Process Control, 3P4 Your name: _____

Tutorial 8 - Monday Student number: _____

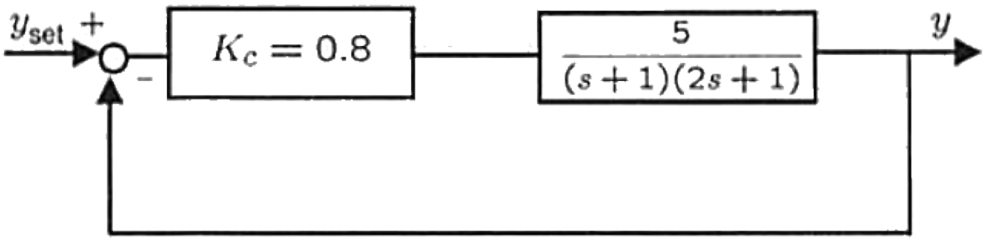
This tutorial provides some practice for the next midterm, and makes sure you understand some concepts from this week's classes.

Question 1

From a previous midterm

1. For the process transfer function $G_p(s) = \dfrac{5}{(s+1)(2s+1)}$: is it overdamped, underdamped, or critically damped? _____
2. For the same process transfer function: what are the roots?

3. Write out an analytical transfer function for the closed loop response, $\dfrac{y(s)}{y_{\text{set}}(s)}$.



4. Determine the amount of offset at steady-state for a step input of 2 units in the set point. (You must do the calculations by hand, not with Simulink).

5. Describe what the time-domain characteristics of the *closed-loop* response will be: overdamped, critically damped, underdamped? And what will be the roots of the closed loop transfer function, $\frac{y(s)}{y_{\text{set}}(s)}$?

Question 2

Challenge for extra credit [double your tutorial grade for today]. Calculate the controller tuning settings (K_c, T_I, T_D) for a PID controller that controls a process that may be approximated by the following transfer function, $G_p = \frac{-4e^{-5s}}{3s+1}$. Explain clearly why the controller gain, K_c is negative.

Now set the derivative mode, $T_D = 0$, then show what the final value of the controlled variable will be for a step change of 2 units in the set point. *Submit answers on a separate page*.