Lab 3

Pre-Lab

Question 2.1)

This is an IIR filter because it is using a combination of the current and past inputs (ax[n]) and the past outputs ((1-a)y[n-1]).

Question 2.2)

The steady-state output for of this filter 1. To reach a steady-state error or 95%, it would take $\frac{\log(0.05)}{\log(1-\alpha)} - 1$ samples.

Work:

$$y[n] = 1 - (1-\alpha)^{n+1}$$

$$0.95 = 1 - (1-\alpha)^{n+1}$$

$$0.05 = (1-\alpha)^{n+1}$$

$$\log(0.05) = (n+1)\log(1-\alpha)$$

$$\frac{\log(0.05)}{\log(1-\alpha)} = n+1$$

$$n = \frac{\log(0.05)}{\log(1-\alpha)} - 1$$

Question 2.3)

In determining the altitude, there could be outliers that provide an altitude way above the actual altitude of the quadcopter. Using this data would make the quadcopter think it is very high up and cause the motors to spin slower, causing the quadcopter to fall and possibly hit the floor. Using a low-pass filter to cut off all altitudes above a specified height would fix these outliers and possibly provide more stability to the quadcopter.