**Quiz 7**

**Lance Go**

**February 24, 2022**

**1. Give pseudocode for a basic PID controller (without integrator anti-windup).**

**There are functions get\_ref() and get\_sensor() to call, and you can make others if you want.**

**There are already global variables, and you can add more:**

static volatile float eint = 0;

static volatile float eprevious = 0;

static volatile float ediff = 0;

\_\_ISR(timer at 1kHz) {

ref = get\_ref();

sensor = get\_sensor();

error = ref – sensor

ediff = error – eprevious;

eint = error + eint;

u = Kp\*error + Ki\*eint + Kd \* ediff;

eprevious = error;

control(u);

interrupt\_flag = 0;

}

**2. Explain what integrator anti-windup is:**

If the integrator is allowed to build up to a very high value, the system can create a response that has too much error in the opposite direction. This can create oscillations in the system. To prevent a build up from happening, integrator anti-windup can be used. Integrator anti-windup is a limit that can be put on the integrator term to stop the integrator before it builds too much.

**3. You have picked Kp, Ki, and Kd gains.**

**(a) The response has too much overshoot. Which gain could you increase to reduce the**

**overshoot?**

Kd

**(b) The response has too much overshoot. Which gain could you decrease to reduce the**

**overshoot?**

Kp

**(c) The response has the right overshoot and settling time characteristics, but too much**

**steady-state error. Which gain could you increase to reduce the steady-state error?**

Ki