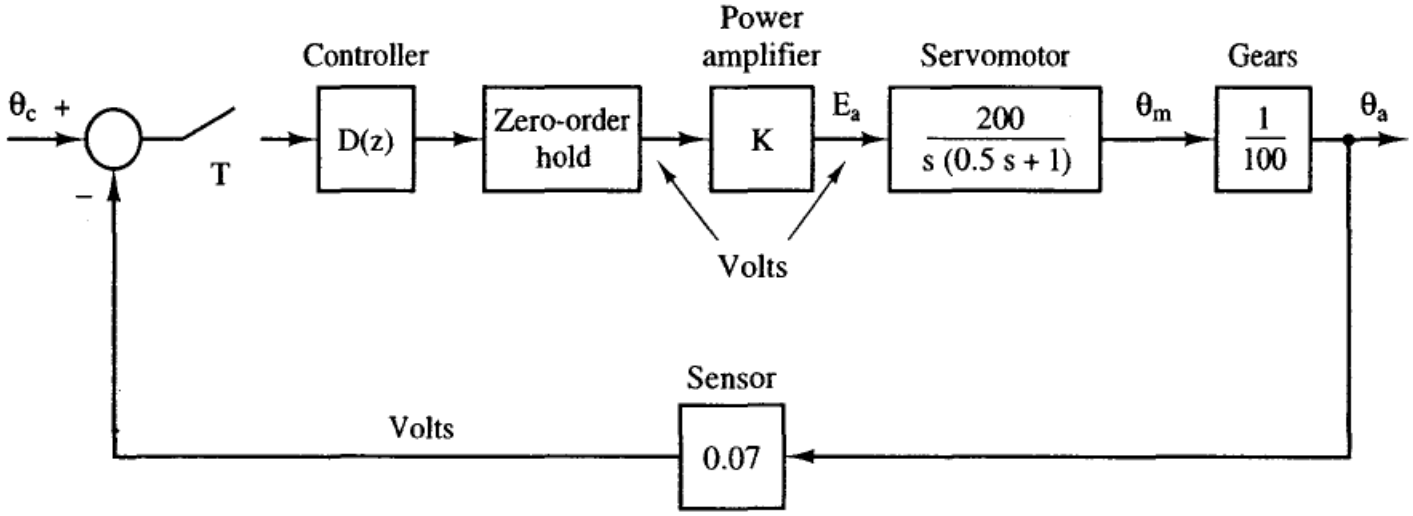
3- Assume a digital filter is given by the following difference equation:

$$y(k) + 0.4y(k-1) - 0.12y(k-2) = 2x(k) + 2.2x(k-1) + 0.2x(k-2)$$

Realize the digital filter using (a) series scheme, (b) parallel scheme, and (c) ladder scheme.

4- Write a computer program to solve and plot y(k) for the system given in Q2. Obtain results for different patterns of a's and b's.

5- Consider the robot arm control system shown below. The power amplifier gain is given by K=2.4 and sampling period is T=0.1 Sec.



a- Find the PTF of the system.

b- Assume a proportional controller D(z)=P, plot the system unit step response using MATLAB for different values of P. Compare with manually computed values. Comment on your results.

c- Repeat Part b but using a digital PI controller. Comment on your results.