O K L A H O M A S T A T E U N I V E R S I T Y

S C H O O L O F E L E C T R I C A L A N D C O M P U T E R E N G I N E E R I N G
S C H O O L O F M E C H A N I C A L A N D A E R O S P A C E E N G I N E E R I N G

ECEN 4413/MAE 4053
Automatic Control Systems
Spring 2011

Midterm Exam #1

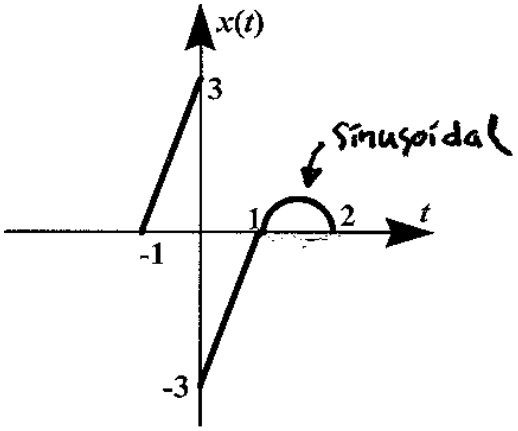
Pick one out of Problems 1 and 2, and do all Problems 3, 4 and 5.

Name : _____

E-Mail Address:_____

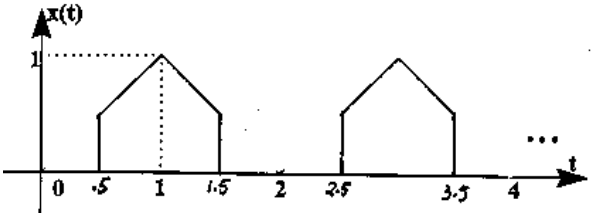
Problem 1:

Describe the following signal, $x(t)$, in terms of some basis functions (i.e., unit step, unit ramp and sinusoidal waveforms)



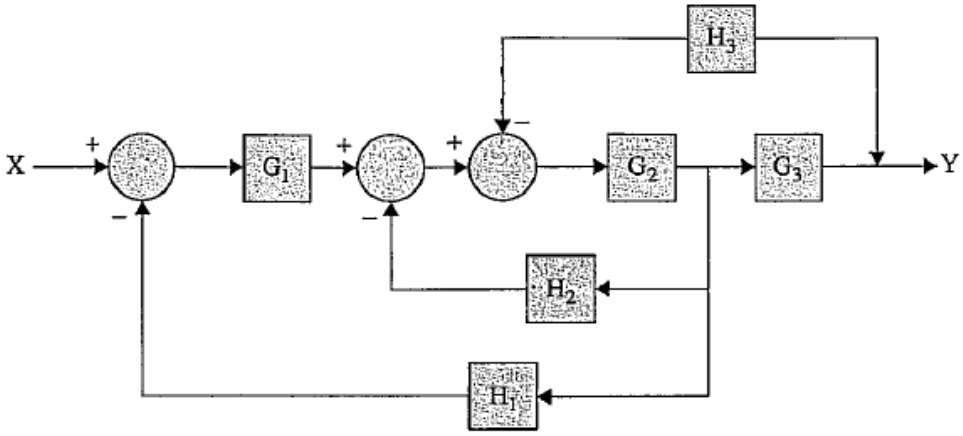
Problem 2:

Determine the Laplace transform of the following signal, $x(t)$, with an infinite number of periods.

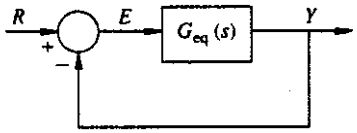


Problem 3:

Using *block diagram reduction technique* to rearrange the following block diagram into the equivalent *G* configuration of the feedback control system shown below.

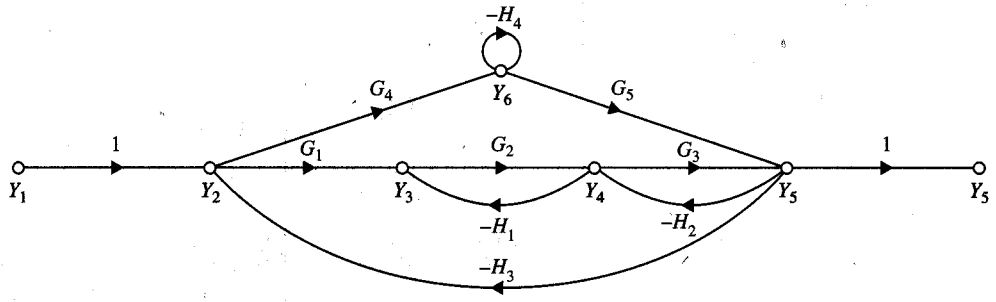


G Configuration



Problem 4:

Apply the gain formula to the SFG shown below to find the transfer functions of $\frac{Y_5}{Y_1}$ and $\frac{Y_5}{Y_2}$.



Problem 5:

The block diagram of a feedback control system is shown below

a) Apply the SFG gain formula directly to the block diagram to find the transfer functions $\left.\frac{Y(s)}{R(s)}\right|_{N=0}$ and $\left.\frac{Y(s)}{N(s)}\right|_{R=0}$.

b) Express $Y(s)$ in terms of $R(s)$ and $N(s)$ when both inputs are applied simultaneously.

c) Find the desired relation among the transfer functions $G_1(s)$, $G_2(s)$, $G_3(s)$, $G_4(s)$, $H_1(s)$ and $H_2(s)$ so that the output $Y(s)$ is not affected by the disturbance signal $N(s)$ at all.