Eskişehir Osmangazi University - Electrical Engineering Department Fundamentals of Control Systems First Midterm Examination - Spring 2009

1. [40 pts.] Consider the signal flow graph of a linear time invariant system shown in Fig. 1. Obtain the transfer function $\frac{C(s)}{R(s)}$.



Figure 1: Signal flow graph referenced by Problem 1

2. [30 pts.] Let the unit step input be applied to the system with the transfer function in Figure 2. Obtain the peak time and peak value of the output.



Figure 2: Transfer function referenced by Problem 2

3. [30 pts.] Sketch the canonical realization of the transfer function

$$H(s) = \frac{2s+1}{s^2+4s+3}$$

Good Luck, A. Karamancıoğlu Solutions

1.

$$\frac{C(s)}{R(s)} = \frac{G_1(1 - G_2H_2)}{1 - G_1H_1 - G_2H_2 - G_1H_2 + G_1H_1G_2H_2}$$
2. $\xi = 0.6, w_n = 2$
 $t_p = \frac{\pi}{w_d} = \frac{\pi}{2\sqrt{1 - 0.6^2}} = 1.9635$



Figure 3: Equivalent transfer function for Problem 2

$$c(t_p) = 0.5(1 + e^{\frac{-\xi\pi}{\sqrt{1-\xi^2}}}) = 0.5(1 + e^{-0.75\pi}) = 0.5474$$

3.



Figure 4: Canonical realization for Problem 3