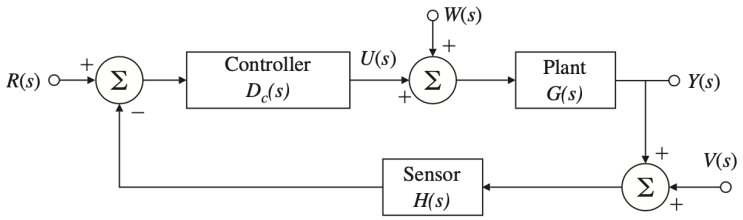
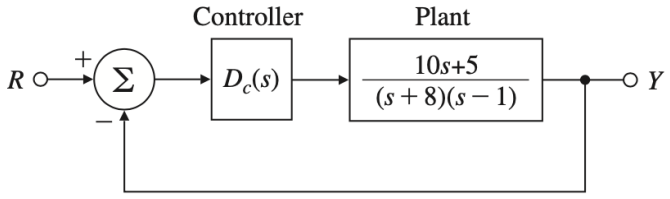
Final Exam

Subject : Control System Engineering 1, Lecturer : Prof. Youngjin Choi,
Date : June 19, 2020 (Contact e-mail : cyj@hanyang.ac.kr)

Problem 1 (20pt) Consider the following figure with $G(s) = \frac{1}{s(\tau s+1)}$, $D_c(s) = k_P + k_D s$ and $H(s) = 1 + k_t s$. Determine the system type and relevant error constant with respect to the reference inputs when $V = W = 0$.



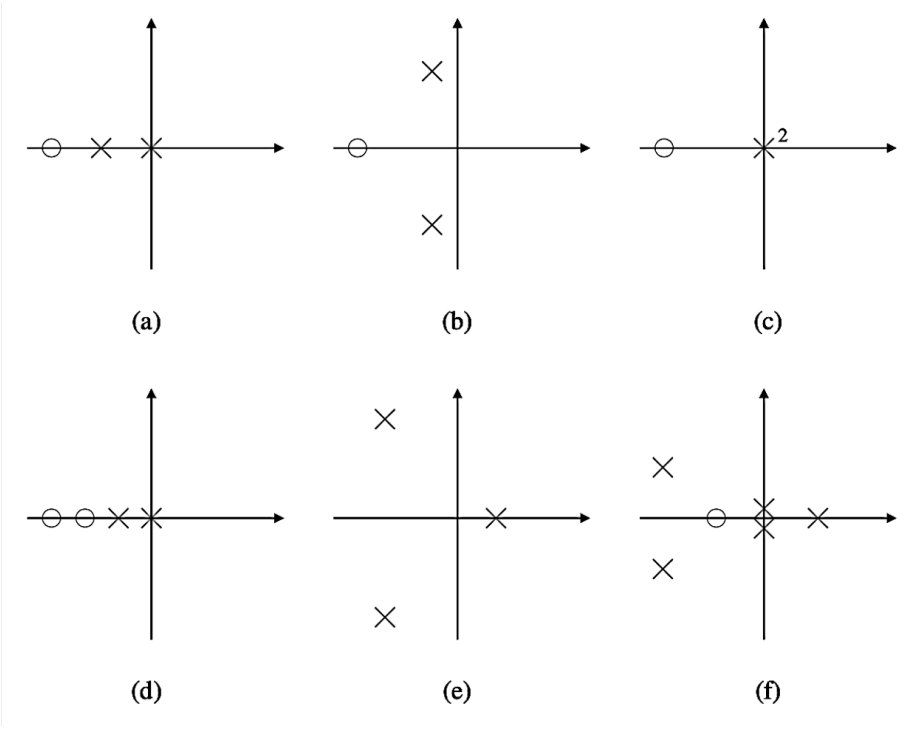
Problem 2 (20pt) Consider the controller of the form $D_c(s) = \frac{1}{s^n}$ with n being a non-negative integer. For what values of n is the closed-loop system stable?



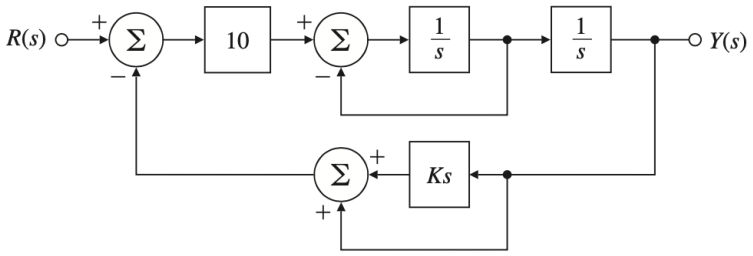
Problem 3 (20pt) Roughly sketch the root loci for the following pole-zero maps. Each pole-zero map is from a characteristic equation of the form:

$$1 + K\frac{b(s)}{a(s)} = 0$$

where the roots of the $b(s)$ are shown as small circles $\circ$ and the roots of the $a(s)$ are shown as $\times$ on the s-plane. Note, in figure (c), there are two poles at the origin.



Problem 4 (20pt) For the feedback system shown in the figure, find the value of the gain K that results in dominant closed-loop poles with a damping ratio $\zeta = \frac{1}{\sqrt{2}}$



Problem 5 (20pt) Draw the root locus with respect to K for the equation $1 + KL(s) = 0$, where the departure angles should be calculated and suggested.

$$L(s) = \frac{s+3}{s(s+10)(s^2+2s+2)}$$