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ECE-420
Exam 1

Fall 2014

Calculators and Laptops cannot be used. You must show your work to receive credit.

Problem 1 __________/15

Problem 2 __________/20

Problem 3 __________/15

Problem 4 __________/20

Problem 5 __________/30

Total ________________

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1a) Use long division to determine the first three nonzero terms in the impulse response for the following transfer function $H(z) = \dfrac{z+2}{z^2-1}$

1b) Assume a system has impulse response $h(n) = (0.5)^n u(n)$ Determine the output if the input is $x(n) = \delta(n) + 3\delta(n\text{-}1)$

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2) For impulse response $h(n) = \left(\frac{1}{2}\right)^{n} u(n-2)$ and input $x(n) = \left(\frac{1}{3}\right)^{n-2} u(n)$

a) Determine $H(z)$

b) Determine $X(z)$

c) Assume $Y(z) = z^{-1}G(z)$, determine $g(n)$ and then $y(n)$

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3) Consider the continuous-time plant $G_p(s) = \frac{A}{s}$. Determine the equivalent discrete-time plant $G_p(z)$ assuming a zero-order hold (ZOH) is placed before the continuous-time plant to convert the discrete-time control signal to a continuous-time control signal.

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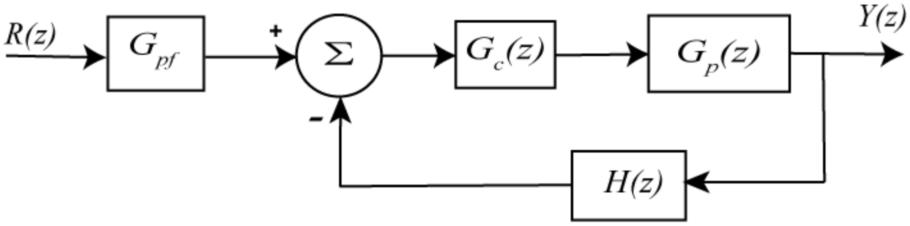
4) Assume the following feedback configuration



If $H(z) = z^{-1}, G_c(z) = \frac{c(z+a)}{(z-1)(z+b)}, G_p(z) = \frac{2z}{z+1}$ determine the parameters *a*, *b*, and *c* if the desired closed loop poles are roots of the equation $\Delta(z) = z^3 + d_1 z^2 + d_2 z + d_3$

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5) For impulse response $h(n) = \left(\frac{1}{2}\right)^{n} u(n-2)$ and input $x(n) = \left(\frac{1}{2}\right)^{-n} u(-\mathrm{n})$, the system output can be written as $A(n)u(n-3) + B(n)u(2-n)$. Determine an expression for **both** $A(n)$ **and** $B(n)$. You do not need to simplify your expressions but you must evaluate all sums.

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