

# Midterm #1

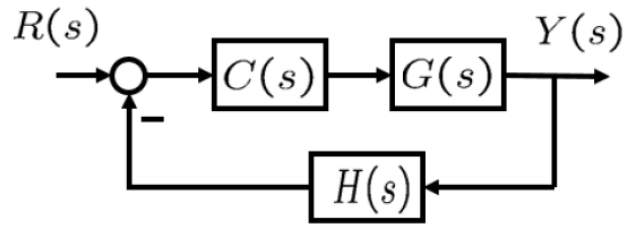
## ECE 317: Feedback and Control

- Closed book and closed notes, except as described below.
- One only ( $8\frac{1}{2}'' \times 11''$ ) page of notes is permitted. (Written on both sides is OK).
- No calculators can be used.
- Scrap paper is not to be used. Show all work on the exam paper.

Student name: \_\_\_\_\_

**Problem 1.**

Given the system below where the plant  $G(s) = \frac{1}{s-1}$ , the feedback gain,  $H(s) = \frac{1}{2}$ , and  $C(s) = k$  (a constant).



- Is the (open loop) plant stable? Why?
- Find the closed loop transfer function,  $\frac{Y(s)}{R(s)}$ .
- Find the range of  $k$  for which the closed loop system is stable.
- Under the condition of a very high loop gain, what is the closed loop gain very well approximated by?



**Problem 3.**

a) Write the definition of asymptotic stability.

b) Write the definition of BIBO stability.

c) Determine if  $G(s)$  in the table is stable, marginally stable or unstable. Justify your answers.

$G(s)$	Stable/ marginally stable/ unstable
$\frac{s-2}{s(s+1)(s+2)^2}$	
$\frac{s-2}{s(s+1)(s+2)}$	
$\frac{s-2}{s(s+1)(s^2+2)}$	
$\frac{s-2}{s(s+1)(s^2+2)^2}$	