

Assignment #9 CE242: Signals & Systems
Dept. of Computer Engineering
Sharif University of Technology
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1. Explain
 - a. What is a transfer function and why we use it?
 - b. A relationship between LT & FT.
 2. Determine Laplace transform for the following time-domain signals. Express the answer in the normal transfer function format, that is, as a ratio of polynomials.
 - a. $x(t) = (t^2 - 4e^{-3t} + 3e^{2t})u(t)$
 - b. $x(t) = [e^{-2(t-2)}u(t-2)] * [e^{-3(-t+3)}u(-t+3)]$
 3. Without computing inverse LT, determine the output signals for each of the following two systems for the given sinusoidal input.
 - a. $H_1 = \frac{20(s+3)}{(s+0.2)(s+6)(s+10)}$, $X_1 = 5\text{Cos}(2t - \pi/6)$
 - b. $H_2 = \frac{10(s+2)^2}{(s+5)(s+7)}$, $X_2(t) = 2\text{Cos}(2t + \pi/3) + 10\text{Cos}(6t + \pi/3)$
 4. For each of the transfer function below, determine the poles and zeros and indicate whether the system is BIBO stable or unstable. If the system is unstable, indicate what property of the transfer function makes it unstable.
 - a. $\frac{10(s+3)}{(s+2)(s^2+12s+136)}$
 - b. $\frac{10(s-3)}{(s^2+8s+16)(s^2+14s+149)}$
 - c. $\frac{10(s^2+4s+3)}{(s^2-4)(s^2-8s+208)}$
 5. Determine time-domain function for each LT.
 - a. $\frac{1}{s+2}$, $\text{Re}\{s\} > -2$
 - b. $\frac{1}{s+2}$, $\text{Re}\{s\} < -2$
 - c. $\frac{s^2-s+1}{s^2(s-1)}$, $0 < \text{Re}\{s\} < 1$